Osteomyelitis & Inflammatory bone Diseases

Osteomyelitis of the jaws is an infectious disease with complicated course, involving multiple surgical interventions and sometimes leading to facial disfigurement as a result of loss of affected bone and teeth and the accompanying scarring.

Since the second half of the twentieth century, there has been a dramatic reduction in the incidence of osteomyelitis cases involving the jaws and other bones of the skeleton. One major factor leading to this development is the introduction of antibiotics, other factors have also contributed, such as improved nutrition and better availability of medical and dental care, especially including advances in preventive dentistry and oral hygiene. Earlier diagnosis due to more sophisticated diagnostic imaging modalities has additionally improved the morbidity associated with this disease.

The incidence of osteomyelitis is much higher in the mandible due to the dense poorly vascularized cortical plates and the blood supply primarily from the inferior alveolar neurovascular bundle. It is much less common in the maxilla due to the excellent blood supply from multiple nutrient feeder vessels. In addition, the maxillary bone is much less dense than the mandible.

Diminished host defenses, both local and systemic, can contribute significantly to the emergence and clinical course of the disease. Osteomyelitis has been associated with multiple systemic diseases including diabetes, autoimmune states, malignancies, malnutrition, and acquired immunodeficiency syndrome. The medications linked to osteomyelitis are steroids, chemotherapeutic agents, and bisphosphonates.

Local conditions that adversely affect the blood supply can also predispose the host to a bony infection. Radiation therapy, osteopetrosis, and bone pathology can alter the blood supply to the area and cause osteomyelitis.

Pathogenesis

In the maxillofacial region, osteomyelitis primarily occurs as a result of contiguous spread of odontogenic infections or as a result of trauma. Primary hematogenous osteomyelitis is rare in the maxillofacial region, generally occurring in the newly born and very young due to breast feeding in this way the infection spread from the infected breast to the maxillary bone causing

infection and osteomyelitis. The adult process is initiated by an inoculation of bacteria into the jaw bones. This can occur with the extraction of teeth, root canal therapy, or fractures of the maxilla or mandible.

This initial insult results in a bacteria-induced inflammatory process, with inflammation there is hyperemia and increased blood flow to the affected area. Additional leukocytes are present in the area to fight off infection. Pus is formed, when the pus and subsequent inflammatory response occur in the bone marrow, an elevated intramedullary pressure is created which further decreases the blood supply to this region.

The pus can travel via haversian and Volkmann's canals to spread throughout the medullary and cortical bones. Once the pus has perforated the cortical bone and collects under the periosteum, the periosteal blood supply is compromised and this further aggravates the local condition. The end point occurs when the pus exits the soft tissues either by intraoral or extraoral fistulas.

Microbiology

More than 500 bacterial have been identified in the mouth. In the past, staphylococcal species were considered the major pathogen in osteomyelitis of the jaws disease-causing organisms. As with most oral infections the prime pathogenic species are streptococci and anaerobic bacteria. The anaerobes are Bacteroides (gram -ve) or Pepto streptococci species (gram +ve anaerobic).

Often, the infections are mixed, growing several pathogens on final culture like fusobacterium spp and actinomyces spp. Antibiotic treatment based on the most likely pathogens. This could include penicillin and metronidazole as dual-drug therapy or clindamycin as a single-drug treatment.

Classification

classification system offered by Hudson is the most advantageous to the clinician. Osteomyelitis is divided into acute or chronic forms based on the presence of the disease for a one-month duration.

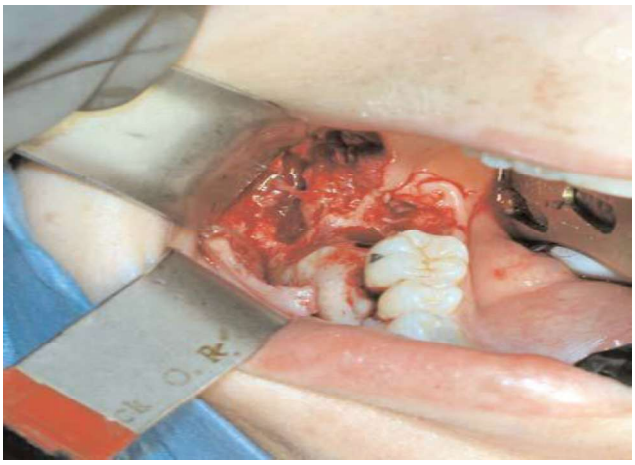
1. Acute osteomyelitis
    a. Contiguous focus

b. Progressive
c. Hematogenous

2. Chronic osteomyelitis
    a. Recurrent multifocal (Figure 2-a,) moth eaten bone
    b. Garré's
    c. Suppurative or nonsuppurative
    d. Sclerosing

Acute contiguous osteomyelitis

CT-scan of contiguous osteomyelitis



Clinical picture of contiguous osteomyelitis

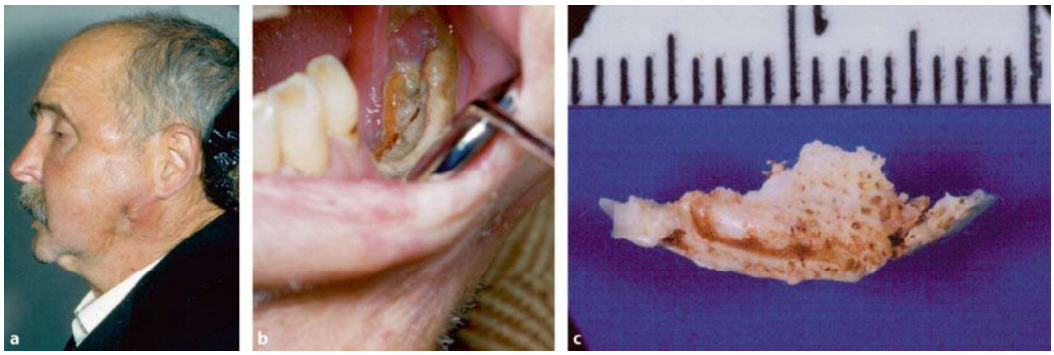
Diseased bone Removed

Moth eaten bone, recurrent multi focal

Clinical Presentation

Very often, as with any infection, the patient with osteomyelitis of the maxillofacial region will present with classic symptoms:

- Pain
- Swelling and erythema of overlying tissues
- Adenopathy
- Fever
- Paresthesia of the inferior alveolar nerve
- Trismus
- Malaise
- Fistulas



Chronic osteomyelitis, fistula in the submandibular area

The pain in osteomyelitis is often described as a deep and boring pain, In acute osteomyelitis it is very common to see swelling and erythema of the overlying tissues, which are indicative of the cellulitic phase of the inflammatory process of the underlying bone.

Fever often accompanies acute osteomyelitis, where as it is relatively rare in chronic osteomyelitis. Parasthesia of the inferior alveolar nerve is a classic sign of a pressure on the inferior alveolar nerve from the inflammatory process within the medullary bone of the mandible.

Trismus may be present if there is inflammatory response in the muscles of mastication of the maxillofacial region. The patient commonly has malaise and fatigue. Lastly both intraoral and extraoral fistulas are generally present with the chronic phase of osteomyelitis of the

maxillofacial region. Often these patients will have a laboratory work-up as part of their initial examination. In the acute phase of osteomyelitis, it is common to see a leukocytosis which is relatively uncommon in the chronic phases of osteomyelitis. The patient may have an elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). Both the ESR and CRP are very sensitive but nonspecific.

Radiographical appearance

It is possible to see a patient with acute osteomyelitis that has a normal-appearing orthopantomogram. However, one can often see the appearance of "moth-eaten" bone or sequestrum of bone, which is the classic appearance of osteomyelitis. Computerized tomography (CT) scans have become the standard in evaluating maxillofacial pathology such as osteomyelitis. its sensitive in late stage when 30%-50% of the bone demineralized.

Magnetic resonance imaging (MRI) is generally considered more valuable in the evaluation of soft tissue lesions of the maxillofacial region. However, MRI can assist in the early diagnosis of osteomyelitis by loss of the marrow signal before cortical erosion or sequestrum of the bone appears. Thus, MRI may benefit in identifying the earlier stages of osteomyelitis. Nuclear medicine has evolved to aid in the diagnosis of osteomyelitis. The technetium 99 bone scan is very sensitive in high lighting areas of increased bone turnover.

Treatment

The first step in the treatment of osteomyelitis is diagnosing the condition correctly. The diagnosis is made from clinical evaluation, radiographic evaluation, and tissue diagnosis. Tissues from the affected site should be sent for Gram stain, culture, sensitivity, and histopathologic evaluations. The clinical response to the treatment of any patient will be compromised unless altered host factors can be optimized. Medical evaluation and management in defining and treating any immunocompromised state is indicated and often helpful. For example, glucose control in a diabetic patient should be stabilized for best response to therapy. Antibiotic therapy used according to the sensitivity

Surgical treatment

Classic treatment is;

1. sequestrectomy and saucerization. The aim is to debride the necrotic or poorly vascularized bony sequestra in the infected area and improve blood flow.

2. Saucerization involves the removal of the adjacent bony cortices and open packing to permit healing by secondary intention after the infected bone has been removed.
3. Decortication involves removal of the dense, often chronically infected and poorly vascularized bony cortex and placement of the vascular periosteum adjacent to the medullary bone to allow increased blood flow and healing in the affected area.
4. Hyperbaric oxygen (HBO) treatment has also been advocated for the treatment osteomyelitis.

Osteoradionecrosis;

Radiation therapy is a valuable treatment modality in treating cancer of the maxillofacial region. Radiation therapy can be used alone or as adjunctive therapy in combination with surgery and chemotherapy.

Radiation therapy like any treatment modality has side effects, including mucositis and xerostomia. One of the most important side effects is osteoradionecrosis (ORN). ORN is generally caused by trauma to the radiated area, usually by dental extraction, but it can also occur spontaneously.

The clinical picture of ORN is most commonly seen with pain and exposed bone in the maxillofacial region ORN is more common in the mandible than in the maxilla. A dosage of radiation above 5,000 to 6,000 rads is generally felt to make the mandible susceptible to ORN. Radiographically, the appearance on the orthopantomogram or CT scan resembles conventional osteomyelitis with areas of osteolysis and bony sequestrum. Often there is an appearance of moth-eaten bone present on these films.

Treatment of ORN is aimed at removing the nonviable (necrotic) tissue and allowing the body to heal itself. Minor debridement of exposed bone and Current therapy of HBO consists of 100% oxygen delivered in a pressurized manner. Tissues treated with HBO have increased levels of oxygen, which has a negative effect on bacteria and HBO treatment consists of dives or treatment sessions for 90 minutes based at 2.4 atm of pressure. 20 to 30 dives are given preoperatively before any surgical intervention is performed. The area of ORN is then debrided and followed with10 additional HBO treatments. Reconstruction of the maxillofacial region is based on the patient's response to the treatment protocol. HBO treatments are expensive and available only in medical centers or academic health science centers.

Osteochemonecrosis;

In the recent years, bisphosphonate therapy has become a widely accepted therapy in various clinical settings such as multiple myeloma, metastatic cancer therapy, and treatment of advanced osteoporosis. With the increased prescription of these drugs, the incidence and prevalence of bisphosphonate-associated complications of the jaw continues to be increased. This seems to be even more the case in patients receiving injectable bisphosphonates, such as pamidronate and zoledronic acid.

The pathophysiological mechanisms leading to bisphosphonate-induced osteochemonecrosis of the jaws are different from osteoradionecrosis. In bisphosphonate-induced osteochemonecrosis of the jaws osteoclastic action is reduced, but osteoblastic production continues, leading to an osteopetrosis like condition. These alterations in bone physiology with eventual increase of the medullary bone as the disease progresses and the inability of osteoclasts to remove superinfected "diseased" bone are regarded as causative factors. In contrast to osteoradionecrosis, where a radiation-induced avascular necrosis is the major cause, avascularity does not appear to be a major cofactor.

Dental management

The dentist should manage patients who are taking oral bisphosphonates in the following ways;

1. Medical consultation to determine the medical diagnoses and type of drugs taken and ideally performance of all necessary dental treatments performed before administration of the drug(s) (similar to the approach indicated for patients undergoing head and neck radiation therapy).
2. Protocol for prevention of complications from cancer chemo- or radiation therapy:
    a. Comprehensive examination
    b. Establishment of excellent periodontal health (through eradication of any infection or inflammation)
    c. Immediate extraction of all nonrestorable or questionable teeth
    d. Elimination of dental caries
    e. Maintenance of excellent oral hygiene and oral health
3. Routine dental care can and should be provided, using routine local anesthetics.
4. All procedures should be performed as atraumatically as possible with little tissue trauma, bleeding and risk for postoperative infection.

5. Specific precautions may be necessary for special types of procedures (i.e., orthodontic, endodontic, prosthodontic, others). Of course, oral surgery or periodontal procedures involving the manipulation of bone will present the greatest risk.
6. Should Bisphosphonate osteonecrosis (BON) occur, no definitive treatment is available at this time; however, some recommendations are as follows:
    a. Antimicrobial rinses (e.g., chlorhexidine 0.12%)
    b. There is no empirical evidence to inform the decision of whether to cease bisphosphonate therapy in the event of development of BON. Some guidelines recommend that the indication for bisphosphonate therapy be considered and bisphosphonate therapy stopped only if the systemic condition permits. Hence, management is interdisciplinary and involves ongoing close monitoring.
    c. Surgical treatment should be conservative or delayed and be limited to
        - removal of sharp bony edges to prevent trauma to adjacent soft tissues;
        - removal of loose segments of bony sequestra without exposing uninvolved bone; and
        - segmental jaw resection for symptomatic patients with large segments of necrotic bone or pathologic fracture.
7. In the instance of any infection, aggressive use of systemic antibiotics is indicated.

Principles of Flaps, Suturing and Management of difficult extraction

Oral surgery skills can be learned through the knowledge of the basic principles of surgery, knowledge of the anatomy of the region and good practical training. Whenever surgical intervention is considered, the operator must decide if the procedure is necessary weighing its benefits and its risks, and the patient must be made aware of the other possible non-surgical methods of treatment for the given problem. Also all the short-term and long-term complications of the surgical procedure must be explained to the patient in relation to the known risks.

The main prerequisite for an operator performing surgical procedures is to ensure **Asepsis and Antisepsis,** to prevent pathogenic microbes from entering the body as well as spread of certain infectious diseases from one patient to another. This is accomplished through;

- Sterilization of instruments involving dry heat, moist heat (autoclave) and chemical means of sterilization.
- Preparation of the patient by seating the patient on the dental chair, disinfecting the skin around the mouth and the oral mucosa and covering the patient with sterile drapes.
- Preparation of the operator by disinfecting the hands and wearing the appropriate sterile gown and surgical gloves.

Flap is simply defined as a section of soft tissue that is outlined by surgical incisions, carries its own blood supply, allows surgical access to underlying tissues, can be replaced as required on its original position, maintained with sutures and is expected to heal. Most of the oral surgical procedures require the reflection of a full mucoperiostial flap incorporating mucosa, submucosa and periosteum to gain access to the area that is the object of surgery.

Incision

It is simply defined as a cut or wound made by cutting with a sharp instrument. The basic principles of incisions in oral surgery include:

- ❖ A blade number 15 is suitable for most oral surgical procedures. Sometimes a blade number 12 is used.
- ❖ A new and sterile blade should be used for each patient and it should be replaced with a new one intraoperatively if its cutting edge becomes blunted when necessary.
- ❖ The scalpel blade is mounted on the scalpel-handle with the help of a needle holder, or hemostat, with which it slides into the slotted receiver with the beveled end parallel to that of the handle.
- ❖ The scalpel is grasped in a pen grasp for maximum control and tactile sensitivity.

- ❖ The incision should be made at right angle to the underlying bone to ensure good healing when the tissues are re-apposed.

- ❖ The scalpel should move at uniform speed and with sufficient firmness to cut through not only the mucosal surface but also the periosteum overlying the bone. It should be made, ideally, with a single movement, repeated strokes at the same place should be avoided as they may impair healing.

Flap design

The essential points that should be considered include:

- ➢ Flap design and incision should be carried out in such a way that injury of anatomic structures is avoided, such as: the mental neurovascular bundle, palatal vessels emerging from the greater palatine foramen and incisive foramen, lingual nerve, submandibular duct, facial artery and vein. So thorough knowledge of the anatomy of the orofacial region is essential.>

- ➢ The base of the flap should be wider than its apex (free gingival margin) to ensure adequate blood supply for better healing.

- ➢ The flap should be of adequate width for good visualization and accessibility of the operative field without subjecting the flap to tension and trauma during manipulation.

- ➢ When planning the flap, the care should be given to the fact that the flap should be wider than the anticipated bony defect after completion of the procedure so that the flap margins, when sutured, should rest on intact and healthy bone to prevent wound dehiscence and poor healing.

- ➢ Delicate handling of the flap during the surgical procedure without excessive tension of crushing in order not to compromise the blood supply which leads to delayed healing.

- ➢ Vertical releasing incisions should start at the buccal vestibule and end at the interdental papilla which should either be excluded or included in the flap, the incision should always pass to the interdental papilla and not end at the labial or buccal surface of the tooth to ensure the integrity of the gingiva, but it should not pass through the papilla for accurate replacement of the flap.

Vertical releasing incision are contraindicated in certain sites in the oral cavity:

- ✓ Transverse incisions in the palate: to avoid injury to the greater palatine artery.
- ✓ Lingual surface of the mandible: to avoid injury to the lingual nerve.
- ✓ Canine eminence: because it increases the tension on the suture line which lead to wound dehiscence.
- ✓ In the area of mental foramen, between mandibular first and second premolars: to avoid injury to the mental nerve.

Types of Mucoperiosteal Flaps

❖ Envelope Flaps

This type of flaps is made by a horizontal incision through gingival sulcus for the teeth or through the alveolar mucosa of the edentulous area with no vertical releasing incisions. The envelope flap is used for surgery of incisors, premolars and molars, on the labial or buccal and palatal or lingual surfaces. The **main indications** of this type of flaps include: surgical extraction of impacted mandibular third molars, palatal approach to impacted maxillary canines or removal of mandibular tori.

The **main advantages** of this flap are; easy re-approximation to original position, good blood supply and it can easily modified to two-sided or three-sided flap by adding vertical releasing incisions to either ends of the flap when necessary.

Disadvantages of this flap are the limited accessibility and visualization, difficulty in reflection with greater tension that can result in tearing at the ends of the flap, in addition to defect in attached gingival and the possibility of injury to the greater palatine artery during reflection of palatal flap.

❖ Two-sided Flap (Triangular Flap)

This flap is the made with a horizontal incision along the gingival sulcus or alveolar ridge mucosa and a vertical releasing incision. The vertical incision begins approximately at the vestibular fold and extends to the interdental papilla of the gingiva. This flap is performed labially or buccally on both jaws and is **indicated in** the surgical removal of root tips, impacted teeth, small cysts, and apicectomies.

Advantages are; it ensures an adequate blood supply, satisfactory visualization and accessibility, good re-approximation; it can be easily modified to a three-sided flap, or even lengthening of the horizontal incision.
Disadvantages are; limited access, tension when flap is retracted and it may result in defect of attached gingiva.

❖ Three-sided Flap (Trapezoidal Flap)

This flap consists of a horizontal incision along the gingival or alveolar ridge mucosa and 2 vertical releasing incisions, this flap is **indicated** when an extensive surgical field exposure is required especially when two-sided flap is inadequate.
The main **advantages** include; very good accessibility and visualization of the surgical field with minimal tension on the tissue, and good reapproximation of tissue to the original position.
The **disadvantages** are the possibility of producing an attached gingival defect. This flap cannot be lengthened or modified once reflected.

❖ Semilunar Flap

This flap is the result of a curved incision, which begins just beneath the vestibular fold and has a bow shaped course with the convex part towards the attached gingiva. The lowest point of the incision must be at least 0.5 cm from the gingival margin, so that the blood supply is not compromised. Each end of the incision must extend at least one tooth over on each side of the area of bone removal. The semilunar flap is used in apicoectomies and removal of small cysts and root tips.
Advantages of this flap are small incision, easy reflection, no attached gingival defect especially around prosthetic appliances (crowns and bridges) and easy oral hygiene.

Disadvantages of this flap are limited accessibility and visualization of the surgical field, re-approximation may be difficult due to the absence of reference points, tendency to tear due to excessive tension on reflection and the possibility that the flap may made over defective bone as a result of inadequate planning or underestimation of the size of the bony defect so that the margins of the flap will not rest on intact bone leading to collapse of the flap and wound dehiscence.

❖ Other types of flaps

- A flap with a **Y-shaped incision**. This flap used in surgical procedures of the palate, mainly for removal of exostoses (torus palatinus). The first flap consists of an incision along the midline of the palate with 2 anterolateral incisions made anterior to the canines, additional posterolateral incisions can be added to improve accessibility indicated in large tori, but care should be taken not to sever the greater palatine vessels. The **major disadvantage** of these flaps is that they can easily tear as the mucosa overlying palatine tori can be fairly thin.

- Flaps that are used for closure of oroantral fistula or communication include; **Buccal Advancement Flap** which is in essence a three-sided flap that after reflection the periosteum is transversely incised so that the flap remains pedicled only by the mucosa allowing it to be advanced and sutured to the palatal tissues. The other flap is the **Palatal Transpositional Flap** that incorporates the greater palatine vessel, it is rotated and sutured to the buccal tissues.

Flap reflection

The mucoperiosteal flap is reflected from the underlying bone using periosteal elevators. There are many any types of mucoperiosteal elevators like Howarth, Ash, the no.9 Molt, Seldin, or Freer types. The elevators should be firmly pushed at approximately 30-45° to the surface of the bone such that the periosteum is stripped from it. It is important to try to raise both mucosa and periosteum in one layer and this requires a considerable force to be applied.

Reflection of the flap begins at the papilla; the periosteal elevator is pushed underneath the papilla in the area of the incision and is turned laterally to pry the papilla away from the underlying bone. This technique is used along the entire extent of the free gingival incision. If it is difficult to elevate the tissue at any one spot, the incision is probably incomplete, and that area should be re-incised. A dry, sterile swab can be interposed between the periosteal elevator and the bone.

The elevator may also be used for holding the flap after reflecting, facilitating manipulations during the surgical procedure.

Oftentimes two elevators can be used to advantage one working and the other aiding retraction in the subperiosteal plane. Adequate undermining of the wound margins is required in order to mobilize the flap. Generous reflection is the key to adequate vision, and wide exposure reduces traction trauma to the wound edges.

Suturing

After completion of the surgical procedure, thorough irrigation of the surgical field using sterile normal saline follows. Then the flap is repositioned to its original position and held in place using sutures to protect the underlying tissues from infection and irritating factors and prevent postoperative hemorrhage. Sutures are also used to repair soft tissue lacerations, ligation of vessels and control of bleeding, immobilization of flaps in their new position, and stabilization of drains in place. Suture diameters vary from **0.02 to 0.8 mm.** This corresponds to **10/0 to 5** on the British Pharmacopoeia (BP) system. The finest suture that will hold the wound secure, without it breaking should be chosen. The amount of suture material used should be kept to a minimum, particularly when braided, to reduce bacterial colonization. Suture material can be a nidus for infection, and knots can be the focus of a persistent and chronic inflammatory reaction (suture knot sinus).

Suture Materials

Suture materials are classified as either **absorbable** or **non-absorbable** material depending on whether the body tissues will degrade the suture material and absorb it over time. Absorption takes place either by Hydrolysis or by proteolytic enzymatic degradation depending on the material used. They can also be classified as **monofilament** or **multifilament.**

❖ Absorbable Sutures

They are used in suturing of deep layers of wounds when multilayered suturing is required, they are also used in children, mentally handicapped patients and in patients who cannot return to the clinic to have their sutures removed. They can cause inflammatory tissue reaction that can impede tissue healing. Some of the popular absorbable sutures include:

- **Plain Catgut:** it is made from collagen derived from healthy sheep or cattle intestine, its tensile strength is lost within 7-10 days, its absorption is through phagocytosis and enzymatic degradation which occurs within 7-10 days producing high tissue reaction. It is used for suturing subcutaneous tissues that do not require prolonged support. **It is not suitable for suturing in oral surgery.**
- **Chromic Catgut:** it is made from collagen derived from healthy sheep or cattle intestine tanned with Chromium salts to facilitate handling and resist tissue degradation. It tensile strength is lost within18-2ldays, its absorption is like that of the plain Catgut but it takes longer time and with moderate tissue reaction. It has the same indication as for the plain Catgut and it is **not suitable in oral surgery.**
- **Polyglactin (Vicryl)**

Synthetic suture made of copolymer of lactide and glycolide coated with polyglactin and calcium stearate.

It is **braided multifilament** suture, 60% of its tensile strength remains for 2 weeks, and about 30% for 3 weeks.

Its absorption is through hydrolysis with complete absorption taking place within 60-90 days, it induces mild tissue reaction. This suture is widely used in surgical practice but it is not advised for use where prolonged approximation under tension is required.

- **Polydioxanone (PDS)**

Supplied as **monofilament** dyed or undyed, it is made of polyester polymer, 70% of its tensile strength remains at 2 weeks, 50% at 4 weeks and 14% at 8 weeks. Absorption occurs through hydrolysis which is complete in about 180 days, it is used when slight longer wound support is required.

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Non-absorbable sutures

These sutures remain in the tissues and are not absorbed, but have to be cut and removed about 7 days after their placement. Commonly used sutures include:

- **Silk:** it is made of raw silk from silkworms, and it is supplied as braided or twisted, dyed or undyed, coated with wax or silicon or uncoated. 80%-100% of its tensile strength is lost within 6 months. Fibrous encapsulation occurs in the body within 2-3 weeks, it causes moderate to high tissue reaction. It is used in ligation and suturing when long term tissue support is needed. Silk sutures are the easiest to use and the most economical, and have a satisfactory ability to make a secure knot.
- **Nylon**

it is made of polyamide polymer and it is supplied usually as monofilament. It loses 15%-20% of its tensile strength per year. It causes mild tissue reaction and it is used mainly for skin, in plastic surgery, neurosurgery, and ophthalmic surgery. Know it is more widely used in oral surgery.

One of the most commonly used suture for the oral cavity is 3/0 black silk. The size 3/0 has the appropriate amount of strength; the multifilament nature of the silk makes it easy to tie and well tolerated by the patient's soft tissues. The color makes the suture easy to be seen when the patient returns for suture removal. However, because of the multiple filaments, they tend to "wick" oral fluids along the suture to the underlying tissues. This wicking action may carry bacteria along with the saliva. Sutures that are holding mucosa together usually stay no longer than 5 to 7 days, so the wicking action is of little clinical significance.

Needles

Needles are usually made of stainless steel which is strong and flexible material. There are different shapes, sizes and cross sections of needles. Needles of 18-26 mm in length are suitable for use in oral surgery.

There are two basic needle types: Those that have the hole at the suture side of the needle and that need to be threaded with suture are "**eyed.**" Conversely, those that have the suture attached to the needle are "**eyeless**" or "**swaged.**" The advantages of the swaged needles include:

- The eyeless needle is composed of a single use needle and suture. This avoids the loss of sharpness that occurs with reusable needles.
- There is only a single strand of suture that is pulled through the tissues, and the gap that is created by the needle is fully plugged by the suture. This reduces potential leakage through the suture line.
- There is no re-threading of an eyeless needle, and its use is more time efficient.

As compared to a regular circle, needles are either; 1/4 circle, $^1/_2$ circle, ¾ circle, 3/8 circle, or $^1/_8$ circle or they can have different shapes like straight needles, J needles, or compound curve needles.

According to the cross section of the needles, there are:

- ✓ **Needles with round or oval cross section** which are considered atraumatic and are mainly used for suturing thin mucosa. Their disadvantage is that great pressure is required when passing through the tissues, which may make suturing the wound harder. They are used in oral surgery especially in areas of thin mucosa they are also used in suturing of peritoneum, bowel, muscles and fat.
- ✓ **Needles with triangular cross section;** these are either cutting or reverse cutting needles. The difference is that in addition to the two cutting edges of the triangle, cutting needles have a third cutting edge on the inside of the curvature while the reverse cutting needles the third cutting edge is on the outer convex curvature of the needle. These designs allow minimal soft tissue trauma during needle insertion as they cut a path through the soft tissues and do not therefore require excessive force on the part of the operator.

The passage of a needle through tissue should follow its curvature. This minimizes tissue damage and the appropriate size and shape of cutting, or round-bodied atraumatic needle, needs to be chosen for the least traumatic passage through tissue.

Instrument for Suturing includes:

- **Needle Holder**

These instruments come in a variety of sizes and design. In general, they have a locking handles allowing the needle to be locked into the beaks of the instrument. They resemble Hemostats but with few differences:

✓ The beaks of the hemostat are longer and thinner than that of the needle holder.

✓ The internal surface of the short beaks of the needle holder is grooved and crosshatched, permitting a firm and stable grasp of the needle, while the short beaks of the hemostat have parallel grooves which are perpendicular to the long axis of the instrument.

- **Tissue Forceps**

Sometimes known as dissecting forceps, the important requirement is that they hold the soft tissues atraumatically so avoiding crushing and with little chance of slippage. This is achieved by a toothed design in the form of a wedge-shaped projection or tooth on one side, and a receptor on the other, which fit into each other when the handles are locked, although possibly causing tiny puncture points, is ideal for the purposes of suturing and holding soft tissues generally. The use of non-toothed forceps will result in crushing of the tissues as, to prevent tissue slippage from grasp, the instrument must be held too tightly.

- **Suture Scissor**

Principles of suturing

❖ Suturing should be undertaken using a no-touch technique to reduce the risk of a needle-stick injury and the fewer the number of sutures used to produce the desired result, the better. Insertion of too many sutures tears the tissue unnecessarily, and the resulting tangle of suture thread tends to accumulate plaque and promote inflammation.

❖ Before the sutures are inserted the non-flap side of the incision should be undermined to facilitate the insertion of the needle.

❖ When re-approximating the flap, the suture is passed first through the mobile (usually facial) tissue, the needle is re-grasped with the needle holder and is passed through the attached tissue of the lingual papilla. But if the two margins of the wound are close together, the surgeon may be able to insert the needle through both sides of the wound in a single pass. However, for better precision it is better to use two passes in most situations.

- The tissue of the flap should be held firmly by the tissue forceps and the needle passed through the mucoperiosteum about 3 mm from the margin, more if the flap is friable because of chronic infection. The needle is then pushed through the corresponding tissue on the other side of the incision, again about 3-5 mm from the margin. The needle should enter the surface of mucosa at right angle, and the passage of the needle should follow it curvature to prevent tearing of the flap.

- After the needle passes through both wound edges, the suture is pulled, so that the needle-bearing end is longer. Afterwards, the long end of the suture is wrapped around the handle of the needle holder twice. The short end of the suture is grasped by the needle holder and pulled through the loops. The suture is then tightened by way of its two ends, thus creating the first double-wrapped knot. Then a single-wrap knot is created, in the counterclockwise direction, which is named a safety knot.
- Where possible, the knots should be drawn to lie to one or other side of the line of incision. Over-tightening of the suture, manifested by blanching of tissue, must also be avoided, it runs the risk of tissue necrosis and wound dehiscence. Overlapping of wound edges when positioning the knot should also be avoided.

- Sutures placed intraorally are normally removed 5-7 days postoperatively. In the removal of sutures, normal dental tweezers should grasp the free ends of the thread and the suture should be cut by sharp scissors. The suture should then be pulled though in its entirety. The suture is better cut just as it enters the tissue to avoid pulling a contaminated suture through the tissue.

Suturing Techniques

■ Simple Interrupted Suture:

This is the simplest and most frequently used type, and may be used in all surgical procedures of the mouth. The needle enters from the margin of the flap (mobile tissue) and exits at the same distance on the opposite side. The two ends of the suture are then tied in a knot. The advantage of the interrupted suture is that it is simple to execute and when sutures are placed in a row, inadvertent loosening of one or even losing one will not influence the rest.

■ Continuous Suture:

This is usually used for the suturing of wounds that are long, e.g., for re-contouring of the alveolar ridge in the maxilla and mandible. This technique for the **continuous simple (or nonlocking) suture** is as follows: after passing the needle through both flap margins, an initial knot is made just as in the interrupted suture but only the free end of the suture is cut off. The needle-bearing suture is then used to create successive continuous sutures at the wound margins. The last suture is not tightened, but the loop created actually serves as the free end of the suture that is used to tie the knot.

The **continuous locking suture** is a variation of the continuous simple suture. This type of suture is created exactly as described above, except that the needle passes through every loop before passing through the tissues, which secures the suture after tightening. Suturing continues with the creation of such loops, which make up parts of a chain along the incision. These loops are positioned on the buccal side of the wound, after being tightened.

The **advantage** of the continuous suture is that it is quicker and requires fewer knots, so that the wound margins are not tightened too much, thus avoiding the risk of ischemia of the area. Its **disadvantage** is that if the suture is inadvertently cut or loosened, the entire suture becomes loose.

- **Mattress Suture:**

This is a special type of suture and is described as horizontal and vertical. It is indicated in cases where strong and secure re-approximation of wound margins is required. The main indication for use of vertical mattress sutures is to evert the skin edges, the technique permits greater closure strength and better distribution of wound tension. The horizontal suture also allows eversion of the wound edges and is used in cases which require limiting or closure of soft tissues over osseous cavities, e.g., post-extraction tooth sockets. In the mattress suture the needle passes through the wound margins at a right angle, and the needle always enters and exits the tissues on the same side.

- **Figure of Eight suturing**

Figure-of-eight sutur occasionally placed over top of socket to aid in hemostasis, it is usually performed to help in maintaining a piece of oxidized cellulose in tooth socket after tooth extraction.

Management of difficult extraction

Difficulties may be encountered during extraction of teeth for a variety of reasons and any oral surgeon should never ignore any warning of the possibility that such difficulties may be encountered during any proposed tooth extraction especially when the patient indicates that such difficulties have been experienced in previous occasions. These difficulties can be diagnosed through clinical examination and a good radiograph that shows the root morphology of the tooth and the surrounding and supporting structures which should be taken before extraction whenever possible.

The main indications for surgical extraction of teeth are:

- ✓ **Retained roots and root tips**.
- ✓ Teeth with **root morphology that is unfavorable** for simple tooth extraction, such as teeth with large bulbous roots due to hypercementosis or those with dilacerated roots or root tips.
- ✓ Teeth that have crowns with **extensive caries**, especially root caries, or that have large amalgam restorations.

- ✓ Teeth with **ankylosed roots**.
- ✓ Teeth that are **fused with adjacent** teeth or roots.
- ✓ Maxillary posterior teeth that are **closely associated with maxillary sinus** due to pneumatization of the sinus into the alveolar process or when there is an increased risk of fracture of maxillary tuberosity during simple extraction.
- ✓ Fully or partially **impacted teeth**.
- ✓ Teeth or retained roots with **periapical lesions** whose removal in entirety is not possible through curettage alone after simple extraction.

Retained roots and root tips that are deeply buried in the alveolus and are asymptomatic are not indicated for surgical extraction especially in older individuals with poor general health, or when there is a risk of serious local complications or damage to vital structures like the inferior alveolar nerve, lingual nerve or maxillary sinus.

Steps of surgical extraction

Surgical extraction of teeth is preceded by proper preparation and disinfection of the patient, and administration of local anesthesia then the surgical procedure proceeds as follows:

1. Creation of a **full mucoperiosteal flap**, this could be envelope, two-sided or three-sided flap based on the anticipated difficulty and the need for better accessibility.
2. For **single rooted teeth** and after reflecting the flap the operator may attempt to re-seat the forceps under direct visualization for better mechanical advantage. The other options include; grasping a bit of buccal bone under the buccal beak of the forceps so that a small piece of buccal bone is removed with the tooth, application of an elevator, or removal of sufficient amount of bone to facilitate the application of the forceps or the elevator. In some cases, a purchase point is made in the root where the elevator is applied and the root extracted.
3. **Bone removal** using surgical hand piece and round burs to expose an adequate part of the tooth or root. Whenever possible the oral surgeon should be conservative by removing bone to allow the creation of a point of application for the elevator for luxation or sometimes removing only a small window of bone overlying the broken apex of roots to allow their retrieval through the socket.
4. In **multi-rooted teeth** sectioning of the crown of the tooth and/or sectioning the roots so that they can be extracted as single rooted teeth.
6. After the tooth and all the root fragments have been removed, the flap is repositioned and the surgical area is palpated for **sharp bony edges**. If any sharp edges are present, they are smoothed with a bone file or a handpiece and bur. The wound is thoroughly irrigated and debrided of loose fragments of tooth, bone, calculus, and other debris.
7. The **flap is repositioned again and sutured** in the usual fashion.

Indications for leaving root fragments

When a root tip has fractured and approaches of removal have been unsuccessful, and when the open surgical approach may be excessively traumatic, the surgeon may consider leaving the root in place. As with any surgical approach, the surgeon must balance the benefits against the risks of surgery. In some situations, the risks of removing a small root tip may outweigh the benefits.

The conditions that must exist for a tooth root to be left in the alveolar process are:

- The root fragment must be **small**, usually no more than 4 to 5 mm in length.
- The **root must be deeply embedded** in bone and not superficial, to prevent subsequent bone resorption from exposing the tooth root and interfering with any prosthesis that will be constructed over the edentulous area.
- The tooth involved must **not be infected**, and there must be no radiolucency around the root apex. This lessens the likelihood that subsequent infections will result from leaving the root in position.
- The root should **not be mobile.**
- If the surgeon elects to leave a root tip in place the **patient must be informed** that, in the surgeon's judgment, leaving the root in its position will do less harm than surgery. In addition, radiographic documentation of the presence and position of the root tip must be obtained and retained in the patient's record, the patient should be recalled for follow-ups to track the fate of this root.
- The **patient should be instructed** to contact the surgeon immediately should any problems develop in the area of the retained root.

Multiple Extractions

If multiple adjacent teeth are t o b e extracted at a single session the surgeon should determine if there is need for interim partial immediate dentures, any type of soft tissue surgery, such as tuberosity reduction or the removal of undercuts or tori in critical areas. If dental implants are tobe placed at a later time, it may also be desirable to limit bone trimming and socket compression. In some situations, dental implants may be placed at the same time as the teeth are removed, which would require the preparation of a surgical guide stent to assist in aligning the implants appropriately.

Extraction sequencing

Maxillary teeth should usually be removed first for several reasons:

- Infiltration anesthetic has a more rapid onset and also disappears more rapidly. This means that the surgeon can begin the surgical procedure sooner after the injections have been given.
- Surgery should not be delayed because profound anesthesia is lost more quickly in the maxilla.
- During the extraction process, debris such as portions of amalgams, fractured crowns, and bone chips may fall into the empty sockets of the lower teeth if the lower surgery is performed first.
- Maxillary teeth are removed with a major component of buccal force. Little or no vertical traction force is used in removal of these teeth, as is commonly required with mandibular teeth.

A single minor disadvantage for extracting maxillary teeth first is that if hemorrhage is not controlled in the maxilla before mandibular teeth are extracted, the hemorrhage may interfere with visualization during mandibular surgery but this is usually not a major problem because hemostasis should be achieved in one area before the surgeon turns attention to another area of surgery, and the surgical assistant should be able to keep the surgical field free from blood with adequate suction.

Posterior teeth are extracted first, this allows for the more effective use of dental elevators and forceps to extract the teeth.

After extraction the buccolingual plates are pressed with firm pressure and the soft tissues are repositioned, sharp spicules of bone should be removed and smoothed with bone nibbler (Rongeur) and bone file, the area should be thoroughly irrigated with normal saline and the papillae in position.

Dental Implantology

5th year **Dr. Auday M. Al-Anee**

Implant Treatment: Basic Concepts and Techniques

Dental implants have given the profession and the patient an extremely predictable and effective means of tooth replacement. The partially edentulous patient can now undergo replacement of a single tooth or several missing teeth with implant retained crowns and enjoy the function and esthetics they had with their natural teeth. The completely edentulous patient no longer has to live with compromised function and the reduced confidence that traditional full denture wearers have historically experienced. Dental implants can offer the edentulous patient comfort, function, and confidence with either fixed prosthetics or implant-retained removable prosthetic options.

The history of modern implant dentistry began with the introduction of titanium implants. In the 1950s, Per-Ingvar Brånemark, a Swedish professor of anatomy, had a serendipitous finding while studying blood circulation in bone that became a historical breakthrough in medicine. He coined the phenomenon osseointegration and developed an implant system with a specific protocol to achieve it predictably. The first patient was successfully treated in 1965.

Implant Geometry (Macrodesign)

Numerous implant systems with various geometric (macrodesign) designs have been developed and used before the current implant systems in use today. Previous implant designs included blade vents (narrow, flat shape; tapped into bony trough prepared with rotary burs), press-fit cylindrical (bullet shape; pressed or tapped into prepared hole), subperiosteal (custom-made framework; adapted to the surface of jawbone), and transmandibular (long rods or posts; placed through the anterior mandible).Some of these implant systems were initially stable and appeared to be successful over short-term periods (e.g., 5 years) but failed to remain stable, became symptomatic or loose, and failed over longer periods. Lacking predictability, these implant systems are no longer used. Since the time of the Brånemark studies, millions of patients have been treated worldwide using variations of these techniques with implants of different geometries and surface characteristics. Similar research including

that of André Schroeder in Switzerland in the mid-1970s contributed to the success of endosseous dental implants.

The serendipitous finding of Brånemark was that when a hole is prepared into bone without overheating or otherwise traumatizing the tissues, an inserted biocompatible implantable device would predictably achieve an intimate bone apposition, as long as micromovements at the interface were prevented during the early healing period.

Currently, most endosseous implants have a cylindrical or tapered, screwshaped/ threaded design. The disastrous results with other implant configurations were largely responsible for the evolution toward the current popular designs.

The most common implant design being used today is the screw-shaped or threaded cylindrical implant. A threaded implant design is preferred because it engages bone well and is able to achieve good primary stabilization. Even systems that started with cylindrical press-fit (nonthreaded) designs progressively evolved to a threaded geometry. The (longitudinal) shape of implants may be parallel or tapered. Although a majority of all implants have been parallel walled, the use of a tapered implant design has been advocated because it requires less space in the apical region (i.e., better for placement between roots or in narrow anatomic areas with labial concavities). Tapered implants have also been advocated for use in extraction sockets.

Implant Surface Characteristics (Microdesign)

Implant surface characteristics (microtopography) have been shown to positively influence the healing process. Accordingly, modification of implant surface characteristics has been a major area of research interest and development. Modifications in surface energy, chemical composition, and surface topography are known to influence cellular activity and tissue responses, leading to enhanced osteogenesis. At the molecular level, modified implant surfaces increase adsorption of serum proteins, mineral ions, and cytokines, which subsequently promote cellular migration and attachment. Implant surface characteristics can also aid in the retention of a fibrin clot, thus providing a migratory pathway for the differentiating osteogenic cells to reach the implant surface. Today, implants are treated

with a variety of technologies to modify surface characteristics (microscale or nanoscale) to enhance bone formation.

Additive Processes

The additive process modifies the microstructure/macrostructure and chemical nature of the implant surface by adding materials or chemicals to the existing surface. Several methods are used to add materials or chemicals to the implant surface, such as inorganic mineral coatings, plasma spraying, biocoating with growth factors, fluoride, and particulates or cements containing calcium phosphates, sulfates, or carbonates. The addition of materials, such as hydroxyapatite, to the implant surface has been shown to enhance or accelerate the initial bone cells, adaptation or proliferation. In general, additive surface modifications tend to increase the surface texture greater than subtractive surface modifications, resulting in topographically “rougher” implant. Surface roughness can also be increased by oxidizing or adding an oxide layer.

Subtractive Processes

The subtractive process modifies the microstructure and chemical nature of the implant surface by removing or altering the existing surface. The roughness of implant surface can be modified by machining, acid etching, blasting, or a combination of these processes to enhance the amount or speed of osseointegration. Implant surfaces that are modified at the microscopic level with techniques such as acid etching are thought to promote favorable cellular responses and increased bone formation in close proximity to the surface.

Implant Surface Chemical Composition

There have been unsuccessful trials with oral implants made of carbon or hydroxyapatite. The lack of resistance, because of material properties, to occlusal forces led to frequent fractures. The so-called noble metals or alloys, however, do not resist corrosion and have thus been abandoned. Today, the majority of oral implants are made of commercially pure (CP) titanium or titanium alloys. Titanium is a reactive metal that oxidizes within nanoseconds when exposed to air. Because of this passive oxide layer, the titanium then becomes resistant to corrosion in its CP form. Some alloys, such as titanium-aluminum 6%, vanadium 4% (Ti6Al4V), are known to

provoke bone resorption as the result of leakage of some toxic components. The oxide layer of CP titanium reaches 10 nm of thickness. It grows over the years when facing a bioliquid. It consists mainly of titanium dioxide (TiO2).

Hard Tissue Interface

The primary goal in implant placement is to achieve and maintain an intimate bone-to-implant connection. This concept is known as osseointegration. Histologically defined, osseointegration is the direct structural and functional connection between organized, living bone and the surface of a load-bearing implant without intervening soft tissue between the implant and bone. Osseointegration clinically is defined as the asymptomatic rigid fixation of an alloplastic material (the implant) in bone with the ability to withstand occlusal forces.

The osseointegration process observed after implant insertion can be compared with bone fracture healing. Implant site osteotomy preparation (bone wounding) initiates a sequence of events, including an inflammatory reaction, bone resorption, release of growth factors, and attraction by chemotaxis of osteoprogenitor cells to the site. Differentiation of osteoprogenitor cells into osteoblasts leads to bone formation at the implant surface. Extracellular matrix proteins, such as osteocalcin, modulate apatite crystal growth. Specific conditions, optimal for bone formation, must be maintained at the healing site to achieve osseointegration.

For osseointegration to occur in a predictable fashion, several important factors are required:

1. A biocompatible material (the implant)

2. Atraumatic surgery to minimize tissue damage

3. Implant placement in intimate contact with bone

4. Immobility of the implant, relative to bone, during the healing phase

Titanium is the material of choice for dental implants. Titanium is biologically inert and therefore does not elicit a foreign body rejection reaction from host tissue. For the implant to have intimate contact with

bone, the implant site must be prepared with a precise technique. All implant systems have specially designed drills that are used in a specific sequence to remove bone as atraumatically as possible. The drill sizes are matched to the size and shape of the implant being placed, creating the precision necessary for developing initial bony contact and stability.

Atraumatic surgical technique in an aseptic environment is critical to minimize mechanical and thermal injuries to bone. This involves using sharp, precision osteotomy drills run at slow speed with high torque while maintaining gentle, intermittent pressure and providing copious irrigation. Irrigation can be accomplished either externally or internally using special handpieces and burrs with internal ports. The goal is to maintain bone temperatures below 47°C during implant site preparation. Any variance causing temperatures to exceed 47°C is likely to cause bone necrosis and failure of osseointegration.

Initial stability of the implant must be achieved and maintained for formation of bone at the implant surface. Stability at the time of placement is predicated on the volume and quality of bone that intimately contacts the implant as well as the length and diameter of the implant.

During the time required for osseointegration to occur, it is imperative that immobility of the implant be maintained. A mild inflammatory response enhances the bone healing, but moderate inflammation or movement above a certain threshold is detrimental. When micromovements at the interface exceed 150 μm, the movement will impair differentiation of osteoblasts and fibrous scar tissue will form between the bone and implant surface. Therefore it is important to avoid excessive forces, such as occlusal loading, during the early healing period.

New bone formation follows a specific sequence of events. Woven bone is quickly formed in the gap between the implant and the bone; it grows fast, up to 100 μm per day, and in all directions. Characterized by a random orientation of its collagen fibrils, high cellularity, and limited degree of mineralization, the biomechanical capacity of woven bone is poor. Thus any occlusal load should be well controlled or avoided in the early phase of healing.

After several months, woven bone is progressively replaced by lamellar bone with organized, parallel layers of collagen fibrils and dense

mineralization. Contrary to the fast-growing woven bone, lamellar bone formation occurs at a slow pace (only a few microns per day).

Clinically, both primary stability and secondary stability of an implant are critical to success. Primary stability, achieved at the time of surgical placement, depends on the implant geometry (macrodesign), as well as the quality and quantity of bone available for implant anchorage at a specific site. Studies using resonance frequency analysis (RFA) have reported decreased implant stability in the early weeks of post-insertion healing. Secondary stability, achieved over time with healing, depends on the implant surface (microdesign), as well as the quality and quantity of adjacent bone, which will determine the percentage of contacts between the implant and bone. For example, areas such as the anterior mandible have dense cortical bone and provide rigid primary stabilization and good support throughout the healing process. Conversely, areas such as the posterior maxilla have thin cortical bone, and large marrow spaces provide less primary stability. For this reason, the posterior maxilla has been associated with lower success rates compared with other sites with greater bone density and support.

Once osseointegration is achieved, implants can resist and function under the forces of occlusion for many years.

Soft Tissue–Implant Interface

Historically, most basic science and clinical efforts were spent on studying the bone-implant interface of osseointegration. Considerably less attention was given to overlying soft tissues. In contemporary implant dentistry, however, this subject is being researched with great zeal. Driven primarily by the need for satisfactory esthetics as well as maintenance of a soft tissue seal or barrier against bacterial invasion, soft tissue has become a major focus of interest.

It is critical to understand both the striking similarities and the obvious differences between the peri-implant soft tissue and periodontal soft tissue. Peri-implant and periodontal soft tissues do share a number of similarities and only subtle differences. Each emerges from alveolar bone through soft tissue. Soft tissue consists of connective tissue covered by epithelium, which is continuous with an epithelium-lined gingival sulcus, the apical-most portion being lined with junctional epithelium forming an attachment.

From that point down to the level of alveolar bone, both types of soft tissue possess a zone of dense connective tissue. This zone of supracrestal connective tissue is responsible for maintaining a stable interface between soft tissue and the implant and acts as a seal or barrier to the oral environment. It is the orientation of the connective tissue fibers adjacent to an implant that differ from a natural tooth. This zone of connective tissue has been measured to be 1 to 2 mm in height. Clinically this becomes important when examining the health of peri-implant soft tissue. Probing depths in a healthy implant would be approximately 1 to 2 mm less than the total measured dimension from the crest of the sulcus to the alveolar bone crest. The other obvious difference between teeth and implants is that teeth have a periodontal ligament with connective tissue fibers that suspend teeth in alveolar bone. The implant, however, is in direct contact with bone without any intervening soft tissue. This difference has a dramatic impact on the biomechanics, proprioception, and prosthetic consideration for implants versus natural teeth. Because an implant, unlike a tooth, does not have cementum, most connective tissue fibers run in a direction more or less parallel to the implant surface.

Questions emerged decades ago, as it did for the natural dentition, about the need for keratinized tissue to surround implants. Keratinized mucosa tends to be more firmly anchored by collagen fibers to the underlying periosteum than non-keratinized mucosa, which has more elastic fibers and tends to be movable relative to the underlying bone. In clinical studies evaluating intraoral implants, with or without peri-implant keratinized mucosa, no clinically significant difference in implant success was reported. However, when there is a lack of keratinized tissue, patients tend to complain about pain and discomfort while performing oral hygiene procedures or other functions in the area. The symptoms are alleviated by increasing the amount of keratinized (firmly bound) tissue around the implant(s) via soft tissue grafting.

Biomechanical Considerations

Once the implant is properly placed, the long-term success is heavily dependent on restorative biomechanical factors— that is, how the stresses imposed on the functioning implant or prosthetic unit or units will be controlled or distributed. The axiom is simple: The load-bearing capacity of the integrated implant has to be greater than the anticipated load during

function. If applied loads are greater than the load-bearing capacity, it is likely to lead to mechanical failure, biologic failure, or both. Mechanical failure may present simply as porcelain fracture or as a loosened or fractured prosthetic screw (the screw that attaches the abutment or framework to the implant). The most devastating mechanical failure occurs when the force is destructive enough to actually fracture the implant fixture. A biologic failure can occur when the functional load exceeds the load-bearing capacity of the implant-bone interface. This initially presents clinically as bone loss around the platform of the implant. If the loss is severe enough and the provocation is long enough, the bone loss may progress around the entire implant and result in complete failure of the implant. The clinician must remember that an implant-retained restoration lacks the “shock absorbing” periodontal ligament that a natural tooth-retained restoration possesses. The periodontal ligament allows slight physiologic movement of teeth, and in the absence of microbe-induced inflammation, natural teeth can move and adapt to the forces without pathologic bone loss. This, however, is not possible with an osseointegrated implant.

The load-bearing capacity of implants is qualified by several factors, including the number and size of the implants, the arrangement and angulation of the implants, and the volume and quality of the bone-implant interface. The same factors that maximize initial implant stability in hard tissue continue to be important. Thick cortical bone and dense trabecular bone surrounding a long, wide-diameter implant that is positioned to be in line with the functional load, would offer the greatest load-bearing capacity and the best prognosis for long-term success. Conversely, a short, narrow-diameter implant placed in an area of thin cortical bone and less dense trabecular bone and in an off-axis angulation would have far less load-bearing capacity and a poorer prognosis for success. The angulation of the implants as it relates to the occlusal plane and the direction of the occlusal forces is an important determinant in optimizing the translation of the forces to the implants and the surrounding bone. Loads directed through the long axis of the implants are tolerated very well. Slight off-axis loads are usually not clinically detrimental, but loads applied at angles greater than 20 degrees or more can result in load magnification and initiate bone loss at the implant-bone interface. Again, if excessive loads persist, bone loss will continue and will likely lead to implant failure.

The number of implants placed in multi-tooth edentulous spans affects the load-bearing capacity of the implanted prosthesis. If there is a three-tooth edentulous span, the fixed prosthetic options would be to place three implants with three splinted crowns, three implants with three single-unit crowns, two implants as terminal abutments for a three-unit fixed partial denture, or two adjacent implants with a fixed partial denture with a cantilevered pontic. The load-bearing capacity decreases with each successive option.

Straight-line or linear arrangement of multiple implants should be avoided as this provides the least biomechanical advantage and is the least resistant to torqueing forces caused by off-center occlusal and lateral loads. Implants should be placed in a more curvilinear or staggered fashion.

Connecting a single integrated implant to one natural tooth with a fixed partial denture will effectively create an excessively loaded cantilever situation. Because of the immobility of the implant compared with the mobility of the natural tooth, when the loads are applied to the fixed partial denture, the tooth can move within the limits of its periodontal ligament. This can create stresses at the implant abutment junction up to two times the applied load on the prosthesis. Additional problems with a tooth to implant-supported, fixed partial dentures include breakdown of osseointegration, cement failure on the natural abutment, screw or abutment loosening, and possible failure of the implanted prosthetic components.

Detrimental forces can be applied iatrogenically by placing non-passive, ill-fitting frameworks on implants. When the screws are tightened in an attempt to seat the ill-fitting framework, compressive forces are placed on the implant-bone interface. This excessive force can lead to bone loss and potential implant failure.

Preoperative Assessment and Treatment Planning

The ultimate goal of dental implant therapy is to satisfy the patient’s desire to replace one or more missing teeth in an esthetic, functional manner with long-term success. To achieve this goal, clinicians must accurately and comprehensively assess the dentoalveolar condition as well as the overall physical and mental well-being of the patient.

Chief Complaint

What is the problem or concern in the patient's own words? What is the patient's goal of treatment? How realistic are the patient's expectations? The patient's chief concern, desires for treatment, and vision of the successful outcome must be taken into consideration.

The patient will measure implant success according to his or her personal criteria. The overall comfort and function of the implant restoration are often the most important factors, but satisfaction with the appearance of the final restoration will also influence the patient's perception of success. Furthermore, patient satisfaction may be influenced simply by the impact that the treatment has on the patient's perceived quality of life. Patients will evaluate for themselves whether the treatment helped them to eat better, look better, or feel better about themselves.

The clinician could consider an implant and the retained prosthesis a success using standard criteria of symptom-free implant function, implant stability, and lack of peri-implant infection or bone loss. At the same time, however, the patient who does not like the aesthetic result or does not think the condition has improved could consider the treatment a failure. Therefore it is critical to inquire, as specifically as possible, about the patient's expectations before initiating implant therapy and to appreciate the patient's desires and values. With this goal in mind, it is often helpful and advisable to invite patients to bring their spouses or family members to the consultation and treatment-planning visits to add an independent “trusted” observer to the discussion of treatment options. Ultimately, it is the clinician's responsibility to determine if the patient has realistic expectations for the outcome of therapy and to educate the patient about realistic outcomes for each treatment option.

Medical History and Medical Risk Assessment

A thorough medical history is required and must be documented for every dental patient. As with any patient planning a surgical procedure, the patient must be assessed preoperatively to evaluate his or her ability to tolerate the proposed procedure, heal, and to have a favorable prognosis.

There are only a few absolute medical contraindications to implant therapy. Absolute contraindications to implant placement based on surgical and

anesthetic risks are limited primarily to patients who are acutely ill and those with uncontrolled metabolic disease. Often these contraindications are limited in duration; once the illness resolves or the metabolic disease is controlled, the patient may become a good candidate for implant therapy. Relative contraindications are concerned with medical conditions that affect bone metabolism or the patient's ability to heal. These include conditions such as diabetes, osteoporosis, immune compromise (e.g., human immunodeficiency virus infection, acquired immunodeficiency syndrome), medications (e.g., bisphosphonates—oral and intravenous), and medical treatments such as chemotherapy and irradiation (e.g., of the head and neck).

Some psychological or mental conditions could be considered absolute or relative contraindications, depending on their severity. Patients with psychiatric syndromes (e.g., schizophrenia, paranoia) or mental instabilities (e.g., neurosis, somatic symptom disorder), those who have mental impairment or are uncooperative, or those who have irrational fears, phobias, or unrealistic expectations may be poor candidates for implant treatment. Certain habits or behavioral considerations such as smoking, tobacco use, substance abuse (e.g., drugs and alcohol), and parafunctional habits (bruxing and clinching) must be scrutinized as potential contraindications as well. Smoking, in particular, has been documented as a significant risk factor resulting in decreased long-term stability and retention of implants.

Contraindications

Absolute contraindications to implant placement

- Acute illness
- Magnitude of defect/anomaly
- Uncontrolled metabolic disease
- Bone and/or soft tissue pathology/infection

Relative contraindications

- Diabetes
- Osteoporosis
- Parafunctional habits
- HIV
- AIDS
- Bisphosphonate usage—oral and intravenous
- Chemotherapy
- Irradiation of head and neck
- Behavioral, neurologic, psychosocial, psychiatric disorders

Dental History

A review of a patient's past dental experiences can be a valuable part of the overall evaluation. Does the patient report a history of recurrent or frequent abscesses, which may indicate a susceptibility to infections or diabetes? Does the patient have many restorations? How compliant has the patient been with previous dental recommendations? What are the patient's current oral hygiene practices?

The individual's previous experiences with surgery and prosthetics should be discussed. If a patient reports numerous problems and difficulties with past dental care, including a history of dissatisfaction with past treatment, the patient may have similar difficulties with implant therapy. It is essential to identify past problems and to elucidate any contributing factors. The clinician must also assess the patient's dental knowledge and understanding of the proposed treatment, as well as the patient's attitude and motivation toward implants.

Intraoral Examination

The oral examination is performed to assess the current health and condition of existing teeth, as well as to evaluate the condition of the oral hard and soft tissues. It is imperative that no pathologic conditions are present in any of the hard or soft tissues in the maxillofacial region. All oral lesions, especially infections, should be diagnosed and appropriately treated before implant therapy.

Additional criteria to consider include the patient's habits, level of oral hygiene, overall dental and periodontal health, occlusion, jaw relationship, temporomandibular joint condition, and ability to open wide.

After a thorough intraoral examination, the clinician can evaluate potential implant sites. All sites should be clinically evaluated to measure the available space in the bone for the placement of implants and in the dental space for prosthetic tooth replacement. The mesial-distal and buccal-lingual dimensions of edentulous spaces can be approximated with a periodontal probe or other measuring instrument. The orientation or tilt of adjacent teeth and their roots should be noted as well. There may be enough space. Conversely, there may be adequate space between roots, but the coronal aspects of the teeth may be too close for emergence and

restoration of the implant. If either of these conditions is discovered, orthodontic tooth movement may be indicated. Ultimately, edentulous areas need to be precisely measured using diagnostic study models and imaging techniques to determine whether space is available and whether adequate bone volume exists to replace missing teeth with implants and implant restorations.

How Much Space Is Required for Placement of One or More Implants?

Alveolar Bone

Assuming an implant is 4 mm in diameter and 10 mm long, the minimal width of the jawbone needs to be 6 to 7 mm, and the minimal height should be 10 mm (minimum of 12 mm in the posterior mandible, where an additional margin of safety is required over the mandibular nerve). This dimension is desired to maintain at least 1 to 1.5 mm of bone around all surfaces of the implant after preparation and placement.

Interdental Space

Edentulous spaces need to be measured to determine whether enough space exists for the placement and restoration with one or more implant crowns. The minimal mesial-distal space for an implant placed between two teeth is 7 mm. The minimal mesial-distal space required for the placement of two standard-diameter implants (4-mm diameter) between teeth is 14 mm. The required minimal dimensions for wide-diameter or narrow-diameter implants will increase or decrease incrementally according to the size of the implant. For example, the minimal space needed for the placement of an implant 6 mm in diameter is 9 mm (7 mm + 2 mm).

Whenever the available space between teeth is greater than 7 mm and less than 14 mm, only one implant, such as placement of a wide-diameter implant, should be considered. Two narrow diameter implants could be positioned in a space that is 12 mm. However, the smaller implant may be more vulnerable to implant fracture.

Interocclusal Space

The restoration consists of the abutment, the abutment screw, and the crown (it may also include a screw to secure the crown to the abutment if it is not cemented). This restorative “stack” is the total of all the components

used to attach the crown to the implant. The dimensions of the restorative stack vary slightly depending on the type of abutment and the implant-restorative interface (i.e., internal or external connection). The minimum amount of interocclusal space required for the restorative “stack” on an external hex-type implant is 7 mm.

Diagnostic Casts and Photographs

Mounted study models as well as intraoral and extraoral photographs complete the records collection process. Study models and photographs are often overlooked in preoperative history taking, but both contribute significantly to the assessment and treatment planning phases of implant dentistry.

Study models mounted on a semi-adjustable articulator using a face-bow transfer give the clinician a three-dimensional working representation of the patient and provide much information required for surgical and prosthetic treatment planning.

Elements that can be evaluated from accurately mounted models include the following:

1. Occlusal relationships
2. Arch relationships
3. Inter-arch space
4. Arch form, anatomy, and symmetry
5. Preexisting occlusal scheme
6. Curve of Wilson and curve of Spee
7. Number and position of the existing natural teeth
8. Tooth morphology
9. Wear facets
10. Edentulous ridge relationships to adjacent teeth and opposing arches
11. Measurements for planning future implant locations

12. Visualizing force vectors, both present and planned

Medicolegally, the mounted study models are preserved as an exact reference of the preoperative condition.

Intraoral photographs are equally important. They allow visual evaluation of the patient's soft tissue (e.g., quantity, quality, location, texture, color, symmetry). Extraoral photographs provide views of the patient from many different esthetic perspectives. Elements that are easily assessed are as follows:

1. Facial form

2. Facial symmetry

3. Patient's degree of expression and animation

4. Patient's appearance (e.g., facial features, facial hair, complexion, eye color)

5. Smile line

6. Incisal edge or tooth display

7. Buccal corridor display

8. Potential esthetic demand

Hard Tissue Evaluation

The amount of available bone is the next criterion to evaluate. Wide variations in jaw anatomy are encountered, and it is therefore important to analyze the anatomy of the dentoalveolar region of interest both clinically and radiographically.

A visual examination can immediately identify deficient areas, whereas other areas that appear to have good ridge width will require further evaluation. Clinical examination of the jawbone consists of palpation to feel for anatomic defects and variations in the jaw anatomy, such as concavities and undercuts. If desired, it is possible with local anesthesia to probe through the soft tissue (intraoral bone mapping) to assess the thickness of the soft tissues and measure the bone dimensions at the proposed surgical site.

The spatial relationship of the bone must be evaluated in a three dimensional view because the implant must be placed in the appropriate position relative to the prosthesis. It is possible that an adequate dimension of bone is available in the anticipated implant site, but that the bone and thus the implant placement might be located too lingual or too buccal for the desired prosthetic tooth replacement. Bone augmentation procedures may be necessary to facilitate the placement of an implant in an acceptable prosthetic position despite the availability of an adequate quantity of bone (i.e., the bone is in the wrong location).

Soft Tissue Evaluation

Evaluation of the quality, quantity, and location of soft tissue present in the anticipated implant site helps to anticipate the type of tissue that will surround the implant(s) after treatment is completed (keratinized vs. nonkeratinized mucosa). For some cases, clinical evaluation may reveal a need for soft tissue augmentation. Areas with minimal or no keratinized mucosa may be augmented with gingival or connective tissue grafts. Other soft tissue concerns, such as frenum attachments that pull on the gingival margin, should be thoroughly evaluated as well.

Debate continues about whether it is necessary to have a zone of keratinized tissue surrounding implants. Despite strong opinions and beliefs about the need for keratinized mucosa around implants versus this mucosa being unnecessary, neither argument has been proved.

Some studies have concluded that, in the presence of good oral hygiene, a lack of keratinized tissue does not impair the health or function of implants. Others strongly believe that keratinized mucosa has better functional and aesthetic results for implant restorations. Keratinized mucosa is typically thicker and denser than alveolar mucosa (nonkeratinized). It forms a strong seal around the implant with a cuff of circular (parallel) fibers around the implant, abutment, or restoration that is resistant to retracting with mastication forces and oral hygiene procedures.

Radiographic Examination

Several radiographic imaging options are available for diagnosis and for planning of dental implantation. Options range from standard intraoral projections (e.g., periapical, occlusal) and extraoral projections (e.g.,

panoramic, cephalometric), to more complex cross-sectional imaging (e.g., computed tomography [CT], conebeam computed tomography [CBCT]).

Multiple factors, however, influence the selection of radiographic techniques for any particular case. Such factors as cost, availability, radiation exposure, and the type of case must be weighed against the accuracy of identifying vital anatomic structures within a given bone volume and being able to perform the surgical placement without injury to these structures. Areas of study radiographically include the following:

1. Location of vital structures

• Mandibular canal

• Anterior loop of the mandibular canal

• Anterior extension of the mandibular canal

• Mental foramen

• Maxillary sinus (floor, septations, and anterior wall)

• Nasal cavity

• Incisive foramen

2. Bone height

3. Root proximity and angulation of existing teeth

4. Evaluation of cortical bone

5. Bone density and trabeculation

6. Pathology (e.g., abscess, cyst, tumor)

7. Existence of anatomic variants (e.g., incomplete healing of extraction site)

8. Cross-sectional topography and angulation (best determined by using CT and CBCT)

9. Sinus health (best evaluated by using CT and CBCT)

10. Skeletal classification (best evaluated with the use of lateral cephalometric images)

Radiographic images allow for quantifying dimensions or for taking measurements. Traditional radiographs must be calibrated for potential magnification. Magnification on a traditional panoramic image can be as much as 25%. One way to determine magnification is to place a metal sphere near the plane of occlusion when taking the radiograph. By comparing the radiographic size with the actual size of the sphere, the magnification can be determined. Digitally acquired periapical, panoramic, lateral cephalometric images and CT and CBCT scans have bundled software applications that allow for very accurate measurement.

Critical measurements specific to implant placement include the following:

• At least 1 mm inferior to the floor of the maxillary and nasal sinuses

• Incisive canal (maxillary midline implant placement) to be avoided

• 5 mm anterior to the mental foramen

• 2 mm superior to the mandibular canal

• 3 mm from adjacent implants

• 1.5 mm from roots of adjacent teeth

CT and CBCT image data files can be reformatted and viewed on personal computers using simulation software. This allows the diagnosis and treatment planning processes to be more accurate with regard to measurements and dimensions. Critical anatomic structures can be visualized in all three coordinate axes so that their superoinferior, anteroposterior, and buccolingual locations can be identified.

Key Fact

The American Academy of Oral and Maxillofacial Radiology recommends panoramic radiography as the initial evaluation of the dental implant patient, supplemented with periapical radiographs as needed.

Surgical Treatment Planning Considerations

Surgical treatment planning takes the diagnostic data that have been gathered and combines them with the surgeon's clinical judgment to determine the potential surgical options. The surgeon must be mindful of the proposed prosthetic goals, typically driven by the number of implants required in suggested locations for a specific prosthetic design. Because implant dentistry is often a team endeavor, it is advantageous for the surgeon to have a reasonable understanding of the prosthetics and for the restoring dentist to have an understanding of the surgical aspects of implant placement.

After evaluating all of the previously described information, the surgeon must determine the prognosis of implant placement based on specific limitations as a result of anatomic variations, bone quality, and bone quantity in different areas of the jaw. The anterior mandible is usually tall enough and wide enough to accommodate implant placement. Bone quality is usually excellent, typically the densest of any area in the two arches. Primary surgical concerns in this area include proper angulation of the implants and avoiding the mental foramen and mandibular canal. Implants should be placed at least 5 mm anterior to the most anterior portion of the mental foramen, avoiding the anterior loop of the mandibular canal.

The posterior mandible limits the length of the implants based on the position of the mandibular canal that traverses the body of the mandible in this region. Ideally, the tip of the implant should be at least 2 mm from the inferior alveolar nerve (IAN). It is important to consider the buccolingual position of the nerve as well. The width of the posterior mandible must also be considered. If the nerve is located very near the buccal cortex, a longer implant could be placed, with the implant extending lingual to the IAN, even though the implant extends vertically past the nerve. CT or CBCT can be helpful in making this determination. The mandibular canal also precludes any posterior implants from engaging the inferior cortical plate, which could lessen the initial primary stability of the implant. The attachment of the mylohyoid muscle helps maintain the bony width along the superior aspect of the ridge, although this can often be deceiving because a deep lingual depression, "the lingual undercut," usually is present immediately below this attachment. This is a critical area to be examined and palpated during the clinical examination.

In planning the implant placement, if primary stability is questionable, increased time for osseointegration may be considered. The clinician may also want to consider “over-engineering” the case by using more implants (e.g., three implants replacing three teeth, vs. two implants replacing three teeth).

The posterior maxilla poses two specific concerns related to implant placement. The first is the quality of bone in this area. As previously discussed, bone quality in the posterior maxilla is typically the poorest of any area, limited by thin cortical bone at the ridge crest and the least dense trabecular bone. This often results in less implant stability at the time of placement. For this reason, more time (6 months or longer) may be required for osseointegration to occur in this region. The second concern is the proximity of the maxillary sinus to the edentulous ridge. Often, as a result of bone resorption and increased pneumatization of the sinus, a limited height of bone remains for implant placement. If an adequate height of bone is present, the implant should be placed, leaving 1 mm of bone between the sinus and the implant. If there is inadequate bone height, then either a “sinus bump” or “sinus lift” procedure would be necessary to augment the height of bone.

The anterior maxilla, even though it is the most surgically assessable area, may be one of the most difficult regions for implant placement. This area, even when healthy teeth are present, usually has a thin buccal plate. After tooth loss, the resorption of the ridge follows a pattern of moving apically and palatally, only exacerbating an already tenuous anatomy. The residual ridge anatomy results in a ridge that is narrow and angulated such that ideal implant positioning may be impossible and the esthetic outcome may be compromised. The nasal cavity and the incisive canal are vital structures that also define the anatomic limitations of anterior implant placement. Implants should be placed 1 mm short of the nasal floor and should not be placed in the maxillary midline.

Final Treatment Planning

The final stage of treatment planning involves consolidating all of the clinical and radiographic information in combination with surgical options and limitations to produce the best final result of the prosthetic treatment. The positioning and angulation of implant placement is critical to the

biomechanical stability and esthetics required for long-term success. To facilitate ideal implant placement, surgical guides are frequently utilized. The surgical guide template is a critical factor for implants placed in an esthetically important area because even slight variations of angulation can have large effects on the appearance of the final restoration. The construction of the surgical guide template is nearly indispensable in patients for whom it is necessary to optimize implant placement to ensure correct emergence profiles in the anterior esthetic zone. The four objectives of using a surgical template for the partially edentulous patient are as follows: (1) delineating the embrasure, (2) locating the implant within the tooth contour, (3) aligning the implants with the long axis of the completed restoration, and (4) identifying the level of cementoenamel junction or tooth emergence from soft tissue. This template can be constructed by using a diagnostic wax-up over the preoperative cast to construct a clear resin template with a guide hole. This provides the surgeon ease of access to bone and uninterrupted visual confirmation of frontal and sagittal positions and angulation. Although underlying bone may dictate some minor variation, the surgeon must stay as close as possible to the template during implant placement. With the aid of computer technology, accurate “virtual” treatment planning can be accomplished. CBCT data are used to produce a three-dimensional reconstruction, which offers the ability to view anatomic structures in cross-section. The ideal prosthetic position can be simulated and the position and angulation of the implant determined. A computer-generated splint can then be constructed with guide sleeves matched to implant drill sizes. This allows precise placement of the implant at the time of surgery. The ultimate result should allow the surgeon to place the implant optimally in bone while maintaining the angulation that provides the best foundation for the final restoration.

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Dental Implantology

5th year **Dr. Auday M. Al-Anee**

Basic Implant Surgical Procedures

Surgical procedures always start with detailed surgical preparation. Preparation for implant surgery requires a thorough review of the patient's chart, including medical and dental histories, operatory notes, radiographs, anticipated implant sizes and locations, surgical guides, surgical sequencing and strategy, possible complications, patient management, anesthesia, operating time, instrumentation, postoperative management, and restorative plan. Preoperative antibiotic prophylaxis is sometimes recommended. An oral dose of 2 g amoxicillin 1 hour preoperatively or, in patients unable to take oral medications, cefazolin 1 g or ampicillin 2 g intramuscularly or intravenously 1 hour before the dental procedure are effective. Alternative medications include 600 mg of clindamycin orally or intravenously. No postoperative antibiotic administration is necessary.

Once the patient has been draped in a sterile fashion and the surgical team has been gloved and gowned, the patient is anesthetized. In many cases, the implants can be placed using local anesthetic block or infiltration techniques. However, in more complex and lengthy procedures, some type of sedation or general anesthesia may be preferred. Local anesthetics containing vasoconstrictors are usually used for hemostasis. Additional long-acting anesthetics for postoperative pain control may be warranted. It is imperative to have good access to the operative site via effective retraction of cheeks and the tongue. A mouth prop is invaluable.

The surgical site should be kept aseptic, and the patient should be appropriately prepared and draped for an intraoral surgical procedure. Pre-rinsing with chlorhexidine gluconate for 1 to 2 minutes immediately before the procedure will aid in reducing the bacterial load present around the surgical site. Every effort should be made to maintain a sterile surgical field and to avoid contamination of the implant surface. Implant sites should be prepared using gentle, atraumatic surgical techniques with an effort to avoid overheating the bone.

Successful osseointegration occurs predictably for submerged and non-submerged dental implants when proven clinical guidelines are followed. Well-controlled studies of patients with good plaque control and appropriate occlusal forces have demonstrated that root form, endosseous dental implants show little change in bone

height around the implant over years of function. After initial bone remodeling in the first year (1 to 1.5 mm of resorption described as "normal remodeling around an externally hexed implant"), the bone level around healthy functioning implants remains stable for many years afterward. The average annual crestal bone loss after the first year in function is expected to be 0.1 mm or less. Hence, implants offer a predictable solution for tooth replacement.

Regardless of the surgical approach, the implant must be placed in healthy bone with good primary stability to achieve osseointegration, and an atraumatic technique must be followed to avoid damage to bone. Drilling of the bone without adequate cooling generates excessive heat, which injures bone and increases the risk of failure. The anatomic features of bone quality (dense compact versus loose trabecular) at the recipient site influences the interface between bone and implant. Compact bone offers a much greater surface area for bone-to-implant contact than cancellous bone. Areas of the jaw exhibiting thin layers of cortical bone and large cancellous spaces, such as the posterior maxilla, have lower success rates than areas of dense bone. The best results are achieved when the bone-to-implant contact is intimate at the time of implant placement.

One-Stage versus Two-Stage Implant Placement Surgery

Currently, most threaded endosseous implants can be placed using either a one-stage (nonsubmerged) or a two-stage (submerged) protocol. In the one-stage approach, the implant or the abutment emerges through the mucoperiosteum/gingival tissue at the time of implant placement, whereas in the two-stage approach, the top of the implant and cover screw are completely covered with the flap closure. Implants are allowed to heal, without loading or micromovement, for a period of time to allow for osseointegration. In two-stage implant surgery, the implant must be surgically exposed following a healing period. Some implants, referred to as "tissue level," are specifically designed with the coronal portion of the implant positioned above the crest of bone and extending through the gingival tissues at the time of placement in a one-stage protocol. Other implant systems, referred to as "bone level," are designed to be placed at the level of bone and require a healing abutment to be attached to the implant at the time of placement to be used in a one-stage approach.

A one-stage surgical approach simplifies the procedure because a second-stage exposure surgery is not necessary. The two-stage, submerged approach is advantageous for situations that require simultaneous bone augmentation procedures at the time of implant placement because membranes can be submerged, which will minimize postoperative exposure. Mucogingival tissues can be augmented if desired at the second-stage surgery in a two-stage protocol or as part of the one-stage protocol.

Implant Site Exposure

Exposure of the implant site can be accomplished in several ways, including flapless surgery or with tissue elevation that may include sulcular, midcrestal, and vertical releasing incisions. Flapless surgery may be indicated when there is adequate keratinized tissue over an ideal ridge form. This creates the least soft tissue trauma and may provide the best postoperative esthetics in patients with excellent presurgical anatomy and papilla shape. In flapless surgery, the implant and the healing or provisional restoration are placed in a single stage.

When a flap is required, the incision should be designed to allow convenient retraction of soft tissue for unimpeded access for implant placement. This is usually necessary when better access and visualization of the underlying bone is necessary and when additional procedures such as bone or soft tissue grafting are done at the time of implant placement.

• Midcrestal incision: The incision should be made through the keratinized tissue, being sure to place the blade up against the mesial-distal surfaces of the teeth adjacent to the edentulous space. In areas with a narrow zone of keratinized tissue, the incision can be made slightly to the palatal or buccal aspect to allow for keratinized tissue transfer to the buccal or facial aspect and better soft tissue closure. If sulcular incisions are necessary, great care is taken to follow the contour of the sulcus so as not to damage the soft tissue architecture.

• Vertical releasing incision: Using a sharp no. 15 blade, a curvilinear, beveled (~45 degrees), papilla sparring incision should be made to reduce or eliminate incision scarring. It must be ensured that the vertical releasing incision is extended apically enough to allow complete release of the flap.

Implant Placement

Flap Reflection

• Reflection at the papilla is initiated with a periosteal or elevator, using gentle, well-directed, controlled pressure. The periosteal elevator's edge can be used in a "light painting stroke" to cleanly release the subperiosteal fibers. At this point, the flap is developed from the papilla up along the vertical release.

• The dissection is then directed along the sulcular tissue to the point where it meets the crestal portion of the incision. The index finger of the opposing hand supporting the facial aspect of the ridge allows greater control and protection of the flap during reflection.

• The reflection is continued by the elevation sulcularly to the distal extent of the incision.

• Once the buccal flap is reflected, the palatal or lingual flap can be reflected enough to visualize the width of the ridge. Any soft tissue tags should be carefully removed.

• When the buccal flap has been reflected completely, a retractor can be positioned against the bone inside the flap. This allows good visualization of the operative site while protecting the integrity of the flap. It is extremely important to avoid inadvertent trauma to the flap with the tip if the retractors.

Preparing the Osteotomy

The surgeon must confirm that the handpiece and motor are functioning properly: the speed setting on the motor should be checked; it must be confirmed that the drill is spinning in the forward mode. The speed should be set to the appropriate speed as recommended by the manufacturer of the implant system being used.

• All drills, including osteotomy drills, should be copiously irrigated internally, externally, or both when preparing the bone.

• The depth indicator markings on the precision and pilot drills should always be reviewed.

• The entry point and its ideal angulation should be determined with the precision drill. The proper angulation should be verified from different vantage points. A surgical guide is usually used to facilitate orientation.

• Drilling is done with the precision drill at full speed to a depth of 1 to 2 mm short of the depth of the intended implant (e.g., 8 mm deep for a 10-mm implant).

• The area is irrigated and the 2-mm pilot drill positioned in the exact same location after verifying the correct angulation. Once position and angulation are confirmed, the 2-mm pilot drill is run at full speed to the intended depth of the implant (e.g., 10 mm deep for a 10-mm implant).

• The area is rinsed, and the guide pin that corresponds to the intended final size of the planned implant is placed. Use of the guide pin allows the surgeon to evaluate the position, spacing, and angulation of the developing osteotomy. It also helps evaluate where the pin lines up against the opposing dentition.

• The surgeon then determines the location on the twist drill that corresponds to the intended platform position of the implant to the ridge. Typically, the top of the platform would be even with the mesial and distal bone height.

• The tip of the narrowest twist drill is placed into the pilot hole, and the correct position and angulation of the drill are verified. Once confirmed, the drill is run at full speed in a gentle pumping motion. It may be necessary to remove the drill and clean the accumulated bone off the drill. The osteotomy is rinsed, and the drill is then repositioned and the angulation confirmed. The drill is again run at full speed and taken to the final depth of the intended implant. The site is sequentially prepared in this manner.

• The osteotomy is rinsed, and the appropriate guide pin is placed to reevaluate position and alignment.

• The tip of this final twist drill is placed into the opening of the osteotomy; then its position and angulation are verified. Great care is taken to achieve perfect position and angulation, as this is the drill that finalizes the osteotomy.

• Once the drill is properly positioned, it is run at full speed in a gentle pumping motion to the final depth of the intended implant. The osteotomy is then inspected with a thin instrument for possible bone perforation (e.g., sinus communication or buccal wall perforation).

• Immediately after completing the osteotomy, the speed of the motor is changed to the desired and/or recommended torque, measured in newton centimeters (Ncm—typically around 30 Ncm) for the insertion of the implant. If the speed is not changed and the implant is put in at the original setting of 800 to 1500 rpm, the osteotomy could easily be damaged, the implant seated too deep, or primary stability lost.

Inserting Implant

• The implant is opened and placed on the driver that has been inserted into the handpiece. The handpiece must be held such that the tip of the implant is pointing up. This will lessen the likelihood of the implant falling off the driver.

• The tip of the implant is inserted into the osteotomy, and the position and angulation are verified again. The implant is driven into position by keeping light pressure in an apical direction until the implant is almost completely seated or until the motor torques out (approximately 1 to 2 mm short of complete seating).

• Using the hand torque wrench, the surgeon continues to seat the implant, using the torque lever of the wrench to quantify the amount of torque present. If the torque exceeds the lever, the implant is hand torqued to its final position by using the handle of the torque wrench.

• The seating of the implant is finalized by verifying that the platform is even with the mesial and distal heights of bone and that any orientation marker is pointed in the correct position.

• The area is irrigated thoroughly.

• It should be determined if there will be a single- or two-stage healing period. This is determined by the torque value measured on the surgical motor or the hand torque wrench. An implant with a torque value of 35 Ncm or greater is considered

to have good primary stability, and single-stage healing is possible. If so, an appropriate-sized healing abutment is placed. If a two-stage process is required, then an appropriate-sized cover screw is placed.

• The abutment should protrude 1 to 2 mm through the tissue. A tapered abutment rather than a parallel abutment must be determined. The intended tissue emergence of the planned restoration helps determine whether the healing abutment is tapered or parallel.

• The healing abutment is placed onto the insertion wrench, again by holding the screw pointing up. The abutment is screwed into the implant and tightened with finger pressure, making sure that no tissue is caught under the abutment.

Suturing Flap

- The flap is sutured using some type of resorbable suture (chromic gut or Vicryl) or nonresorbable suture (proline).
- The anterior papilla is secured first. The buccal aspect of the papilla is entered with the suture needle, which is passed through the embrasure to engage the palatal tissue. The needle is then positioned lower on the palatal tissue and penetrated and brought through the embrasure to the buccal and the papilla engaged apically to the first entry point.
- The vertical release is then sutured, followed by the mesial and distal sides of the abutment. These are simple interrupted sutures tied in the same fashion as the first suture described.

Postoperative Management

A radiograph should be taken postoperatively to evaluate the position of the implant in relation to adjacent structures such as the sinus and the inferior alveolar canal and relative to teeth and other implants. This radiograph also serves to verify the complete seating of the cover screw or healing abutment.

Patients should be given analgesics. Mild to moderate strength analgesics are usually sufficient. Antibiotics are often given prophylactically before surgery but are usually not required in the postoperative period. Patients may also be instructed to use 0.12% chlorhexidine gluconate rinses for 2 weeks after surgery to help keep

bacterial populations at a minimum during healing. The patient is evaluated weekly until soft tissue wound healing is complete (approximately 2 to 3 weeks). If the patient wears a tissue-borne denture over the area of implant placement, the denture can be relined with a soft liner after 1 week. Interim partial dentures or orthodontic retainers with an attached pontic may be worn immediately but must be contoured to avoid soft tissue loading over the implant site.

Uncovering

The healing time or the length of time necessary to achieve osseointegration varies from site to site and from patient to patient. Insertion torque values, quality of bone, bone grafts, patient health, location, number of implants, and soft tissue health all have an impact on healing time. Typical healing times are 4 to 6 months. In single-stage surgery, no surgical uncovering is necessary. The implant stays exposed via the healing abutment after surgery and throughout the healing phase. After an appropriate integration time, restoration of the implant can proceed.

In a two-stage system, the implant must be surgically uncovered and a healing abutment placed. The goals of surgical uncovering are to attach the healing abutment to the implant, preserve keratinized tissue, and modify the form or thickness of tissue. A soft tissue healing period after uncovering must be allowed before restoration of the implant can take place, typically 2 to 4 weeks.

The simplest method of surgical uncovering is the “tissue punch”. This method of uncovering utilizes a soft tissue punch equal to or slightly larger than the diameter of the implant placed. The implant is palpated through the tissue to determine its location. The tissue punch is placed directly over the implant circumference and twisted through the soft tissue thickness, taking care not to damage the bone at the level of the implant platform. The punch is then removed, along with a precisely determined piece of tissue that was lying directly above the implant, easily exposing the implant cover screw. The cover screw is then removed, and an appropriate sized and appropriate-shaped healing abutment is placed. The advantage to this technique is that it is less traumatic, no periosteum needs to be reflected, and only a short soft tissue healing time is required. This technique does, however, require an adequate zone of keratinized tissue so that the implant can be

accurately located. Disadvantages to this technique include sacrifice of a portion of the keratinized tissue, inability to visualize the bone surrounding the implant, and the inability to directly visualize the precise abutment–implant interface.

If the implants cannot be accurately located, if the clinician needs to visualize underlying bone, or if a slight keratinized tissue transfer is indicated, then a crestal incision with the creation of a slight soft tissue flap is required to uncover the implants. If an adequate zone of keratinized tissue is present, the soft tissue flap can be contoured with a scalpel, scissors, or a punch to conform to the shape of the healing abutment. This allows for a nicely shaped and contoured soft tissue cuff around the healing abutment and eventually the final implant restoration. Obvious advantages to this technique include easy access, minimal invasiveness, and ability to directly visualize the bone surrounding the implant and to precisely fit the healing abutment to the implant platform. The disadvantage to reflecting a flap during uncovering is the possibility of bone loss due to stripping the periosteum from bone during the uncovering. Advanced techniques for cases with an inadequate zone of attached tissue include tissue transfer procedures, tissue grafting, and split-thickness apically repositioned flaps.

Implant Stability

Initial implant stability is one of the most important predictors of long-term implant success. This depends on the depth and density of bone, implant size, and precision of the surgical technique. A good sense of implant stability can be obtained during the seating process and by verifying adequate torque resistance capability of the seated implant.

Radiofrequency analysis has been used to measure and verify implant stability. This technology involves attaching a transducer to an implant and applying a steady-state resonance frequency to the implant. The advantage of this technology is that it is not dependent on measuring implant movement in just one direction but rather by evaluating the complete bone-implant interface.

Complications

Implant placement surgery can be performed with great accuracy and with little complication if the case has been diagnosed, planned, and surgically performed well. However, as with any surgical or clinical procedures, complications are possible and include the following:

• Complications that can occur with any surgical procedure, including pain, bleeding, swelling, or infection.

• A positioning error resulting in implants placed at a compromised angulation or position. The implant may be placed too close to an adjacent tooth root or too far to the mesial, distal, or buccal aspect, thus compromising bony support. The implant can be placed too far into bone, making prosthetic access difficult. If the implant is not placed deep enough into bone, leaving threads of the implant body above the osseous crest, there will be compromise to bony support, soft tissue health, hygiene, and esthetics.

• Surgical technique complications such as a tear of the soft tissue flap, poor closure of the incision, or excessive soft tissue trauma from retraction may result in tissue dehiscence, infection, and eventual loss of the implant. Poor attention to detail in preparation of the osteotomy such as overdrilling the diameter of the osteotomy could result in poor prognosis for integration.

• Invasion of critical anatomic structures can create more serious complications. If the implant invades or impinges on the canal of the IAN, this may result in paresthesia (altered sensation that the patient does not find painful, e.g., numbness, tingling), or dysethesia (altered sensation that the patient finds painful or uncomfortable). If the implant invades the maxillary sinus or the nasal cavity, this may result in an infection. Bone structure compromise can present as overthinning of the buccal or facial plate or dehiscence or fenestration of overlying tissue. Bone perforation can occur at the inferior border of the mandible because of inaccurate drilling depth or on the lingual aspect of the posterior mandible because of the lingual undercut from poor positioning or angulation of the implant drills.

• Mechanical complications can present as an implant platform fracture because of excessive insertion torque. If the osteotomy is improperly prepared in dense bone, it is possible to get the implant "stuck" in bone, short of complete seating, making it extremely difficult to retrieve the implant.

• Incision line opening can occur from inadequate suturing or not having tension-free closure.

• Esthetic complications can occur from poor implant positioning or angulation, making proper prosthetic restoration unrealistic.

Implant Components

❖ Implant Body or Fixture

The implant body, or fixture, is the implant component placed within bone during the first stage of surgery. Most contemporary implant fixtures are referred to as root form implants, taking the form of a cylinder or a tapered cylinder, and are made of titanium or titanium alloy. Most current implant fixtures have an external threaded design, although historically, there have been smooth-surfaced implants that were pressed into position. A wide variety of external thread designs and different surface textures and coatings that attempt to maximize implant stability and the process of osseointegration have been offered by manufacturers. Most implant fixtures incorporate an antirotational design feature at the interface of the adjoining prosthetic components. This antirotational feature may be located internally or externally to the implant platform.

❖ Cover or Healing Screw

After placement of the implant fixture in a two-stage surgical approach, prior to suturing, the implant fixture is sealed at its platform with a low profile, intra-implant cover screw. It is important that the surgeon be sure that the cover screw is fully seated on the implant platform prior to suturing the flap to prevent bone from growing between the screw and the implant. In the second-stage uncovering procedure, the cover screw is removed and replaced with a healing abutment.

❖ Healing or Interim Abutment

Healing abutments are dome-shaped intra-implant screws that provide permucosal access to the implant platform. Healing abutments are placed at the completion of the implant placement surgery in a one-stage surgical approach or after uncovering in a two-stage surgical approach. Healing abutments are made of titanium or titanium alloy. The abutments can be parallel walled or tapered and range in height from 2 to 10 mm. The height of the abutment used is determined by the thickness of tissue present. The healing abutment should project 1 to 2 mm superior to the height of the gingival tissue. A tapered healing abutment is used to help shape soft tissue to a more appropriate emergence for the planned restoration (e.g., a crown). A parallel-walled abutment would be used where the tapered emergence is not necessary (e.g., a retentive bar for an overdenture). It is important to allow for sufficient healing of soft tissue after placing the healing abutment prior to making any impressions for the final prosthetics.

❖ Impression Coping

Impression copings facilitate transfer of the intraoral location of the implant to the same position on the laboratory cast. Impression copings can be either screwed into the implant body or screwed or snapped onto an implant abutment.

Typically, the impression transfer can be either closed-tray transfer or open-tray transfer. The closed-tray technique captures the index of the impression coping, and after the impression is removed from the mouth, the impression coping is unscrewed from the implant and placed along with an implant analog back into the impression. An open-tray transfer uses a specific impression coping that is designed to emerge through the impression tray. When the impression is ready to be removed from the mouth, the impression coping is unscrewed and pulled out in the impression. The open-tray method is considered the more accurate transfer method and is indicated when large-span frameworks or bar structures are planned or when the implants are too divergent to easily remove the impression tray in the closed-tray technique. A heavier-bodied polyvinyl siloxane or polyether impression material is recommended. Prior to making the transfer impression, it is imperative that the clinician take a radiograph to confirm that the impression

coping is accurately seated on the implant platform. If the impression coping is not properly seated, the accuracy of the transferred location of the implant will be incorrect. On completion of the transfer impression, an implant analog is screwed onto the impression coping to allow the fabrication of a laboratory cast.

- Implant Analog or Replica

Implant analogues are manufactured to replicate exactly the top of the implant fixture (fixture analog) or abutment (abutment analog) in the laboratory cast. Both are screwed directly into the impression coping. The impression coping or analog component is then placed back into the impression (closed-tray transfer) or is maintained in the impression (open-tray transfer), and the impression is ready to be poured. It is tremendously beneficial to create a soft tissue moulage in the impression prior to pouring. The soft tissue moulage is an elastomeric product that simulates the soft tissue portion on the dental cast. This allows the laboratory technician to have an accurate and flexible representation of soft tissue. The laboratory technician then has a working model that can be used to fabricate either the abutment or the framework for the intended prosthetic design.

- Implant Abutment

The abutment is the portion of the implant that supports or retains a prosthesis or implant superstructure. A superstructure is defined as a metal or zirconia framework that attaches to either the implant platform or the implant abutment(s) and provides retention for a removable prosthesis (e.g., a cast or milled bar retaining an overdenture with attachments) or the framework for a fixed prosthesis. Abutments are described by the method in which the prosthesis or superstructure is retained to the abutment. Abutments can be divided into three main categories: (1) screw retained, (2) cement retained, and (3) prefabricated attachment abutments. A screw-retained abutment uses a screw to retain the prosthesis or superstructure, whereas a cement-retained abutment uses cement to retain the prosthesis or superstructure. A prefabricated attachment abutment (e.g., locator or O-ring attachments) helps retain a removable prosthesis.

❖ Prosthesis Retaining Screw

Prosthesis retaining screws are intended to attach prosthetic abutments, screw-retained crowns, or frameworks to the implant fixture or implant abutment. The screws are generally made of titanium, titanium alloy, or gold alloy and are sized specific to the type, size, and design of the implant or abutment system. The screws typically have a hex or square design to accept a specific size and shape of wrench or driver. Most prosthesis screws are tightened to specific tolerance by a torque wrench or handpiece. The torque value is measured in newton centimeters and typically ranges from 10 to 40 Ncm.

Defining implant outcomes

Some implant outcomes are reported as the presence or absence of the implant at the time of the last examination, regardless of whether the implant was functional, suffered from bone loss, or had other problems. This type of assessment is a measure of **implant survival** and should not be confused with implant success. In contrast to such an overly simplified assessment, some investigators report implant outcomes using specific criteria to determine implant success.

Implant success is defined by specific criteria used to evaluate the condition and function of the implant. Criteria for implant success have been proposed in the literature but have not been used consistently. The problem is that a universally accepted definition of implant success has not been established. In the classic definition, Albrektsson and colleagues defined success as an implant with no pain, no mobility, no radiolucent peri-implant areas, and less than 0.2 mm of bone loss annually after the first year of loading.

Implants that are osseointegrated but not functional are referred to as **sleepers** and should not be considered successful merely because they are present and osseointegrated.

Aesthetic Results and Patient Satisfaction

The ultimate goal of treatment is to achieve natural-appearing, optimally functioning, implant-supported tooth replacements. Proper tooth dimensions and contours, and ideal soft tissue support are key factors for successful aesthetic

outcomes. If crown form, dimension, and shape and gingival harmony around the implants are not ideal, the patient may consider the implant restoration unacceptable, because the result does not represent a natural dental profile. For some patients, such as those with severe alveolar deficiency, an ideal aesthetic outcome may be impossible because reconstructive surgical procedures are complex, require extensive time, and remain unpredictable. For others, a less-than ideal aesthetic outcome may be acceptable.

Aesthetic problems and dissatisfaction happen when results do not match a patient's expectations. Satisfaction with the aesthetic outcome of implant prosthesis varies among patients. The risk of failure is greater among those with high aesthetic demands and risk factors such as a high smile line, thin periodontal soft tissues, or compromised bone support.

Good Luck

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ORAL AND MAXILLOFACIAL SURERY:-

Is one of the dental specialties dealing with management of diseases, injuries and defects of human jaws and associated structures. Oral surgery forms the connecting link between medical and dental specialties.

Diagnosis in surgery:-

Oral diagnosis is the art of using the scientific knowledge to identify the oral diseases and also to distinguish one disease from another.

The diagnostic process classically involves the following steps:-

1- History taking.
2- Clinical examination.
3- Investigation.
4- Provisional diagnosis.
5- Definitive diagnosis and treatment plan.

In oral surgery practice, clinician is often faced with the diagnosis of the following conditions:-

1- Dental and facial pain.
2- Swelling (lump, mass).
3- Ulcers;
4- Injuries (dental, facial bones).
5- Tempromandibular joint problems.
6- Medically compromised patient.
7- Facial deformity.

History taking:-

The art of taking an accurate case history is probably the most important single step in the diagnosis of medical or surgical condition. History taking should be systematic, using special set or sequences. During history taking the clinician or the dental surgeon listen to the patient's story or talks and list the symptoms in order of severity or importance. By patient's words.

Symptoms:-

Means a subjective problem that the patient describes e.g. pain, parasthesia.

Signs:-

Means (objective) an abnormal presentation detectable by the clinician, e.g. swelling, ulcer.

So detection of signs and symptoms of a disease may aid in diagnosis of that disease.

Objectives of taking history:-

1- To provide the dentist with informationsthat may be necessary for making diagnosis.

2- To establish a good or positive professional relationship with the patient which affect cooperation and confidence.

3- To provide dentist with information concerning patient's past and present medical, dental and personal history.

4- To provide information about patient's systemic health which may greatly affect the treatment plan and prognosis and diseases that could be transmitted to the dentist, his staff or other patients.

5- It serves as a legal document.

How you take history:-

During history taking the dentist should encourage his patient to describe his symptoms in his own words, interrupting his story only to explain a point or stop a useless talk.

A clear and concise summary of patient's complaints should be recorded in the case sheet. The symptoms should be recorded or being listed in order of its importance (e.g. pain, swelling, bleeding).

During taking the history give your patient your whole attention and never take shortcuts.

You have to avoid speed in taking the history, so you have to give the patient a suitable time to give all information, because hurry in taking history may lead to many pitfalls that affect the accuracy or completeness.

You have to avoid the leading questions (e.g. does the pain comes on taking hot or cold?) it's better to ask him what is or what are the things that brings pain to you? Or anything hurt you?

During taking history don't depend on the patient diagnosis or the diagnosis of a previous doctor, so you have to ask the patient to describe his complaining-only-to establish your .diagnosis process.

Components of the patient history:-

The case history may include commonly the following sections or components:-

1- Biographic data (personal history).

2- Chief complaint (C.C).

3- History of the chief complaint (history of the present illness) H.P.I.

4- Past dental history.

5- Medical history and systems review.

6- Family history.

Biographic data:-

Includes the full name of the patient, age, sex, address and telephone number and occupation. *these*informationsmay aid or contribute to the diagnosis since some medical problems have a tendency to occur in a particular age group, sex or race. The patient occupation maybe associated with a particular disease or may influence the type of therapy.

Chief complaints (C.C):-

The chief complaint is usually the reason for the patient's visit. The chief complaint(s) is best stated in the patient's own words in a brief summary of the problems (e.g. pain, swelling, ulcer, parasthesia, numbness, clicking, haliatosis,

bleeding, trismus). If the patient complaining of several symptoms in which case they should be listed, but with the major complaint first.

History of the present illness (H.P.I):-

This part of the story must be gone into complete details and get the patient to **tell** the story in his fashion, never ask the patient leading questions and you have **to see** if the patient in a condition able to give you a history which is reliable and his statement, can be relied upon.

It's best to start by asking the patient about:-

I- Duration (record the length of the complaint).

7,- Onset (date of onset, manner of onset).

3- Precipitating/predisposing factors, (e.g. hot, cold, sweet).

4- Characteristic, and this includes:-

a) Nature e.g. (continuous, intermittent, stabbing).

b) Severity e.g.(mild, sever, very sever).

c) Location.

d) Radiation (feeling of pain in site other than that of causative lesion, called referred pain).

e) Temperature features.

f) Aggravating- factors.

g) Relieving factors.

h) Associated constitutional symptoms and signs.

5- Course and progress.

6- Therapy:-

a) Type of therapy and dose.

b) Provider.

c) Effect of therapy.

d) Date of therapy.

7- Other informations.

So if a patient comes with a chief complaint (pain) very detailed history of the pain should be taken and particular attention paid to the following points:-

a) **The duration of pain**: Whether any incident which might have played some part in the etiology of the pain precede its onset (e.g. a blow on the jaw, dental treatment), duration record the length of the pain.

b) **Site of the pain**: The patient should be asked to point to the place where the pain is felt, using his finger.

c) **Any radiation of the pain**: If the pain radiates, the patient should be asked to demonstrate its course with the tip of his finger. On other occasions pain maybe felt in a site other than of the causative lesion or remote from the diseased area and this type called "referred pain", e.g. pain of pericoronitis radiates to the ear.

d) **The precise characteristic of the pain**: the pain maybe described as sharp, sever, dull, throbbing, excruciating, lancinating, mild, continuous, intermitted, all these objectives can be applied to the pain in different pathological process which may help you in the diagnosis. (In acute pulpitis, the pain is sharp and sever, in acute dental abscess the pain is dull, throbbing and sever and the tooth tender, in acute maxillary sinusitis the pain is dull, throbbing and continuous).

e) **Timing of pain**: Some pains are characteristically worse at particular time in the day e.g. pulpal pain often wakens the patient at night and tend to keep him awake, in-acute periodontitis the pain is worse at meal' time.

f) **Any factors which precipitate the pain**: Pulpal pain is often precipitated by thermal and osmotic stimuli (hot, cold, sweet). Periodontal pain often precipitated by biting and chewing.

g) **factors or Any drugs which relieve pain**: This will give you an idea about the nature and duration of severity of the pain.

h) **The presence of other symptoms**: Like the patient that says that, the pain started for two days, then a swelling appeared after that or discharging sinus appeared or a discharge of pus, or pain, swelling then Parasthesia of the lower lip ...etc.

i) **The patient also may be asked about relevant past medical history** which may assist you in the diagnosis of the pain like patient with facial pain of vascular origin like migraine, or chronic psychosomatic origin or angina (angina pectoris) pain. In addition to that the patient asked about his opinion of the cause of the pain.

Another example of complaint is:-

Patient presented with a "lump or mass":-.

The oral surgeon must be ascertain by asking some questions: -

1- How long the swelling has been present.
2- Whether it is getting larger or smaller or fluctuated in size.
3- What are the symptoms of the lump: The lump maybe painful or not. If the lump is associated with Parasthesia or numbness of the lower lip for example.
4- Whether there is any possible cause for the swelling e.g. trauma, injuries, or systemic illness known to the patient.
5- What made the patient notice the lump? By feeling or because it is painful or someone else noticed it and told him.

Past dental history (P.D.H):-

The past dental history includes:-

1-The frequency of previous visits (e.g. previous extractions or oral surgical procedures).

2- Any difficulties or complications (e.g. excessive bleeding or fainting).

3-Determination of the availability of past dental or oral radiographs. In other words, it is important to ask the patient about any type of dental or oral

treatment received before, and if there is any complications or unsatisfaction arise and his impression about the type of treatment.

Medical history and systems review (M.H):-

The patient's medical history includes review, the past and the present illness or diseases because:-

1- These informations(M.H) may aid in the diagnosis of various conditions occurring or has oral manifestation that are related to specific systemic disease (e.g. aids, leukemia).

2- The presence of many diseases may lead or need modification for the treatment plan, and affect the manner in which therapy is provided.

3-Drugs used in treatment of some systemic diseases can also have effects on the mouth (have oral manifestation), or dictate some modification to the dental or surgical treatment (e.g. anticoagulant drugs, chemotherapy).

The past medical history includes:-

1-Previous serious illness or diseases.

2- Childhood diseases.

3- Hospitalization.

4- Operations.

5- Injuries to the head and neck.

6- Allergy to drugs or general allergy.

7- Listing of medication taken in the last six months.

Some examples of serious illness:-

♦Heart attack or diseases (e.g. myocardial infarction, angina pectoris).

♦Stroke (cerebrovascular accident C.V.A).

♦ Hypertension.

♦ Heart failure.

♦ Bleeding

disorders.Diabetes.

♦ Rheumatic fever or disease.

- ♦ Hospitalizations may indicate past disease and how it was treated.
- ♦ Aids (acquired immune-deficiency syndrome).
- ♦ Viral hepatitis.
- ♦ Neoplasm and the method of treatment (surgical, cytotoxic drugs) especially if the growth in the head and neck region **or** previous radiation (radiotherapy).
- ♦ Allergic reaction to drugs.

Review of the systems: Is that part of medical history covering each major system of the body. Review of systems lead to concentration on the signs and symptoms related to that system disorders, which dictate us to more investigations or referring of the patient for medical evaluation and preparation. The review of systems includes:-

Cardio vascular system, respiratory system, central nervous system, genitourinary system, musculoskeletal system, endocrine system, ears, eye, vital signs (blood pressure, pulse, temperature, respiratory rate)

Oral surgery

Components of medical history

Any patient come to you should be asked certain concise questions that aids you to have medical history, and these includes :

l. If he is currently receiving any medical care or under supervision of any clinician.

2 . Whether he has been hospitalized and Why ?

3 . If you have any serious illness remembered by the patient ?

4 . If you have any surgical operation before ?

5 . If your patient takes any type of drugs before in the past or present time ?

Family History: (F. H.)

Details of (F.H.) may reveal valuable information about diseases that are occurring in families (e.g. Tuberculosis , Hemophilia , Psychiatric or neurotic disorders , Breast cancer) Congenital Anomalies such as lip clefts or palate clefts

.Clinical Examination

Careful history taking should be followed by a thorough and systematic clinical examination.

Diagnostic instruments includes:

1. Dental Mirror.
2. Dental Prone.
3. Tweezer.

The clinical examination in Oral Surgery should be systematic and should be always includes the vital signs like Body Temperature , Pulse Rate , Blood Pressure , respiratory rate , also should have always Comparative Observations of both sides .

Clinical Examination includes:

1 . Extra oral Examination .

2 . Intra oral Examination :

In extra oral examination we consider the general evaluation e.g. Observation the patient Posture , Gait, Facial Form, Nutrition Status , Speech , Body movement, Skin, Hair , Vital Signs . In addition to that we examine the area of the head and the neck thoroughly and this includes :

-Examination of the Tempromandibular Joint.

-Lymph Nodes.

-Salivary Glands.

-Bones of the Skull.

-Sinuses (Maxillary Sinus)

-Ear , Eye& Perioral Tissues .

-Neck examined for enlarged Thyroid Gland , Lymph Nodes of the neck, & swelling.

Methods of Clinical Examination:

In Clinical practice , examination of patient involves FOUR ROUTINE PROCEDURES

1.INSPECTION.

2.PALPATI0N.

3.PERCUSSION.

4.AUSCULATI0N.

•**INSPECTION (VISUAL)** :- At the start of every examination you must begin by looking at patient as a whole before looking at the region in question for signs that may provide clue for a Diagnosis any changes in the color , or asymmetry of the face , any growth , ulceration, Scar , Defect, Loss of tissue should be inspected by your eye .

PALPATION:- Next use your fingertips to feel for tender spots , Lump , Fluctuant Swelling , & Mobile teeth . Palpation gives information about texture , Dimension , consistency , Temperature& Functional Events

.

PROBING:- Is the palpation with an instrument & is one of the most important diagnostic techniques used in Dentistry. The teeth are probed for caries with the dental probe & periodontal probe is used to measure the periodontal sulcus depth . Lacrimal probe used for examination of parotid &submandibular salivary gland ducts . Fistulous tracts can be probed with GuttaPercha points to determine the origin of the Fistula .

PERCUSSION :- Is the technique of striking the tissue with fingers or an instrument (e.g. Handle of the mirror) . The examiner listen to the resulting sounds & observes the response of the patient. Extra orally , percussion is often used to detect tenderness in the frontal and maxillary sinuses by tapping the finger tips against a finger placed over the sinuses . Intra orally, percussion is used to evaluate the teeth by tapping the teeth with mirror handle , this technique may induce pain in the area of inflammation from periodontal diseases or periapical abscess.

AUSCULATION- Is the act or process of listening for sounds within the body. e.g.Auscultation to the clicking in the Tempromandibular Joint (T.M.J.) by the use of stethoscope . Auscultation technique is rarely used in Dentistry .

Extra oral Examination

Objectives: -

l.To evaluate any general abnormalities & in particular those of the head & neck region .

2.To look for signs & symptoms of the patient that could influence diagnosis & treatment. This examination includes :-

*General examination of the patient including his Posture, Gait, Facial Form , Nutritional, Status ,Habits ,Speech ,Skin ,Hair, nail, & all exposed parts of the body.

*Examination of head include T.M.J., Lymph Nodes (Submandibular, Sub mental, etc..), Salivary gland Parotid & Submandibular gland etc.), Bones of skull, Sinuses (Maxillary Sinus), ear , eyes,&peri oral tissues .

Examination of neck include Thyroid gland, Lymph Nodes (Cervical node anterior & posterior)& other midline structures & muscle (The neck should be

inspected for midline or lateral swelling, scar, or any inflammatory lesions palpated for Thyroid enlargement or Cervical lymph node enlargement.
The T.M.J, palpated for any clicking or pain , & asking the patient to open and close the mouth to see if there is any limitation of opening (Trismus), or deviation of occlusion .
The eyes should be examined for Exophthalmos or proptosis , pallor of Conjunctiva may indicate Anemia. Sclera of the eye should be also examined, Yellow discoloration may indicate Hepatitis or Obstructive Jaundice (Liver Diseases).

IntraoralExamination:-

Objectives

1.To detect soft tissue abnormalities .
2.To evaluate the status of teeth and other hard tissues .

Intraoral examination consists of evaluation of the following areas in systematic ways : Lips, Labial & Buccal Mucosa, Muco buccal folds, floor of the mouth, Tongue, Hard & Soft Palate, Oropharynx, Muscle of mastication(Lateral & Medial muscles.), Teeth, Gingiva, Orifice of the ducts of the Parotid and Sub*ma*ndibular Glands .
intra oral examination should begin with the observation of the mouth for extent or deviation. The extent of the opening usually described in terms of the of the width of the patient's fingers e.g. 2, 3 or 4 fingers opening then we look for the oral Hygieneweather is good, fair poor, or very poor.
We use the mouth mirror to reflect or retract the cheek & the lips with good light, to evaluate the condition of the vestibules, floor of the mouth, ventral surface of the tongue avoid any overlooking of these hidden areas, also the opening of the salivary glands ducts examined for enlargement, redness, & discharge.
The ventral, lateral, dorsal, aspects of the tongue should be examined for the presence or absence of papillae, fishuring, ulceration, growth, indurations,

limitation in extraction, & lateral movement.

Hard & soft tissue examined for swelling, ulcers, sinuses, & perforation .

Mucosal changes may be observed in association with Leukoplakia, Tobacco irritation, Pigmentation .

The gingiva examined for the slipping, the color & the size of interdentally papillae, any cause of food impaction, the presence of calculus, sinuses or retained roots, pocket etc...

Teeth Examination:

The presence, absence, appearance, mobility, retained roots, retained deciduous teeth, Malposed teeth, mobility of teeth classified as nil, marked or gross Attrition (Exposed dentin), Exposed roots, Carious Lesions, Vitality test (hot & cold application , Pulp tester , etc...). The teeth might be percussed or probed with our instrument to see any tenderness or sensitivity of the teeth. Any edentulous area should be dried with a piece of cotton and examined for the presence of retained roots or discharging sinuses . Occlusion should be examined in closed and rest position the presence of open bite, type of occlusion (Neutro occlusion class I, or disto occlusion class II , or mesio occlusion class III)

Investigations

Sometime the clinician determines that additional tests are needed to clarify some aspects of the diagnosis such tests include radiographic examination, Biopsy(Histological Study), Cytology, Aspiration, Clinical Laboratory studies .

*Radiographic examination:

Is one of the special methods of examination which mostly used in the Oral Surgery. It provide information about hard & soft tissues that are hidden for eye which aid in diagnosis & to evaluate the progress of the disease . For example Peri apical, occlusal, & extra oral views like lateral oblique of the Mandible radiograph. CT Scan, MRI

.

•VTTALITYTEST:-

1 .Hot application (e.g. Hot instrument)

2.Cold application (e.g. Ethyl Chloride Application)

3.Electrical pulp Tester. Used to check the vitality or response of teeth.

BIOPSY:-

Small pieces of tissue taken from the lesion submitted to microscopical examination (Histopathology examination). Biopsy could be incisional or Excisional, Exfoliate Cytology. It is used to confirm the diagnosis of the lesion .

•ASPIRATION :-

Is the withdrawal of fluid from the lesion may aid in diagnosis . For example aspiration of pus indicates an inflammatory process like abscess or in infected cyst. Aspiration of yellow fluid may indicate cystic lesion , aspiration of blood may indicate Vascular lesion like Hemangioma , etc.... Aspiration is one of the methods used to aspirate fluid from swelling for evaluation the nature of that swelling which may assist in Diagnosis .

•LABORATORY TEST:- LIKE

1.bacteriological examination.

2.Hematological examination

3.Urine analysis (GUE)

4.Blood Chemistry &Serological examination .

5.Culture 8 sensitivity test.

All these tests or any one of these tests might be ordered to aid as in confirmingour Diagnosis.

So collection of all information taken from the history & clinical examination &accessory information (Special tests) must be evaluated, analyzed to reach thefinal Diagnosis.

•PATIENT RECORD (MEDICAL) RECORD :-

It consist of :-

1.case sheet.

2.All radiographs.

3.all investigation papers.

4.Reffering papers.

Objectives & Benefits :-

l.It assist in Diagnosis of the diseases.

2.For follow up & future checking.

3.For statistical analysis.

4.For studies & educations.

5.For Medico legal purposes.

Lee.. 5

EXTRACTION OF TEETH (EXODONTIA):-

Extraction of teeth is the most important part of minor oral surgery and the most common procedures to general dental practitioner(dentist).

Definition:-

Exodontia is a painless removal of teeth from their bony alveolar socket with relatively minimal amount of trauma to the investing or surrounding tissues, so that the wound may heal without postoperative problems.

Basically, we have two methods of extraction:-

1- Intra-alveolar extraction (forceps extraction).
2- Trans-alveolar extraction (surgical extraction).

In forceps extraction which is enough for extraction in most of cases consist of removing the tooth or root by the use of forceps or elevators or both. While in trans-alveolar extraction we dissect the tooth or root form its bony attachment by rising a flap and removal of some of the bone surrounding the roots, which are then removed by the use of elevators and/or forceps.

INDICATIONS OF Extraction:-

There are many indications for tooth extraction, if conservative treatment has either failed or is not indicated, a tooth may have to be extracted. The reasons for extraction of teeth are based on the presence of local pathology, the feasibility of restorative procedure(function of the dentition as a whole and the patient's attitude and education). Although the modern dentistry tries and takes all measures to preserve and maintain teeth in the oral cavity, there are still a variety of general indications for removing teeth.

Indications of teeth extraction.

1-Severe caries:-

This is the most common reason to remove a tooth. Badly carious teeth that are beyond restoration should be removed.

Badly carious teeth result in deterioration of the oral hygiene resulted in bad oral hygiene and bad smell in addition to that sharp edges of the carious teeth leads to repeated trauma and ulceration to the mucosa and the tongue, in addition to pain during eating and drinking. Untreated teeth with caries may end with pulpitis, periapical pathology etc...

2-Severe periodontal disease:-

Severe and extensive periodontal disease is a common reason for tooth removal, in chronic periodontitis there is excessive bone loss and mobility in the tooth. As a rough guide, loss of about half of the normal alveolar bone or extension of pockets to the bifurcation of the roots of posterior teeth and hypermobility of the teeth means that extraction of the involved tooth is necessary.

Patient with advanced periodontitis may complains of mild to severe throbbing pain in case of development of Paradontal abscess.

3- pulp pathology:-

For example acute pulpitis or chronic pulpitis, non-treatable pulpal lesion. if endodontic therapy wasn't possible or if the tooth isn't amenable for endodontic treatment, extraction is indicated.

4- Apical pathology:-

Periapical lesions like periapical abscess, periapical granuloma, cyst. If the teeth fail to respond to all conservative treatment to resolve apical pathology due to technical reasons or other causes such teeth are indicated for extraction.

5- Orthodontic reasons:-

During the course of orthodontic treatment, tooth or teeth maybe extracted for:-

a) **Therapeutic extraction** e.g. extraction of upper first premolar for treatment of malposed upper canine and extraction of teeth to provide

space for teeth alignment.

b) **Malposed teeth**: teeth which erupted out of the line of arch are difficult to clean and not amenable for orthodontic treatment are indicated for extraction.

c) **Preventive extraction**, means that during mixed dentition period (permanent and deciduous teeth), dental surgeon may extract few deciduous teeth to prevent malocclusion and all these extractions should be done after proper evaluation by specialist orthodontic.

6-Prosthetic considerations:-

Extraction of teeth are indicated for:-

1) Providing efficient dental prosthesis.
2) To provide better design for success of partial denture, few teeth maybe extracted.
3) Solitary tooth or non-strategic tooth to enable the patient to have complete denture e.g. full mouth clearance.

7- Impacted teeth.:-

Retention of un erupted teeth beyond the normal time of eruption may sometimes be responsible for: -

a) Vague facial pain.
b) Periodontal problems of the adjoining teeth.
c) Tempromandibular joint problems.
d) Bony pathology e.g. cyst (dentisgerous cyst), tumor, pathological fracture.
e) May predispose to anterior teeth crowding
f) Significant infection (pericornoitis) e.g. partially erupted third molar.

8-Supernumerary teeth

The teeth maybe impacted or malposed and such teeth may predispose to malocclusion, periodontal disturbances, facial pain, bony pathology (cyst), aesthetic problems and preventing the eruption of adjacent teeth.

9- Tooth in the line of fracture of the jaws:-

This tooth maybe extracted if:-

a) It is a source of infection at the site of the fracture.

b) The tooth itself is fractured.
c) Interfere with fracture reduction.
d) Interfere with healing of fracture.

10- Teeth in relation with pathological conditions:-

They are indicated for extraction if they are involved in:-

a) Cyst formation.
b) Neoplasm (tumor).
c) Osteomyelitis (Infection of bone).
d) Pyogenic granuloma

And the tooth interfere with complete surgical removal of the lesion the tooth should be extracted.

11-Retained roots

Retained roots may remain embedded in the bone without problems for a long period, but sometimes removal of such roots maybe necessary, for example, root maybe at the sub mucosal level producing recurrent ulceration under the denture, sometimes root fragments may be involved in initiation of bony lesions like osteomyelitis, cystic lesion or neoplasm, if such fragments are in close relation to the neurovascular bundle (e.g. inferior dental nerve of the mandible) the patient may complain of facial pain or numbness in the area supplied by that nerve. As a general rule, very small fragments maybe left alone and that patient should be kept under periodic observation, and all other root fragments are indicated for removal.

12- prior to irradiation:-(before radiotherapy)

Irradiation is one of the methods of treating oral carcinomas and teeth which cannot be kept in a sound condition should be removed before irradiation, trauma (extraction) with superadded infection will lead to development of osteoradionecrosis of the jaw bone which is unpleasant complication and difficult to be treated.

13-Focal sepsis:-

Sometimes teeth or a tooth may appear sound clinically, but on radiographic examination the tooth may appear to be considered

as a foci of infection (teeth associated with periapical pathology or periodontal problems), these teeth or tooth should be extracted in certain conditions e.g. heart surgery; heart valve replacement, kidney transplant, eye Surgery

14- Aesthetic:-

Poor aesthetic, severely stained (tetracycline, fluorosis) attrition or hypoplastic (hypoplasia) of enamel or dentine and they cannot be restored may be indicated for extraction.

Contra-indications of teeth extraction.

In general, the contra-indications are subdivided into ;

1- Local contra-indications.

2- Systemic contra-indications.

Local contra-indications:- (L.C s)

There are several L.C s to extractions of indicated teeth:-

1- Acute and uncontrolled infection:-

Extraction in the presence of acute and uncontrolled infection may lead to spread of infection locally or systemically leading to many complications some of them are dangerous and life threatening (e.g. cavernous sinus thrombosis, mediastinitis, Ludwig's angina)and acute periapical abscess and facial abscess especially in medically compromised patient. In addition to that limitation of mouth opening especially in lower wisdom tooth infection.

2- Previous radiotherapy:-

Previous therapeutic radiation in oral and maxillofacial region for treatment of cancer lead to fibrosis and decreased vascularity of the tissue or area of extraction and end with a condition in the bone called osteoradionecrosis

3- Teeth located within area of tumor:-

Especially in vascular lesion or malignant tumor should not be extracted because extraction may lead to dissemination of the tumor, unhealed

socket and postoperative complications, for example, bleeding postoperatively and intraoperative.

Systemic contra-indications:-

Systemic contra-indications preclude extraction because the patient's systemic health is such that the ability to withstand the surgical work may be compromised. So extraction should be postponed until the severity of the problem has been resolved and maybe arranged after consultation with the physician to perform extraction safely without complications so caution is advised in the following conditions:-

1- Severe uncontrolled metabolic disease, e.g. uncontrolled diabetes, end-stage renal disease.

2- Uncontrolled leukaemia and lymphomas.

3- Sever uncontrolled cardiac disease, e.g. myocardial infarction, unstable angina pectoris, dysrhythmias.

4- Sever uncontrolled hypertension.

5-Pregnancy.

6- Bleeding disorder e.g. haemophilia, platelet disorder, patient on anticoagulants.

7- Patients who take a variety of medicationse.g. patient on steroid and immunosuppressive drugs, cancer and chemotherapy.

8- Uncontrolled epilepsy.

Pre-extraction evaluation:-

P.E.E is very valuable and necessary for successful

extraction practice. Hurry and inadequate P.E.E of the case may lead to many embarrassing intra-operative problem for the operator, in addition to the postoperative problems to the patient,

P.E.E include:-

1- Clinical preoperative evaluation.

2- Radiological evaluation

1-Clinical P.E.E also includes:-

a) **General evaluation.**

b) **Local evaluation.**

a-General evaluation includes:-

- General impression of the patient.
- History of general diseases, Nervousness and orientation
- General oral hygiene.
- Gingival inflammation, calculus, neglected mouth.

b-Local factors evaluation Includes:-

- Clinical examination of the accused tooth.
- Adjoining structures.
- Access to the tooth. This includes the mouth opening, location of the tooth (e.g. buccally malposed, in standing) may present difficulty in positioning the dental forceps for extraction, so you may remove such a tooth surgically.

- Tooth mobility: The mobility of the tooth to be extractedshould be assessed preoperatively, greater than normal mobility is frequently seen with severe periodontal disease, but sometimes it maybe because of the underlying pathology like neoplasm

● **Condition of the tooth:- e.g**.

a) Carious destruction.
b) The presence of large restoration.
c) Presence or absence of the adjoining teeth.
d) Non-vital tooth.
e) State of the supporting tissue.
f) Shape, position, long axis and size of the crown.
g) Attrition.

Good P.O.E resulted from correction of data collected from history, clinical examination, radiographs and laboratory aids in addition to that P.E.E need good knowledge and experience in the basic sciences e.g. anatomy, physiology, pathology.

In general, P.O.E may help you in:-

a) Determine the method of extraction and type of anaesthesia.
b) Reduce the time spend for extraction.
c) Reduce the intra and post-operative crisis and complications.

2- Radiological evaluation:-

Preoperative clinical assessment maybe supplemented some times by preoperative radiographs, and the positive indications for preoperative radiograph are:-

1) History of difficult or unsuccessful extraction.
2) Crown with extensive caries, large restorations, non-vital tooth when diagnosis is not certain and tooth is malposed.
3) A tooth which is abnormally resistant to forceps extraction.
4) If after clinical examination you decide to remove the tooth surgically.
5) Any tooth which is in close relation to important or vital structures like neurovascular canal, maxillary sinus, mental nerve, nasal cavity.
6) Attrition teeth in elderly patient (maybe associated with hypercementosis).
7) If a tooth is partially erupted or completely unerupted or retained root.
8) Any tooth which has been subjected to trauma,

fracture of the root and/or alveolar bone maybe

present.

9) An isolated maxillary molar especially if it is unopposed and over erupted. The bony support of such a tooth is often weakened by the presence of maxillary sinus and this may predispose to certain of oro-anrtal communication or fracture of the maxillary tuberosity.

10) Whenever, underlying bony pathology is suspected e.g. cystic lesion, tumor.

11)Any systemic condition which may predispose to dental or alveolar abnormality like:-

a) Osteitis deformans (Paget's disease), in which the roots are hypercementosed andankylosed leading to difficult extraction, infection of the socket.
b) Cleido-cranial dysostosis, for pseudo-anodontia (multiple impactions, hooked roots occur, supernumerary teeth).
c) Patient who have received therapeutic irradiation to the jaw which may have to predispose to osteoradionecrosis.
d) Osteopetrosis (marble bone disease), which cause extraction very difficult and predispose to chronic osteomyelitis.

- **A good radiograph and careful interpretation may give or aid the operator to many factors that may cause difficult extraction, e.g.:-**

1- Abnormal number and shape of roots.
2- An unfavourable root pattern.
3- Caries extending to the root mass.
4- Fracture or resorption of the root.
5- Hypercementosis of roots.
6- Ankylosis (there is no space in periodontal ligament), and sclerosis of the bone.
7- Gemination (the development of two teeth from one bud).
8- Impaction.
9- Bony sclerosis and pathological lesions.

Also careful interpretation of the radiograph may also reveal or show the possibility of the following complications:-

1) Involvement of, and damage to inferior dental nerve and mental nerve e.g. on extraction of impacted lowerthird molar
2) The creation of oro-anrtal fistula or or-nasal communication.
3) The retention of intra-bony pathology e.g. cyst.
4) The displacement of root or tooth into maxillary sinus.
5) Fracture of maxillary tuberosity.

Oral Surgery
Exodontia

General Arrangement or considerations for Extraction

1. Light:

Dentist or oral surgeon work in a limited accessible area (oral cavity) , then he is going to do his work (extraction site) in a relatively inaccessible area in addition to that the shadow of the hand & the instrument he use , so good illumination of the operative field is very important & necessary to perform your work efficiently & safely .

2. Position of the operator:

When extracting any tooth in the oral cavity except the right mandibular molars, premolars, canines, the operator stand on the right-hand side of the patient, in other words in front of the patient. For removal of right mandibular teeth (molars, premolars & canines) the operator stands behind the patient in order to achieve the good working position. For left-handed dentists, he should stand behind the patient when extracting lower left teeth.

3.Position of the patient:

Correct position of the patient is very important to avoid any Occupational **Postural** problems. The patient is seated comfortably in the dental chair with head rest adjusted to fit the shape of the neck & support of the head. Patients undergoing extraction of maxillary teeth should be positioned where the dental chair back support reclined so that the upper arch lies at an angle of 60 degrees to the floor (inclination of about 60 degrees). For extraction of mandibular teeth, the dental chair should be reclined slightly less (about 30-45 degrees) so that when the patient opens his mouth the occlusal plane parallel to the floor.

4.Height of the dental chair:

This is very important. If the site of the operation is either too high too low in relation to the operator he works in mechanical disadvantage & in tiring & uncomfortable position.

When maxillary teeth are being extracted the chair should be adjusted so that the site of the operation is levelled at the operators' elbow. During extraction of mandibular teeth the chair height should be adjusted so that the tooth to be extracted about 16cm (6 inches) below the level of the operators elbow. When the operator is standing behind the patient the chair should be lowered sufficiently to enable him to have a clear view of the field of the operation.

* The dental surgeon should attempt to have: -

1. Quick, efficient, unhurried & methodical approach to his work.
2. Sympathetic encouragement, to gain confidence & cooperation of the patient
3. You have to avoid to increase the misgivings of the patient by displaying instruments.
4. The dressing of operator should be suitable.
5. Try to do your work in a septic environment reduce the chance of contamination by using gloves, mask, trimming of the nails, tied the hair,…etc.

Instruments used in simple uncomplicated teeth extraction includes the followings:

- Diagnostic instruments :(Dental mirror, probe, Tweezer in kidney dish).
- Dental forceps.
- Dental elevators.

The instrument required for extraction are selected, sterilized & placed in a sterile dish at the side of the patient.

Dental forceps:

The most widely used instrument employed in extraction of the teeth are dental forceps. Dental forceps are designed in a large number of patterns & configuration which adapt to different teeth & techniques used to extract teeth. It is composed of three parts

1. Handle.
2. Hinge joint.
3. Blades (Beaks)

The more desirable properties & requirements of dental forceps

1. That must be made of strong metal so that it can resist the forces exerted during extraction movements.

2. It must be constructed of non -corrosive metal so that it can resist rusting during sterilization by boiling water and autoclaving.

3. The handles of forceps should be serrated in order to prevent slippage & good grip during extraction movements. The handles must of such design so that they can give the operator a chance to use maximum leverage force. Also it must be of suitable shape & size so that they can applied to area of extraction without injury to the opposing teeth & surrounding tissues.

4. The blades

The blades (beaks) are the source of the greatest variation among forceps . The beaks is designed to adapt to the root of the teeth at the junction of the crown & root & to adapt to the root surface & not to the crown . Also beaks designed for single rooted , two rooted , & three rooted teeth so that the tips of the blades will adapt closely to various root formation decreasing the chance for the root fracture . Other variation is the width of the beaks , some forceps are narrow (fine) & others are wider (heavy) . The edges of the blades is sharp enough so they cut through the periodontal fibres without causing injury to the gingiva . The blades should fit the surface of the extracted tooth . The space between the blades should be enough to accommodate the crown of the extracted tooth without making crushing of the crown . The design of the blades should be suitable to be applied to the surface of the root of the tooth so that the blades are parallel to the long axis of the tooth to be extracted.

5. The hinge joint:

Is that part of the dental forceps which transfers & concentrate the force applied to the handle of the dental forceps & then to the beaks . It is the part which connecting the handle to the beaks . The joint must be

. Bevelled so that it will not cause pinching of the lip or injury to the lip .

. Heavy & strong allow free movement without rocking .

• Lubricated with oil after sterilization to prevent rusting which lead to limitation & difficulty during application of the forceps blade to the tooth to be extracted .

Oral surgery

TYPES OF DENTAL FORCEPS

THE FORCEPS FOR UPPER TEETH

1- The upper straight forceps:-

The blades, joint and handle are in one long straight line. We have two types, one with broad blades that is we call heavy blades and this is used for extraction of upper central incisors and upper canines, left and right.

The second type of straight forceps has narrow blades or we call it fine blades for extraction of upper lateral incisors (left and right) and upper anterior retained roots.

2- The upper premolar forceps:-

Here we have two bends in the design of the forceps, one where the beaks (blades) bend in relation to the joint of the forceps to apply the forceps parallel to long axis of premolar, the 2nd bend or curvature is of the handle to avoid injury to the lower lip and apposing teeth (mandibular). The upper premolars teeth has either one root or two roots (one buccal and one palatal), so there is no difference in the anatomy of the tooth root of the premolar on the buccal and palatal surface so the two blades of the premolars forceps are mirror image to each other.

3- The upper molar forceps (full crown upper molar forceps):-

Since upper molar teeth have three roots, two buccal and one palatal, the blade of palatal side is round to conform or fit on palatal root, while blades on buccal has pointed tip or projection so it can enter or fit the bifurcation between the two buccal roots (mesial and distal) on the buccal side of the tooth. So we have two forceps; one for the right molars and one for the left molars and these forceps also double bend for the same requirement as mentioned for premolar teeth.

The Bayonet forceps, the blades of the forceps are off set to the long axis of the handles, used for extraction of upper 3rd molars right and left. In addition, there is another bayonet with fine curved blades for extraction of upper posterior roots.

Bayonet forceps for crowned maxillary 3rd molars

THE FORCEPS OF LOWER TEETH;-

Here we have the long axis of the blades is in right angle to the long axis of the handle so the blades can be applied apical to the cemento-enamel junction (on the root) of the tooth surface parallel to the long axis of the tooth and the handle not to cause injury to the upper lip. The forceps for the lower teeth are:-

1- Forceps for extraction of lower central and lateral incisors and canine:-

We have fine blades for extraction of the lower central and lateral incisors and lower anterior retained roots which have fine roots with flattened sides (mesiodistally) and heavy blades used for extraction of canines.

2- Premolar forceps:-

Because the bucco-lingual width of the crown in the premolar teeth is larger than that of lower incisors and canines we use forceps with heavy blades but partially away from each other when close to accommodate the crowns of these teeth without crushing for the crown.

Lower premolar tooth forceps

Lower molar tooth forceps

3- Full crown lower molar forceps: -

Since the lower molar teeth have two roots, one mesial and one distal root so the buccal and lingual blades of the forceps designed with projected tapered tip to fit the bifurcation of these teeth on the buccal and lingual sides, so the buccal and lingual blades are identical so the same forceps can be used on the right and left sides on opposite to that in upper molar teeth.

In addition to that we have two Bayonet forceps for lower 3rd molars; one for left side

and the other for right side.

Mechanical principles of extraction:-

The removal of teeth from the alveolar process employs the use of the following mechanical principles:-

I- Expansion of the bony socket:-

This is achieved by using the tooth itself as a dilating instrument, and this is the most important factor in forceps extraction, and this principle need:-

1- Sufficient tooth substance be present to be firmly grasped by the forceps.

2- The root pattern of the tooth in such that it is possible to dilate the socket to permit the complete dislocation of the tooth from its socket, e.g. dilacerated, divergent, converge roots.

3- Nature of the bone, elastic bone especially in young patients is maximal and decreased with age, older patients usually have denser, more highly calcified bone that is less likely to provide adequate expansion during extraction of the teeth.

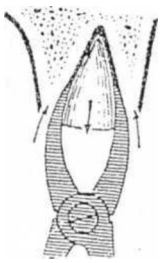
4- Thickness of the bone. Thick bone expansion is less likely to occur by using normal force.

II- The use of a lever and fulcrum

This is used to force a tooth or root out of the socket along the path of least resistance and the principle is the basic factor governing the use of elevators to extract teeth or roots

III-The insertion of a wedge or wedges:-

Between the tooth-root and the bony socket wall, thus causing the tooth to rise in its socket and this explains why some conically rooted mandibular premolar and molars sometimes shoot out of their socket when forceps blades are applied to it.



Physics forceps:

The Physics Forceps uses first-class lever mechanics. One handle of the device is connected to a “bumper,” which acts as a fulcrum during the extraction and stabilizes the beak during wrist movements. The beak of the extractor is positioned most often on the lingual or palatal root of the tooth and into the gingival sulcus

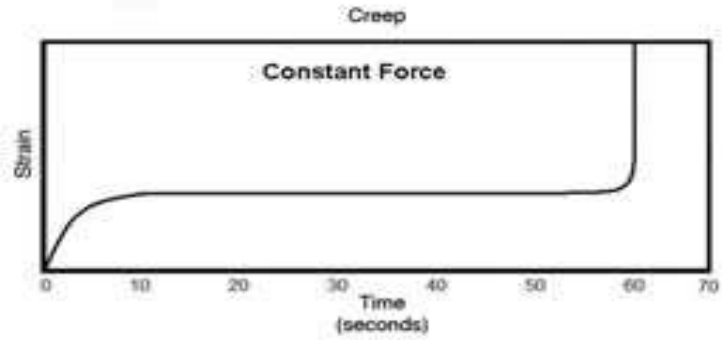
Standard Physics forceps set.

Bumper guards

The bumper is most often placed on the facial aspect of the dental alveolus, typically at the mucogingival junction. Unlike conventional forceps, only one point of contact is made on the tooth being extracted. No squeezing pressure is applied to the handles or to the tooth. Instead, the handles (once in position) are rotated as one unit for a few degrees, and then the action is stopped for approximately 1 minute. The torque force generated on the tooth, periodontal ligament, and bone is related to the length of the handle to the bumper (8 cm), divided by the distance from the bumper to the forceps beak (1 cm). As a result, a force on the handle connected to the bumper will increase the force on the tooth, periodontal ligament, and bone by 8 times. No force is required to be placed on the beak, which is only on the lingual aspect of the tooth root. Therefore, the tooth does not split, crush or fracture.

Moment of force in physics represents the magnitude of force applied to a rotational system at a distance from the axis of rotation. The principle of moment is derived from Archimedes' operating principles of the lever and is defined as M=rF, where "F" is the applied force and "r" is the distance from the applied force to the object. This is referred to as the moment arm. The length of the moment arm (or lever arm) is the key to the operation of the lever, pulley, and most other simple machines capable of generating mechanical advantage. This means that if the force applied to generate work cannot be increased, it is still possible to gain a greater amount of work by increasing the moment arm of the lever.

"Creep" is a phenomenon whereby a material continues to change shape over time under a constant load. In a tooth extraction, creep may occur in bone and the periodontal ligament. Reilly established the creep curve of bone, whereby under a constant load of 60 Mpa, the bone over time changes shape (strain) in 3 different stages



A creep curve demonstrates that a constant force applied to bone or a periodontal ligament results in initial changes in shape, with a prolonged period (horizontal line) necessary before the material fractures or releases (the vertical aspect of the line on the right at 60 seconds).

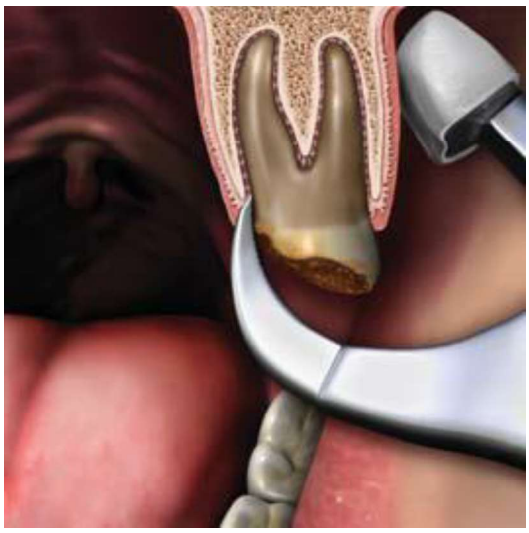
The majority of bone changes occur within the first minute, whereby the strain of bone (the change of length divided by the original length) is modified. The higher the force that is applied, the greater the deformation of the bone. This process allows the tooth socket to expand and permits the tooth to exit the socket.

A secondary creep action occurs over time and allows the bone to further deform when the force is applied during a 1- to 5-minute period. The longer the time, the greater the

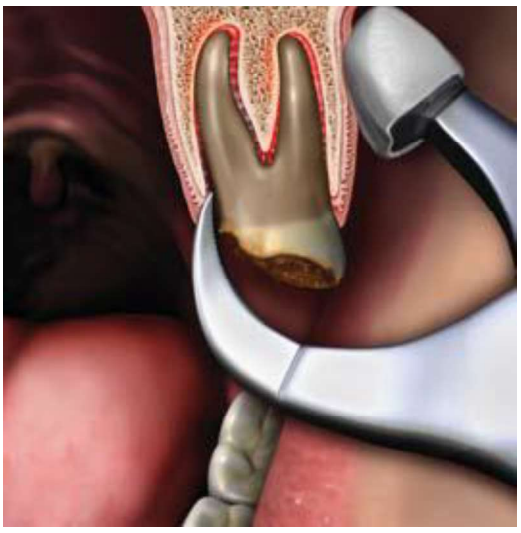
deformation; however, it expresses only a 10% to 20% difference compared to the initial one-minute strain. Eventually, the third phase of the curve causes the bone to fracture if the load is applied over a long time frame, representing creep rupture. A similar phenomenon occurs in the periodontal complex.

Mechanical forces shift lateral force to a tooth, causing primary movement to the periodontal ligament and space. A greater force overtime causes a slight additional tooth movement. Therefore, the creep of the periodontal complex is similar to the creep of the bone, whereby the constant load weakens the periodontal ligament. Thus, a constant load on the tooth over time increases the tooth socket dimension and decreases the strength of the periodontal complex.

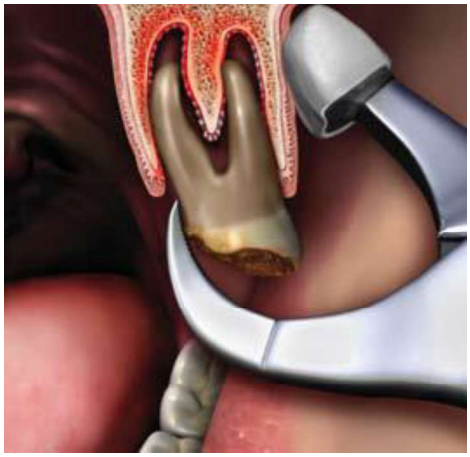
Once creep has expanded and weakened the periodontal ligament and bone, the handle of the extraction device may be slowly rotated another few degrees for 10 to 30 seconds. This action contributes to the creep rupture of the ligament and usually elevates the tooth a few millimeters from the socket. At this point the tooth is loose and ready to be removed from the socket using any pincer-like device, i.e, pickups, extraction forceps, or hemostats.



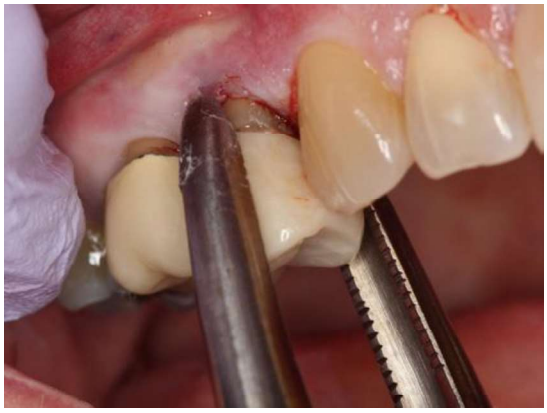
The Physics Forceps is in position, and constant pressure is applied.



Creep is expanding the bone and rupturing the periodontal ligament.



The tooth is rotated slightly and elevated from the socket.



The tooth was delivered from the socket with a pincer-type instrument as the Physics Forceps are not designed to remove the tooth all the way from the socket but simply to elevate the tooth or release the periodontal ligaments.

The tooth was easily removed from the socket.

The extraction of a tooth using the Physics Forceps is similar to the removal of a nail from wood using a hammer versus a pair of pliers (Figures below). The handle of the hammer is a lever, and the beaks of the hammer's claw fit under the head of a nail. The hammer's head acts as a fulcrum. A rotational force applied to the hammer handle magnifies the force by the length of the handle, and the nail is elevated from the wood. Unlike a nail in wood with parallel sides and friction along its full length, a tooth is tapered. After being elevated a few millimeters, the periodontal ligament fibers are broken and the tooth may then be easily removed without additional rotational force. This is important to note, since further rotational force on the tooth may fracture the

facial plate of bone.

A "traditional" dental forceps removes a tooth similar to how a pair of pliers removes a nail.

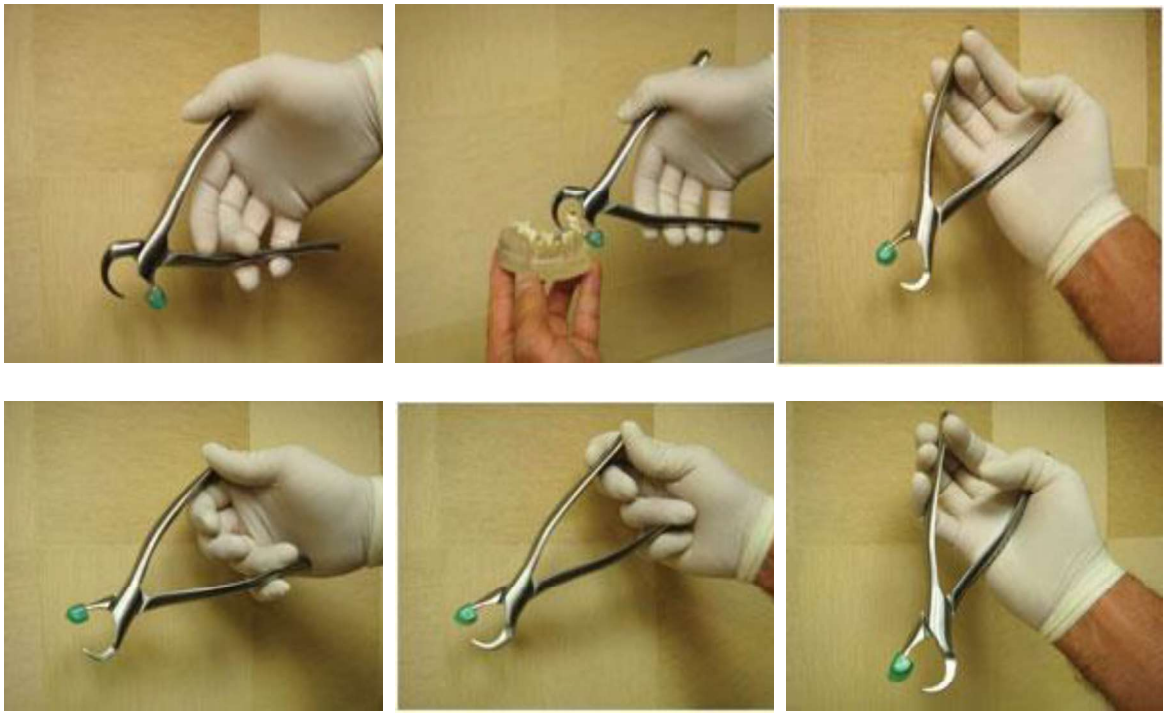
A claw hammer uses class I lever mechanics, with the handle one lever, the head of the hammer as the fulcrum, and the claw as the short lever applied to the nail. The Physics Forceps uses a similar action to remove a tooth.

Stress is the internal distribution of force per unit area that balances and reacts to external loads applied to a body. Stress can be broken down into its shear, tensile, and compressive components. Materials in general are weakest to shear forces and strongest to compressive loads. For example, bone is strongest to force in compression, 30% weaker to tension, and 65% weaker to shear forces ***(Reilly DT., 1975)***. When a rotating force is applied to the Physics forceps on a tooth, the stress to the tooth and the periodontal complex is a shear component of force. The force applied to the gums and bone by the bumper of the Physics Forceps is over a greater surface area and is a compressive force, thus bracing the buccal bone. This permits the lingual plate to expand more and protects the facial plate from fracture.

The instrument is uniquely designed to allow tension to be placed of the periodontal ligament and to achieve excellent leverage. This tension results in the physiologic release of an enzyme by the body that breaks down the periodontal ligament over a short period of time which is called hyaluronidase (hyluronate

glycanohydrolase). This is an enzyme that catalyzes the hydrolysis of the interstitial barrier, hyaluronan (hyaluronic acid), which is the cement substance (extracellular matrix) of all human tissues ***(KUMAR DM., 2015)***. This process may take 20 seconds or up to 4 minutes depending on the tooth and surrounding bone structure of the patient. The clinician must be patient, as the technique will feel like nothing is happening since none of the usual operator movements are employed. With the breakdown of the periodontal ligament, the tooth will release or "pop" out of the socket in an upward and outward motion, mirroring the arch form of the head of the instrument. This innovative instrument allows tooth dislodgment with little or no pressure, simply utilizing leverage. The handles are never squeezed like a conventional forceps; rather they are held lightly in the hand, and the wrist is rotated to simply create tension on the palatal aspect of the root. There is no forearm, bicep, or shoulder pressure used. The handles simply allow the beak to engage the root structure without slipping off. During a short time of constant tension, the root will disengage or pop from the socket incisally and facially. Although the facial bone may expand slightly, the movement of the tooth out of the socket is not straight facial, but rather up and out of the socket. This allows for maintenance of the facial plate of bone, when the instrument is used correctly. One of the biggest misconceptions of this innovative technique is that it is a "forceps" as the names implies, when it fact it is a lingual elevator ***(Kosinski T, Golden R., 2015).***

Atraumatic extraction with the Physics Forceps (Golden Dental Solutions). Using the proper hand position and hold are a must when utilizing the Physics Forceps technique.



Oral Surgery

Elevators:-

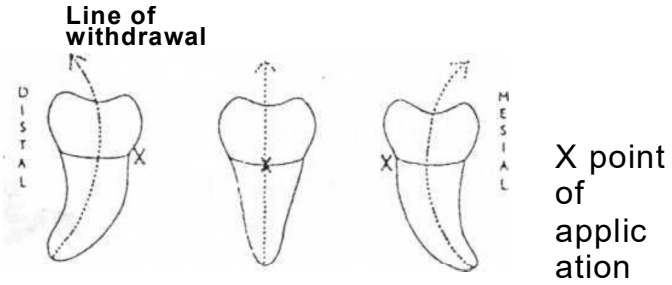
Are exo-levers, instrument designed to elevate or luxate the teeth or roots from their bony socket in close or surgical method of extraction to force a tooth or root along the line of withdrawal.

Line of withdrawal:-

Is the path along which the tooth or root will move out of its socket when minimal force is applied to it, and this line is primarily determined by root pattern (long axis of the tooth).

Point of application:-

Is the site on the root at which force must be applied to effect delivery, it is determined by the line- of withdrawal. We have buccal point of application, distal point of application, and mesial point of application.



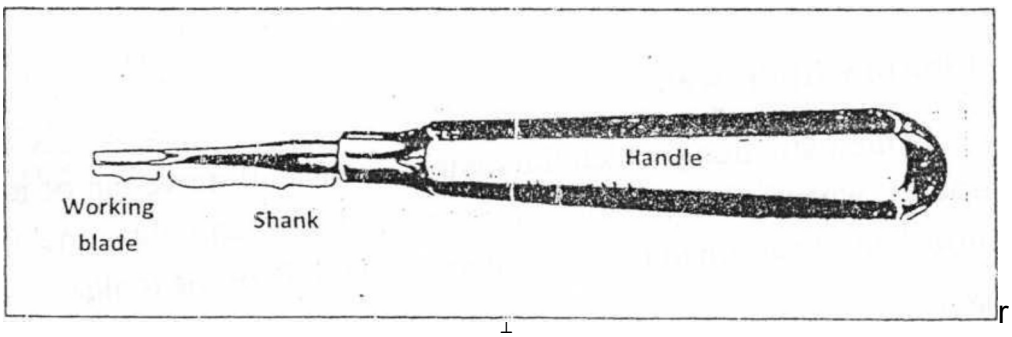
Parts of elevators:-

All elevators have the following parts:-

I-Handle: This maybe a continuation of shank or at right angle to it.

II- **Shank**.

III- Blade: This part engages the crown or root and transmit force to the tooth, bone or both. The working side of the blade is either concave or flat.



Mechanical principles of uses of elevators:-

The work principles as applied to the use of elevators maybe that of:-

1- Lever principle.
2- Wedge principle.
3- Wheel and axle principle.
4- Combination of these principles.

Clinical uses of elevators:-

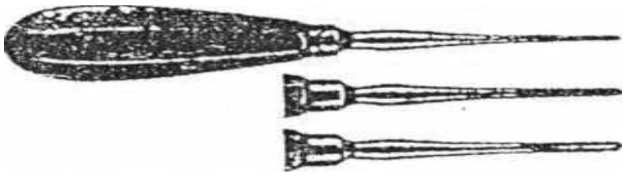
1- Elevators are used to luxate and remove teeth which cannot be engaged or grasped by the beaks of forceps (e.g. impacted teeth, malposed teeth), also badly carious teeth, teeth with heavy filling.
2- To remove old roots and fractured roots and sectioned roots.
3- To loosen teeth prior to use of forceps.
4- To split teeth which have had grooves cut in them, as in separation of roots.
5- To remove small amounts of bone to create point of . application for the beaks of forceps, or removal of interseptal bone.
6- Any tooth resisting normal extraction force by extracting forceps.

Elevators commonly used:-

There are so many elevators available but few are widely used because of their efficiency.

1-straight elevator:-

Elevator in which the blade, shank, and the handle are straight. The working blade or end is blind and round, there are many types and sizes of straight elevators,

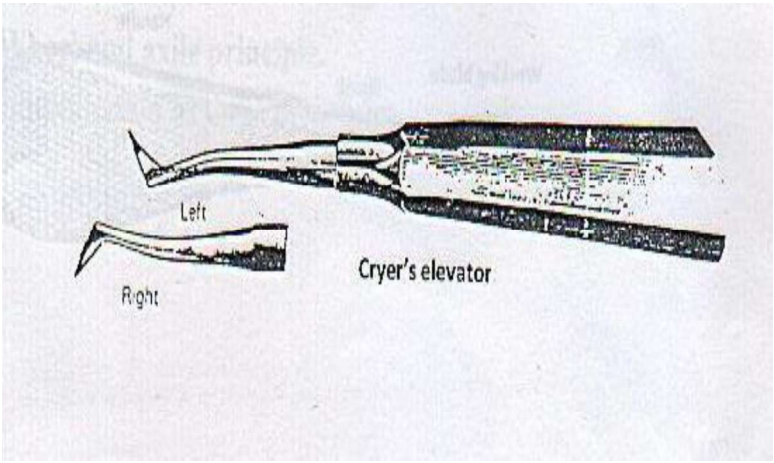


2-Coupland's chisel (elevator);-

It is similar to straight elevator but the working end is sharp and straight cut, used for chiselling of bone to create point of application or to split of teeth. It's of different sizes, size 1, size 2, size 3. Depending on the width of the working end.

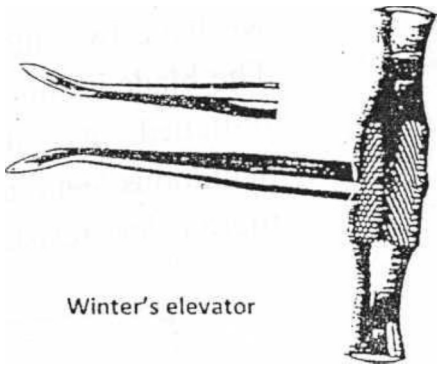
3-Cryer's elevators:-

In this type the working blades are sharp, pointed and triangular in shape just like a claw, forming an angle with the shank of the elevators. These are pair instrument mesial and distal (right & left) designed to fit the root surface on mesial and distal surface. It's mostly used for removal of retained root of the lower molar and for elevation for impacted teeth after surgical exposure of the bifurcation of the tooth.



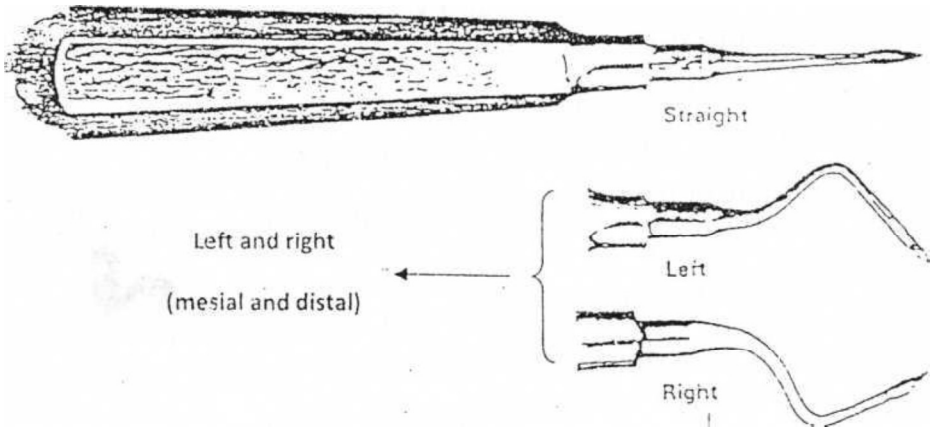
4- W inter's elevator:-

In which the working end is the same that of Cryer's elevator but the handle is in right angle to the shank so it is called winter's (T-bar) cross-bar handle elevator. Winter's elevators are very powerful and great force maybe applied or generated (sufficient to fracture the mandible) so the use of this elevator should be with great care to avoid fracture of the jaw.



5- Apexo elevators:-

The working blade is long, the margins are sharp, we have 3 Apexo, 2 angled and 1 straight (mesial, distal, straight). The blade forming an angle with the shank, this elevator is used mainly for removal of apical fragments of root deeply present in the socket of the lower jaw especially morals. We push it between the socket and the root to loosen the fractured tip and remove it from the socket.



6-War-wick James elevators:-

It is a light duty elevator. It's like Cryer's elevator, also we have two angled (mesial and distal) and one straight. The blade is short and the end is rounded and the handle is flattened, it's used for extraction of retained roots, deciduous teeth, anterior lower teeth extraction, and where there is less resistance area. e.g. extraction of upper wisdom tooth.

Guiding principles for use of elevators:-

The following rules should be observed when using elevators in general:-

1-Never use an adjacent tooth as a fulcrum, unless that tooth to be extracted itself in the same visit, and the fulcrum should always be bony one (alveolar bone).

2- An elevator should always be supported to avoid slippage and injury to the patient.

3- Avoid the use of excessive force if the tooth/root is resist luxation, by gentle rotation, then stop, look for the obstruction for elevation and deal with it.

4- The direction of force should be such that the roots are not directed toward major structures such as the maxillary antrum.

5-An elevator should never be used "blindly" in the socket

.

6- If an application point is not present, then this should be created by careful removal of bone.

7-Elevators should always be sterile and sharp.

8-- The sharp edges of the working blades are placed between the alveolus and the root surface and gently rotated apically along the long axis of the elevator to luxate or displacing the tooth or root.

Complications of use of elevators:-

Although elevators are very useful instrument for facilitating extraction of teeth, but misuse or miss-judgement may lead to some complications, part of it may be serious:-

1- Injury to the soft tissues, like injury to the tongue, floor of the mouth, soft and hard palate, caused by slipping of elevator during its use

.

2- Wrong application of force or excessive force may lead to fracture e of jaw especially the lower jaw at the angle of the mandible, also excessive force may lead to crushing of the alveolar bone and fragmentation

3- Fracture of maxillary tuberosity especially in extraction of upper third molars.

4- Uncontrolled force may lead to displacement of roots into maxillary sinus, infratemporal fossa, buccal soft tissue, submandibular space or inferior dental canal.

5- Use of elevator in periapical area of abscessed tooth may cause spread of infection to the surrounding tissue.

6- Tip of instrument (working blade) may be fractured and remain In the socket causing postoperative infection or delay healing, so always check the tip of instrument after use.

So most problems with elevators arise from:-

a) Miss-judgement of amount of force exerted.
b) Improper positioning of the elevators.

ORAL SURGERY ***3RD Grade***

INSTRUMENTS FOR BASIC ORAL SURGERY

These lectures will introduce the basic and main instruments required to perform routine oral surgical procedures ,these instruments are used for many purposes including both soft and hard tissues (e.g./ Bone , dental procedures):-

The main instruments include the followings:-

1- Instruments to incise the tissues .
2- Instruments for elevating mucoperiosteum.
3- Instruments for controlling haemorrhage .
4- Instruments to grasp tissues.
5- Instruments for removing bone includes:-
a. Rounger forceps(bone cutter, bone nibbler)
b. Chisel and mallet.
c. Bone file.
d. Burs and hand piece.
e. Instruments to remove soft tissues from bony defects

6-Instruments for suturing mucosa:

a. Needle holder.
b. Needle.
c. Suture material.
d. Scissors.

7- Instruments for retraction of soft tissues.

8. Instruments for irrigation and for providing suction.

1-Instruments to incise tissues:

These instruments used to do incision in the soft tissues and this procedure needs scalpel and scalpel handle, the most commonly used handle is number 3 and number 7 . The tip of the scalpel handle is prepared to receive a variety of different scalpel blades that can be inserted into a slotted receiver, the most commonly used scalpel blade for intra oral incisions is number 15 , its relatively small and can be used to make incision around teeth and through mucoperiosteum.

Another scalpel used to make incisions on the skin extra orally is number 10..

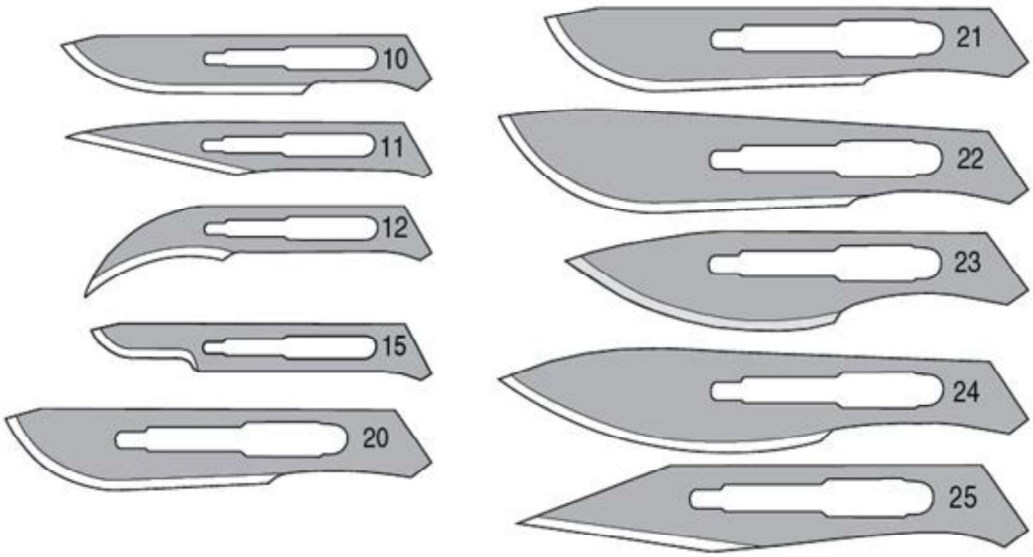
Other commonly used blades for intra oral surgery are number 11 and 12.

Blade no. 11 mostly used for making stab incision such as for incising abscess , its

pointed triangular in shape , the hooked no. 12 blade is useful for mucogingival procedures especially in the posterior area of the oral cavity , for example maxillary tuberosity or posterior aspects of the upper molar region on the buccal or lingual aspects.

Scalpel handle no.3

Dental scalpel blades:



2-Instruments for mucoperiosteum elevation

After an incision is made through the mucoperiosteum (mucosa +sub mucosa+ periosteum=mucoperiosteum)

The mucosa and periosteum should be reflected from the underlying bone with periosteal elevator . The instrument that is mostly used in our department is Howarth periosteal

elevator, this instrument has a sharp pointed end and a broad flat round end .

The broad flat round end is inserted into the incision beneath the cut edge of the periosteum to elevate or strip it off the bone , and the sharp end of the elevator used for detachment of muscle insertion or sometimes to complete the incision done by the blade if there is some resistance for the elevation by the flap, many types and sizes of the periosteal elevators are available like Mitchell trimmer

Mitchell trimmer is useful in separating through the fibres from around the crown of the unerupted teeth and the neck of erupted teeth.

The periosteal elevator can be used to reflect soft tissues by push stroke in which the broad end of the instrument slides underneath the flap separating through the periosteum from the underlying bone and sometimes periosteal elevators are used by a pull stroke or scrap stroke in special locations.

Howarth periosteal elevator:

Mitchell trimmer:

3-Instruments for controlling haemorrhage:

When incision is made through the tissues , small vessels may be cut leading to bleeding , to control this bleeding we have instruments Which aid in the stoppage of bleeding called haemostat or artery forceps , this comes in a variety of shapes and sizes , it's a delicate instrument which may have straight or curved beaks , this

instrument has a locking device assisting in the clamping of the blood vessels

In addition to its use as an instrument for controlling bleeding its used in oral surgery to evacuate pus from abscesses by inserting the haemostat inside the abscess after an incision is made , also haemostat may be useful in grasping tissues from the tooth socket and pick up small root tips , pieces of calculus, fragments of amalgam or any other small particles that have been dropped in the mouth or wound area.

Haemostat:

4-Instruments used to grasp tissues:

Here we have :

A-Toothed -tissue forceps.

B- Allis tissue forceps.

These instruments used to hold and stabilize flap during suturing to assist in passing needle through the mucoperiosteal flap , also these instruments, used to hold tissues or grasping tissues in some types of surgical procedures .e.g.\ Taking biopsy.

It should be used gently to prevent crushing of the tissues especially in the case of Allis tissue forceps

Allis tissue forceps:

5-Instruments for removing bone includes:

A-rounger forceps (bone cutter , bone nibbler)

B-chisel and mallet.

C-surgical burs and hand piece.

D-bone file.

E-instruments used to remove soft tissues from bony defects

sometimes we need to remove bone to gain access into a lesion like intra-bony cystic lesion, or bony biopsy or to correct an existing bony defect or abnormal bony exostosis or even sometimes to remove a retained root or a sharp bony projection ..etc.

So we have many tools and instruments to perform such a duty. the use of any one of these instruments depends on the case and preference of the operator, so we have many modalities to perform bone removal.

A- Bone rounger:

It's also called (bone nibbler) or (bone cutter) it's used to cut bone quickly and efficiently this instrument has sharp blades that are squeezed together by the handles cutting or pinching through the bone , it also has a leaf spring or spring loaded handles to control the opening of the blades, some of these are side cutting others are end

cutting.

End cutting types are used to cut bone in less accessible areas like inside the tooth socket , these instruments are very useful for trimming of sharp bony projections or removing of a thin plate of compact bone during saucerization of bone cavity.

Bone Cutter (rounger forceps):

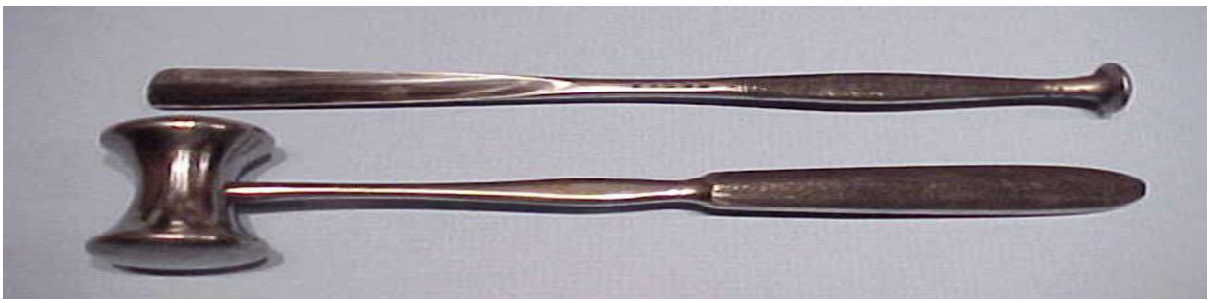
B-Chisel and mallet:

This is another method for removing bone especially when large piece of bone need to be removed ,we have many sizes and lengths of chisels ..chisel have a sharp monobeveled working end used to cut bone , bibevelede called ***osteotome*** , may be used for splitting bone or teeth.

cutting of bone by chisel need to be used by applying force and by the use of mallet,. A mallet with a nylon cover or facing will exert less shock to the patient, also its less noisy ..

Removal of bone using chisel and mallet mostly done under general anaesthesia.

Chisel & Mallet:



C- Surgical burs and hand piece:

It's a useful method and commonly used to remove bone by rotary means (hand piece) under local anaesthesia, burs are either used to remove bone or to cut a window in the bone , it's also useful in dividing teeth , we have dental steel burs and tungsten carbide burs carbide burs cut bone more efficiently than steel burs, these burs are-either-round or fissure burs...

* large diameter bone burs may be used for removal of wide area of bone or for smoothening of the margins of bony defect, in most cases the use of either size 6 or 8 bone burs will enable the production of deep narrow slots in the bone ,burs can be used with angle or straight hand piece which should have an accepted speed and torque to remove bone efficiently and should always be used with irrigation by distilled water or saline to prevent damage to the bone by heat generation during cutting.

*when large amount of bone need to be removed , large bur that resembles an acrylic bur is used .

High speed turbine which is used in restorative dentistry must not be used because the air exhausted into the wound may produce tissue emphysema.

Dental surgical burs:

D- ***Bone file:***

This instrument is used for smoothening of bone before suturing of the flap , it's usually double ended instrument with a small and large ends , the working end of the bone file have grooves or slots to work in a ***pull stroke*** only, bone file is not used to remove bone

its used only for final smoothening ..
Notice that its used in a pull stroke one direction only , if pushing movement is used it will lead to crushing of bone and this should be avoided.

Bone file :

E-Instruments to remove soft tissues from bony defects:

It is called Curette : it's just like excavator , angled , double ended ,of different sizes,the working end is like a spoon, round -oval in shape, its mostly used to remove soft tissues from a bony cavity like :periapical granuloma or cystic lesion from the bone, it also may be used to remove foreign bodies or small pieces or spicules from the bony socket.

Curette:

INSTRUMENTS FOR BASIC ORAL SURGERY II

6-Instruments for suturing:

At the end of the procedure the mucoperiosteal flap must be returned back to its original place or position by sutures, the instruments used to do any suturing may include the followings:

A-Needle holder

the needle holder is an instrument with a locking handle device the handle is long and the beaks are short ,stout for intraoral suturing, a 15 cm handle length needle holder is often recommended the beaks of the needle holder are shorter and stronger than the beaks of the haemostat, the inner surface of the beaks is crosshatched to provide good surface for grasping of the needle and to prevent its rotation or movement during suturing while in haemostat the inner surface has parallel grooves which differentiates it from the needle holder, so haemostat should not be used for suturing but preserved for its original work to control bleeding during surgery.

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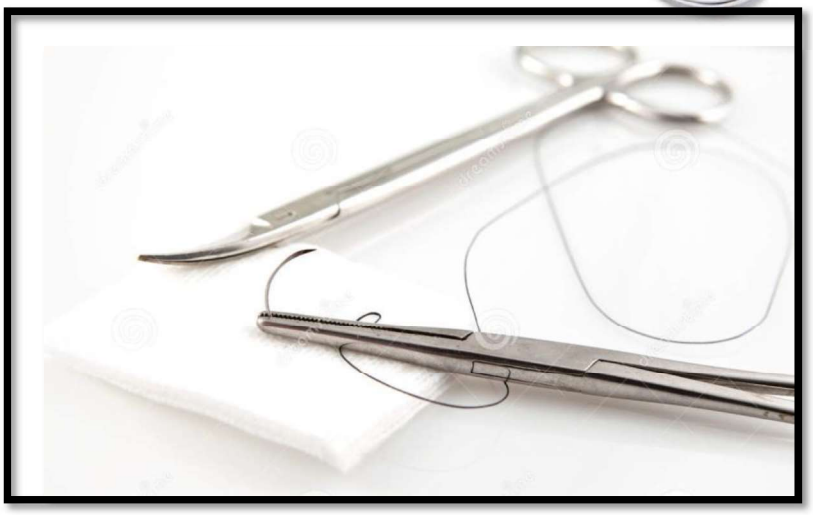


B-Needles:

Most sutures come fused to needles in a pre-sterilized package, suture needles differ according to the shape of their cross section and their length, there are generally two types:

1-cutting needle, have a triangular cross section

2-taper point, which are round or oval in cross section.

According to the shape of the needles, straight needles are only used where tissues or areas of surgery are easily accessible and therefore they are not used in oral cavity because of the limitation of space in oral cavity, so curved needles are mostly used of a length of 21-25 mm or 3/8 or 1/2 (half circle) and this design allows the needle to pass through the limited area of suturing easily, the cutting needle(triangular cross section) also called *traumatic needle* but it has a good advantage of being able to enter the tissues easily during suturing specially in tout areas like mucoperiosteum of the hard palate(keratinized mucosa) or skin where the tissue is difficult to penetrate the tapered needle is generally used for closing muscle or fascia that are easily penetrated.

C-Suture material:

many types of suture materials are available and could be classified by size , resorb ability ,and whether or not they are monofilament or poly filament .Sutures are made of wide variety of materials and come in several sizes, each designed for a particular purpose

1-size

Sutures are available in various sizes that range from one zero (1/0) to (1 l/0)eleven zero, increasing number of zeros means decreasing the suture diameter, the most size used in oral and maxillofacial surgery is size 3/0 and 4/0 ,the size of the suture usually expressed on the package e.g. 3/0 ,4/0, 2/0....the size 3/0 used most commonly in suturing oral mucosa, which is enough to prevent tearing of the oral mucosa and strong to withstand the tension placed on them intraorally.

2.Resorbability:

Sutures may be resorbable or non-resorbable, resorbable sutures are made of materials that the body is capable of easily breaking them down, like catgut sutures and this is used for suturing deep structures like muscles, fascia, so these sutures does not require removal, while non resorbable sutures like black silk sutures ,nylon, stainless steel, those need removal of the suture postoperatively..
For the resorbable sutures we have two types. Plain gut and chromic gut ,the plain gut is subjected to rapid resorption or digestion by the proteolytic enzymes produced by the inflammatory cells ,while the chromic catgut is treated with special chromic salts ,to provide resistance for the proteolytic enzymes.

D-Scissors:-

the final instrument necessary for placing sutures are suture scissors ,the suture scissor usually have long handles, short cutting edge or beaks because main purpose is to cut suture during suturing or on the removal of sutures postoperatively, other types of scissors used in oral surgery are called soft tissue scissors or operating scissors: these scissors are used for cutting of tissues and for dissection or undermining of tissues during surgery , we mainly have two types of operating scissors..

1-small,sharp,delicate ones used for fine work

2-blunt nosed scissors: used for undermining soft tissues as well as for

Blunt tissue scissors

notice that these operating scissors should not be used for cutting sutures or other material because these materials make them blunt ,and it became less effective for cutting tissues.

7-instruments for retraction of soft tissues:

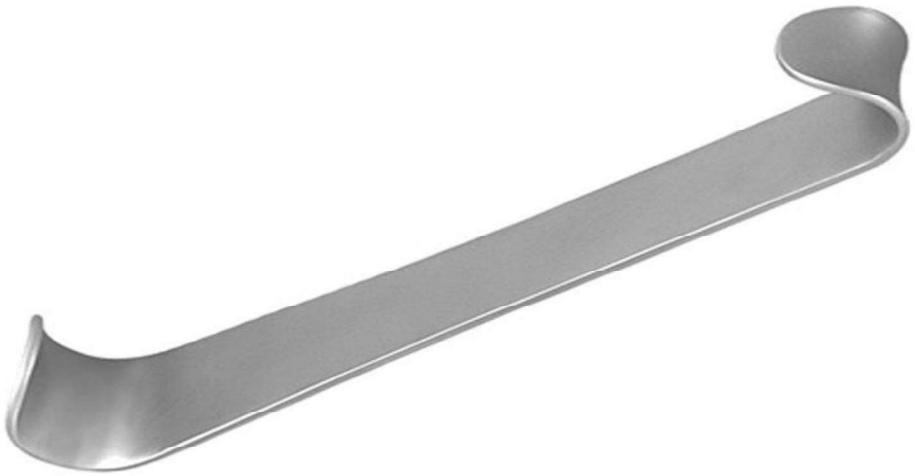
These instruments may be held by the surgeon or his assistant to help the surgeon to have a clear field or area during his work so that it will provide accessibility to the working field and in addition to that it will help in the protection of surrounding tissues from trauma or injury during surgery

There are many types and varieties of retractors ,that have been designed to retract the cheek ,tongue ,lips and mucoperiosteal flaps ,so we have ..

A-Cheek retractor:

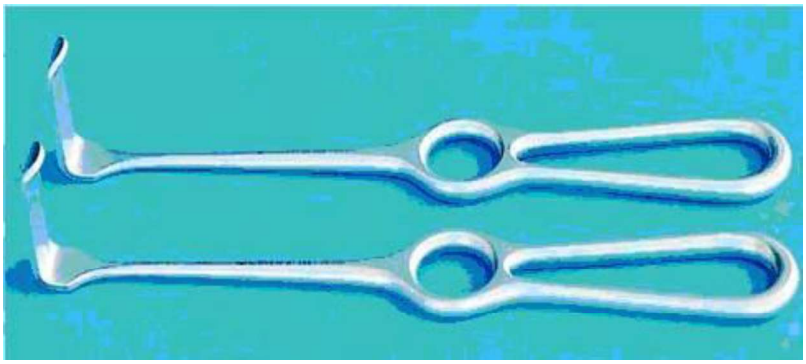
from its name its used to retract the cheek ,the most popular one is the *kilner retractor,* its double ended with different sizes and widths ,and it's held against or at the angle of the mouth ,to retract the cheek away from the operative area .

cheek retractors



B-Mucoperiosteal flap retractor:

it is used to retract the flap away from the operative area ,to provide good vision for the surgeon and to help protect the flap from trauma ,it should be held against the bone and not on the flap ,there are many retractors of different shapes and designs especially made for flap retraction and even *periosteal elevator (Howarth 's)* may be used as a retractor for the flap ..

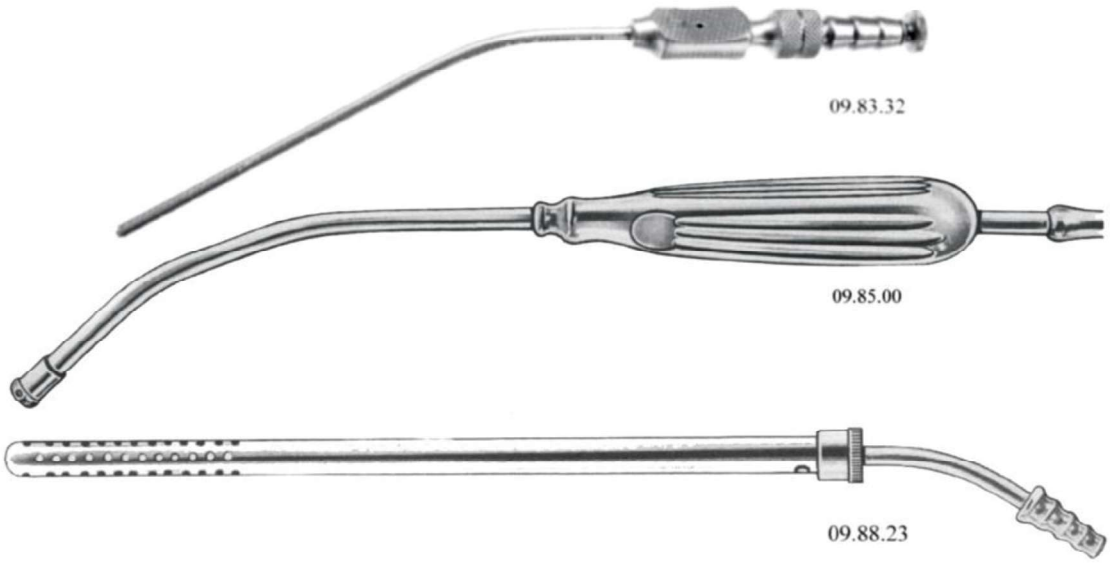


There is also special retractors for the tongue but usually the mouth mirror is the most common instrument used for tongue retraction and lip retraction

8-insrument for irrigation and suction

A-instrument for suction:

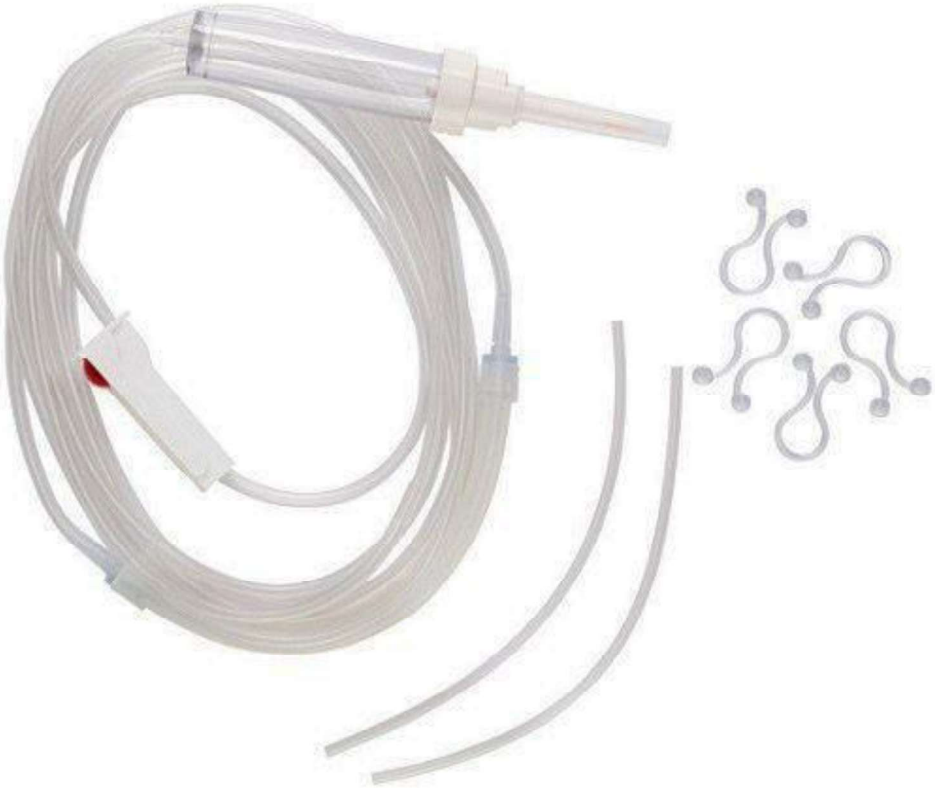
These instruments used to provide good visualization of the operative field by aspirating the blood ,saliva and the irrigating solution (e.g. saline , distilled water) used during operation . in oral surgery a fine metal suction tips on vacuum pressure most used to perform such duty . the use of suction also is very important and most be used when we are working under general anaesthesia to prevent the possibility of aspiration of blood and other fluids by the patient.



B-Instruments for irrigation:

When we use hand piece and bur to remove bone its necessary to use irrigating solutions like normal saline to cool the bur and prevent bone damage by the heat generated during cutting of bone ,also irrigation will clean the area of surgery from small debris and chips during the surgical procedure and after finishing before suturing the area ,large plastic syringe with blunt 18 gauge needle is used for irrigation purposes ,the needle should be blunt and smooth so that no damage to the vital organs or soft tissues can occur ,the needle also preferable to be angled to have good and efficient direction of the irrigation fluid .

Irrigation set:



Oral surgery
Technique of forceps extraction

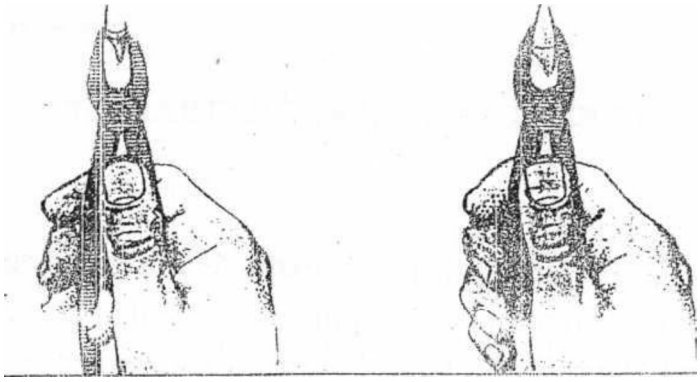
Regardless of the tooth to be extracted in the oral cavity, some common principles are applied to all dental extraction. The general steps in the closed-extraction (forceps extraction) procedure are: -

1- Soft tissue retraction: -

Before starting the application of the dental forceps, the gingival tissue surrounding the tooth should be reflected with blunt probe or tweezers, the neck of the tooth freed labially and lingually as far as the bony alveolar margin, so that no laceration or tearing of the gingival occur on extraction. So, care should be exercised to avoid application of the beaks over the gingival tissue. Reflection of the gingival tissue allows the surgeon to ensure that profound anesthesia is secured before starting extraction. Also, gingival retraction allows the beaks of forceps to be positioned more apically without interference or impingement of the gingival tissue.

2- Handling of the forceps: -

The forceps should be grasped by the palm of the right hand and the thumb finger is placed below the joint. The little finger is placed inside the two handles of the forceps so that it can control the opening and closure of the handle and guide the forceps beaks on the root surface, and when the tooth is grasped the little finger is placed outside the handle.



Handling of dental forceps while closing and grasping the tooth

Handling of dental forceps while opening

3- Retraction and support (the use of the left hand):

When using the forceps and elevators to luxate and remove teeth. It's important that the surgeon's opposite hand play an active role in the procedure. For the right-handed operator (dentist), the left hand has a variety of functions:

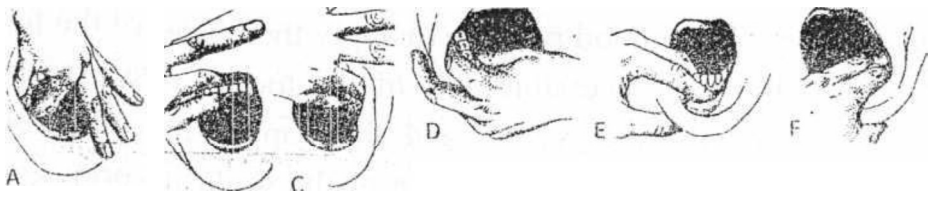
a) It's used to reflect the soft tissues of the cheeks, lips and tongue to provide adequate visualization of the area of surgery.

b) It helps to provide protection for the soft tissue structures and protect other teeth from forceps, if they release suddenly from the tooth socket.

c) It helps to stabilize the patient's head during extraction process.

d) The opposite hand plays an important role in supporting and stabilizing the lower jaw when mandibular teeth are being extracted to prevent injury and post-operative pain in the tempromandibular joint (T.M.J). And also, to prevent dislocation of the mandible during extraction especially when extraction is performed under general anesthesia

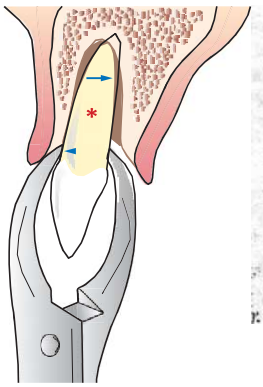
e) The opposite hand supports the alveolar process and provide tactile information to the operator concerning the expansion of the alveolar process during luxation process.

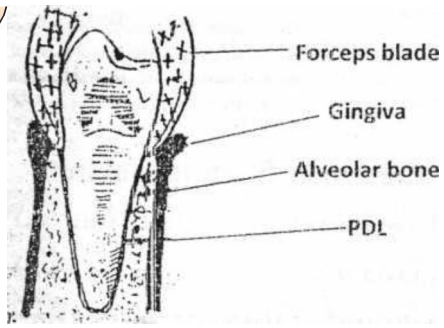


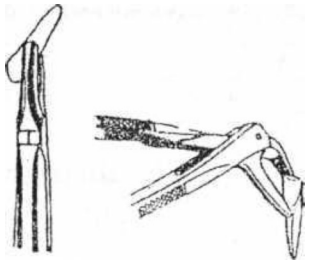
Correct use of left hand during extraction of: A, Right maxillary premolars, B, Maxillary anterior teeth. C, Left maxillary premolars and molars. D , Right mandibular cheek teeth (N.B. The operator stands behind the patient when extracting these teeth) E, Mandibular anterior teeth. F. Left mandibular molars and premolars

4- The application of forceps blades to the tooth (tooth grasp):-

After you select the proper forceps for the extraction of particular tooth. The forceps blades are applied on both labial (buccal) and lingual (palatal) surface of the tooth, so that the blades are parallel to the long axis of the tooth to be extracted





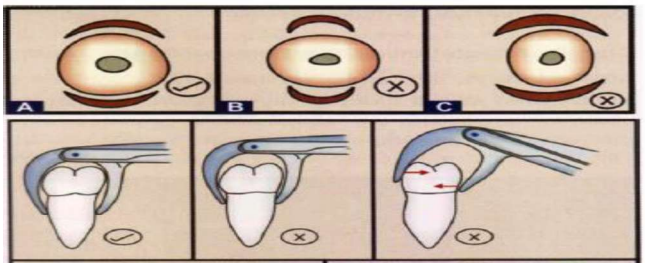


Incorrect alignment of upper premolar (left) and lower premolar (right)

The blades of the forceps are moved on the tooth surface apically and are allowed to move apically cutting through periodontal and gingival fibres to grasp the tooth-root surface below the cemento-enamel junction. The tooth to be extracted is grasped firmly, the blades are not allowed to slide on the surface of the root during extraction movement.

It's a good practice to apply the blades of the forceps to the less accessible side of the tooth to be extracted first under direct vision and then apply the other blade on opposite side. If one side of the tooth is carious, then the forceps blades applied to the carious side first and extraction movement should be started toward the carious side.

The surface of the beaks of the forceps should lie as close as possible to the surface of the tooth grasped tightly without slipping during extraction



5- The displacement of the tooth from its socket: -

This is performed by using the extraction movements.

The extraction movements are: -

a- Outward movement (labial or buccal)

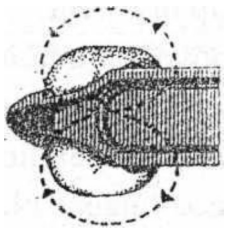
b- Inward movement (lingual or palatal)

c- Rotatory movement (rotation movement).

The purpose of extraction movements is:

1-Cutting the tooth attachment.
2- Separating the tooth from the wall of the socket.
3- Dilatation of the bony wall of the socket utilizing the resiliency of the living bone.
4- The removal of the tooth from the socket.

When the blades applied to the root surface a firm grip of the root taken by the forceps and buccolingual and lingobuccal movements are made in that order. This pressure should be firm but not crushing, smooth and controlled not jerking. By this movements normally after few lateral movements the tooth is felt to be loosen and begin to rise out of the socket, when this loosening occurs, rotatory or figure 8 movement will help to delivery of the tooth



. **Occlusal view of mandibular molar illustrating the figure 8 of movement**

Rotatory movement:

Can be used as primary movement for extraction of teeth with conical straight roots such as the upper central incisors and lower second premolars, also rotatory movements are useful in completing the removal of teeth previously loosened by other means and this is called secondary rotatory movement.

The gross distortion and laceration of the buccal plate and mucosa are happened if excessive lateral movement is done. The final movement by which the tooth is removed from its socket should be always directed outwards, so reducing the trauma

to the opposing teeth and preventing slipping of the tooth in the mouth which may be swallowed or aspirated by the patient.

If the tooth dose not yield (no movement) after applying a reasonable force, excessive force should not be used, stop and re-evaluate the case clinically and/or radiographically because the tooth may be need surgical extraction.

Post-operative care of extraction wound: -

1- Examine the extracted tooth to be sure that there is no fracture in the roots (retained root), keeping in mind the anatomical variations in number of roots of each tooth, because some teeth have accessory roots.

2- Always examine the socket for any loose fragments of bone or roots (pieces of enamel), foreign materials (e.g. calculus, amalgam particles, or pathology (e.g. periapical granuloma, polyp) all these should be removed by using curette or suction tip or tweezer.

3- You have to remove or smooth any sharp bone or projections of inter-radicular bone, then apply suture if necessary, e.g. if there is laceration in the soft tissue.

4- The expanded bucco-lingual plate should be compressed or squeezed back to their original configuration or shape in order to reduce any distortion of the supporting tissue to re-establish the normal contour before extraction

5- Make sure that the socket is full of blood, (to form blood clot)

6- Place a properly shaped and size (2X2 Cm) gauze piece over the socket (and never put it into socket) in such a way that the patient close his mouth and it is not visible to gain initial control of haemorrhage. It is important to place the gauze directly over the extraction site in the space occupied by the crown of the extracted tooth and not over the occlusal table of teeth to ensure that the pressure is correctly transmitted over the socket to achieve haemostasis.

Instructions to the patient:

1- Keep biting over the gauze for at least (0.5-1) hours and discharge after that

but if haemostasis is not established, you can use another.

2- Do not spit during first ***1/2*** hour and use minimal talking and avoid violent exercise or activity to assist the formation of a firm clot in the socket, so rest for the first few hours following extraction are recommended ,avoid insertion of the tongue tip inside the socket which lead to dislodgement of clot or disturb its formation

3- use only cold fluid and soft diet for the few postoperative hours and not take solid or hard food for the rest of the day, and chew on the opposite side of extraction.

4- in case of continuous bleeding. Place a sterile gauze in place over the wound and keep it in place for an hour, if bleeding not stopped contact your dentist.

5- always prescribe the proper analgesic and antibiotic if necessary (e.g. The presence of residual infection, diabetic patient, patient on immune-suppressive drugs, aids...etc.

Oral surgery

Complications of exodontia

Complications can arise during the procedure of extraction or may manifest themselves sometime following the extraction ,so we have immediate complications and post-operative one.

All these complications arise from error in judgment, misuse of instruments, exertion of extensive force or from anatomic causes or factors.

By careful diagnosis and planning of the procedures many complications can be avoided but some of these complications may occur even when utmost, care is exercised , so that the dentist or the oral surgeon should be qualified to deal with each complications successfu1y.

So the possible complications are:-

1- Failure to secure anesthesia.

Failure to secure profound or good anesthesia may be due to:-

a- Faulty technique, or Insufficient dosage of anesthesia.

b- Expired anesthesia.

c- The presence of acute infection.

2- Failure to remove the tooth with either forceps or elevator.

failure to remove the tooth after applying a reasonable amount of force without movement or yielding of the accused tooth need further clinical and radiological evaluation, because the tooth may be need surgical extraction.

3- Fracture (#)of:-

A. Crowns and roots.
B. Alveolar bone.
C. Maxillary tuberosity.
D. Adjacent or apposing tooth. ,
E. Mandible.

a-Fracture of crowns and roots: -

The most common complication during tooth extraction is fracture of the tooth crown or roots.

The factors that may lead to fracture of crown or roots may be classified into three groups:

1.Factors related to the tooth itself.
2.Factors related to the bone investing that tooth.
3.Factors related to the operator (dentist).

1- factors related to the tooth itself

means that the tooth may be badly carious, or heavily filled, brittleness of the tooth due to age, or non-vitality, root canal filled tooth. Also peculiar root or crown formation like dilacerated tooth, geminated tooth, severely curved root, divergent roots, convergent roots, hyper-cementosis, accessory root and complex root shape, malposed tooth, insufficient space for the application of the extraction instrument, internal & external! resorption.

2-Factors related to the investing bone

means the surrounding bone might be excessively dense or sclerotic due to localized or systemic causes.

3-factors related to the operators

includes improper application of the beaks of the dental forceps or elevator on the tooth to be extracted; like the placement of the beaks of the dental forceps on the crown instead of the root or below the cemento-enamel junction, also the beaks are not parallel to the long axis of the tooth, also the use of wrong type of forceps.

Incorrect application of force during extraction by wrong direction in addition to that the use of twisting or rotational movement when not indicated like the use of twisting movement in extraction of upper 1^{st} premolar or upper 1^{st} and 2^{nd} molar for example.

b- Alveolar bone fracture: -

Fracture of alveolar bone frequently occurs when extraction is difficult. The fractured bone may be removed with tooth to which it is firmly attached or it may be remain attached to the periosteum or it may be completely detached in the socket or wound.

It is a common complication that especially occurs on labial(buccal) area during extraction of upper canine and upper and lower molar teeth.

This complication might be due to: -

1.The alveolar bone is very thin.
2. Accidental inclusion of the alveolar bone within forceps blades
3. Configuration of the roots.
4. The shape of the alveolus.
5.Pathological or physiological changes in the bone itself like Ankylosis (bony connection between the tooth and bone), the presence of destruction in the alveolar bone due to the presence of discharging sinus.

c- Maxillary tuberosity fracture: -

Sometime the tuberosity is completely fractured when we try to remove maxillary 3rd or 2nd molar.

Fracture of maxillary tuberosity may lead to a wide opening into the antrum called Oro-antrum communication with irregular tearing in the covering soft tissue lead to profuse bleeding and post- operatively may lead to difficulties in the retention of upper denture.

This complication might occur if the molar tooth to be extracted is isolated and subjected to full force of bite leading to sclerosis of the surrounding bone, or due to downward extension of the maxillary sinus to the nearby edentulous alveolar bone or due to large abnormal size of the maxillary sinus extended to involve the tuberosity; in addition to that, the use of excessive force or wrong positioning of the elevator in the extraction of upper 3rd molars

.

d-Fracture of the adjacent and opposing tooth; -

Adjacent teeth occasionally may be damaged during extraction procedures, this may include loosening or dislocation or fracture of the adjacent teeth.

This misshapes occur mostly due to careless use of the dental forceps or elevator by wrongfully using the adjacent tooth as a fulcrum during the use of elevator or the application of the beaks of dental forceps, also fracture of the crown of adjacent tooth or fracture and dislodgment of its filling.

In addition to that opposing teeth may be chipped or fractured if the tooth being extracted yield suddenly to uncontrolled force of the forceps striking the opposing tooth leads to this complication.

e-Mandible fracture: -

This is a rare complication, but it might occur almost exclusively with the surgical removal of impacted lower third molar tooth.

A mandibular fracture is usually the result of the application of a force exceeding that needed to remove a tooth and often occurs during the use of dental elevators(winters elevator), but sometimes pathological or physiological changes may lead to weakened mandible like: -

1.Senile atrophy and osteoporosis of the bone.

2. Osteomyelitis e.g. osteoradionecrosis.

3. cystic lesion.

4. Impacted teeth.

5. Tumor, benign or malignant..

So, preoperative clinical and radiographic evaluation is very important to avoid such complication or preventing it.

4. Dislocation of the tempro-mandibular joint (T.M.J.): - Exertion of high amount of force during extraction of lower teeth especially posterior teeth may lead to dislocation of the condyle of the mandible and the patient becomes unable to close his/her mouth, especially in patient who had a history of recurrent dislocations in TMJ.

if this dislocation occur it should be reduced immediately by the operator by standing in front of the patient and his thumbs placed intra-orally on the external oblique ridge lateral to the molar teeth and other fingers outside the mouth under the lower border of the mandible, downward pressure with the thumbs and upward pressure with the other fingers may reduce the dislocation, if reduction is delayed it become difficult to reduce it because of muscle spasm and the patient may need general anesthesia to reduce the dislocation, also the patient may complain of traumatic arthritis of the TMJ. Post-operatively due to high pressure applied to the joint during extraction, so supporting the mandible during extraction prevents such complication.

5. Displacement of a root into the soft tissue and tissue spaces and the maxillary antrum: -

During extraction especially on use of elevator, a root or piece of root may be dislodged into the soft tissue through a very thin bony plate overlying the socket and disappear buccally or lingually into the soft tissue between periosteum and bone in the vestibule, but sometimes a root or even a tooth may be displaced into the tissue spaces surrounding the jaws e.g. a retained root in the lower molar teeth may be displaced into the sublingual or submandibular space or e.g. upper third molar may displaced into the infratemporal space.

So the extraction with high force without direct vision on the retained root may lead to such complications, also retained root may be displaced into the maxillary antrum during the extraction of upper molar or sometimes premolar teeth especially palatal root of upper molar teeth.

The presence of large antrum or the use of excessive force during extraction or due to pathological conditions like periapical pathology. All these factors may assist or predispose to such complication, so pre-operative radiograph and clinical evaluation may assist in the prevention of such complication.

6- Excessive bleeding after extraction:-

At the beginning one must understand that some slight oozing of blood for several hours following tooth extraction is considered normal. But sometime excessive or abnormal bleeding may occur following tooth extraction.

The causes of excessive bleeding may be due to:-

A. Local factors

The local causes which are the commonest causes for prolonged bleeding as in usual, due to gross tissue damage, when there is severe bone injury and tearing of the periosteum many vessels are opened also severe gingival lacerations, also damage to large arteries like inferior dental vessel or greater palatine vessels may lead to profuse bleeding, also the presence of Hemangioma (central) and other vascular abnormalities may lead to such complication
Also post-operative infection of the extraction wound causing erosion of the blood vessel leading to secondary haemorrhage, also the working in acutely inflamed area may assist in the prolonged bleeding.

B .systemic factors

For the systemic causes like systemic haematological disorders like thrombocytopenia, reduction in the clotting factors, anticoagulant drugs, hereditary blood disease like haemophilia , all these factors may lead to severe bleeding; so good history and clinical examination and blood investigation is very important and essential before any extraction especially if the patient gives you a history of bleeding on previous extractions or trauma.

7-damage to the surrounding soft tissues.

a. Damage to the gum or lip.

like laceration of the gum during extraction occurs if the gingival tissue not reflected before extraction so gum adhere to the tooth to be extracted from its socket should be carefully dissected before any further attempts to deliver the tooth are made, also the inclusion of the gum by forceps beaks or by blind application of the forceps may lead to crushing of the soft tissue, also the lower lip may be pressed or crushed between the handles of the forceps and the lower lip on extraction of upper teeth if sufficient care is not taken .

b. damage to the tongue and floor of the mouth

Also slipping of elevator during extraction may lead to damage or wounds in the floor of the oral cavity, there are many vital structures in the floor of the oral cavity which might be damage like [sublingual gland , submandibular duct, lingual nerve & tongue]. So the operator should always keep in his mind that supporting of elevator during extraction is very important.

C. Damage to nerves

occur mostly on surgical extraction of teeth rather than simple extraction but one must always be aware of the risk when operating in the region of the (inferior dental nerve, lingual nerve & mental nerve). Inferior alveolar nerve injury is an uncommon occurrence in extraction of erupted mandibular teeth. In rare cases third molar roots may *encircle the nerve* so that extraction of the tooth will cause nerve injury also curration or improper use of elevators to remove root apices may cause tearing or displace bone fragments so that will impinging or pressing the nerve in the canal "inferior dental canal" result in *Parasthesia or anesthesia* of half of lower lip.

The mental branch of the alveolar nerve also may be injured during surgical procedures in the premolar region. The lingual nerve may be damaged during exodontias of the lower molar teeth especially the lower wisdom tooth by trapping the lingual soft tissue in the forceps beaks or by direct trauma from misusing of elevator or by using surgical extraction to remove impacted wisdom tooth.

8-post -operative pain:

Post-operative pain and discomfort after extraction due to traumatized hard tissue may be from bruising of bone during instrumentation or from using burs for removal of bone also damage and rough handling of soft tissue during extraction is another cause for postoperative pain.

The most common cause for the moderate to severe continuous pain after extraction is related to a well-known cause called ***dry socket*** *or acute localized alveolar Osteitis.* -The patient presented with continuous moderate to severe pain after 24-72 hours after extraction which may last for 7 to 10 days clinically the patient may presented with empty socket (there is no clot in the socket) , exposed bone or empty socket with some evidence of broken-down blood clot and food debris within it with intense bad odour. The aetiology of this condition is incompletely understood but many predisposing factors exist like infection, trauma, blood supply, site, smoking, sex, vasoconstrictors or systemic factors.

9-post- operative swelling:

After extensive surgical interference and exodontias some time may be associated with post-operative swelling ,this swelling may be related to one or more of the following causes: (A-Oedema , B-Infection, C-Hematoma.)

a. Oedema*:*

oedema occurs after surgery as a result of tissue injury *(it is normal response)*when there is great damage to the tissue by using blunt instrument. And rough handling of tissue may Increase the chance of production large oedema.

So laceration of tissue during extraction, trauma to the bone or periosteum are some of the most common causes of oedema and in other words *post-operative swelling,* persistent post-extraction swelling or the development of swelling several days after surgery is usually due to infection.

b. infection

swelling due to infection can be distinguished from postoperative oedema by the increased skin temperature ,greater redness of the overlying tissues, the usual presence of fever and sometime fluctuation is present due to presence of pus. The infection should be always considered a serious complication and need urgent management.

c.hematoma

means a collection of blood in the extra-vascular spaces of the tissues. It is rare complication following extraction of the teeth, but sometimes hematoma or ecchymosis may develop postoperatively if haemostasis is not developed and persistent bleeding from either the socket or adjacent alveolar bone.

10-The creation of an oro-anrtal communication.

On extraction of upper molar teeth and sometimes upper premolars a communication between the oral cavity and maxillary antrum may be created. This communication if not healed or closed after few days a chronic condition occurs called *Oro- antrum fistula.*

Close proximity of the maxillary cheek teeth to the maxillary antrum which are separated only by little amount of bone and sometime even the soft-tissue lining of the maxillary sinus, the presence of periapical infection, the antrum itself may be abnormal in size, misjudgement of force used in extraction or the presence of pathological lesions .all these factors may assist in the production of this complication.

to confirm the presence of this complication ,the patient is asked to pinch or close the nostrils together and blow air gently into the nose , the operator may see blood bubbling, or shooting of air through the communication is heard or a piece of cotton on tweezer may be defected. The *presence of* this complication need surgical correction by well-trained oral surgeon and surgical unit in which all instruments and qualified staff present.

11-Trismus:

Means inability to open the mouth, trismus is one of common complication following extraction of teeth especially the surgical removal of teeth especially the surgical removal of wisdom teeth. Trismus may be caused by post-operative *oedema, hematoma, inflammation of the soft tissue. Trauma and arthritis* of the tempromandibular joint, it may be related to the use *of inferior dental block* local anesthesia so the management of the trismus depend on diagnosis of the cause of this complication

12-syncope(fainting):-

Collapse on the dental chair is a common complication during extraction. The patient may often complaining of feeling dizzy, weak & nauseated ,and the skin is seen to be pale ,cold and sweating, these complains may be accompanied by loss of consciousness, and the patient if not noticed at the beginning of the fainting may shows episode of convulsion.

The primary pathophysiological component of this situation is *cerebral ischemia* secondary to an inability of the heart to supply the brain with an adequate volume of oxygenated blood. In the presence of anxiety ,blood flow is increasingly directed toward the skeletal muscles at the expense of other organ systems such as the gastrointestinal tract ,in the absence of muscular movement ,the increased volume of blood in the skeletal muscle remains there, decreasing venous return to the heart and decreasing the volume of blood available to be pumped by the heart (uphill) to the brain.

A slight decreased in cerebral blood flow is evidenced by the signs and symptoms of vasodepressor syncope(i.e. light headedness ,dizziness, tachycardia, palpitation) if this situation continues cerebral blood flow declines still further and the patient loses consciousness.

When the operator notice these signs and symptoms a first aids treatment should be started by lowering the head of the patient by putting him in supine position by lowering the back of the dental chair. Care should be taken to maintain the airway and you have to notice the condition of the patient .if consciousness is not returned within 1-2 minutes otherwise one should consider that something serious like *respiratory arrest* or *cardiac arrest* may happen and the patient need medical emergency.

LOCAL ANAESTHESIA IN ORAL SURGERY

Definition:-

Local anesthesia (LA) is defined as a loss of sensation in a circumscribed area of the body caused by a depression of excitation in nerve endings or inhibition of the conduction process in peripheral nerves. An important feature of LA is that it produces this loss of sensation without loss of consciousness, in this point LA differs dramatically from general anesthesia.

Pain:- unpleasant physical sensation Experienced following the application of noxious stimuli:

Although the supporting tissues of the teeth can them selves give rise to pain most of the nerve endings in the periodontal membrane are properoicptive

Pain threshold:- a point at which the patient feels discomfort when exposed to painful stimuli.

The patient who feels minimal discomfort from painful stimuli is having high pain threshold

Many factors influence this response such as fear, apprehension and fatigue, all of which lower the pain threshold.

Anesthesia:- means loss or abolition of all modalities of sensation which includes pain and touch

Analgesia:- means loss of pain sensation only.

Paraesthesia:- means altered sensation (tingling sensation) and this may occur when a damaged nerve is regeneration or when a local anesthesia is either starting to work or its effect is wearing off. the effect of a local anesthetics on nerve fiber has been shown to be dependent on

1-the duration of exposure of local anesthesia

2- Concentration

3- Volume of the solution

Premedication:- is the use of drugs to reduce a patient's apprehension prior to operative treatment.

Sedation techniques:- involve the administration of a sedative to reduce anxiety in the conscious patient, usually, given by I.V route .

Relative analgesia:- is a sedation technique in which the patient remains conscious but mental relaxation is induced by inhalation of a mixture nitrous oxide, oxygen and air. Local anaesthesia used when necessary.

Classification of nerve fibers:

The fibers of peripheral nerves classified according to the basis of electrophysiological and morphological differences:

Type A ; fiber: largest fibers further divided into four groups :-
1) A- alpha (α): responsible for motor action & muscle properioception.
2) A-beta (β): responsible for motor action & muscle properioception.
3) A-gamma (γ): responsible for motor action & muscle properioception.
4) A- delta (δ): responsible for fast sharp pain, temperatures, touch, & pressure

Type B fibers : preganglionic responsible for sympathetic activity.

Type C fibers : unmyelinated , the most numerous in the peripheral nervous system. Responsible for conduction of dull or burning pain.

Noxious stimuli are transmitted to the CNS by way of Aδ &C fibers. The lightly myelinated Aδ fibers are responsible for conduction of sharp, bright pain while unmyelinated C fibers conduct dull or burning pain.

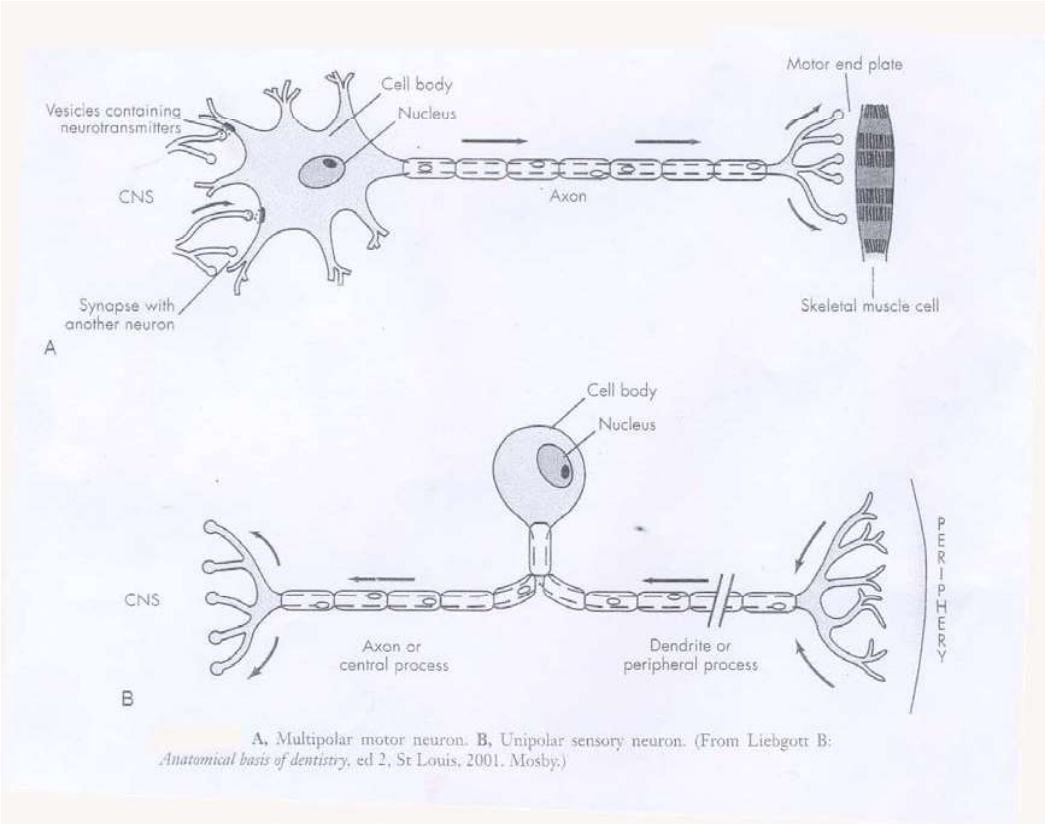
Requirements of local anesthetic agents:-

- It should not be irritating to the tissue to which it is applied
- It should not, cause any permanent alteration of nerve structure
- Its systemic toxicity should by low
- It must be effective regardless of whether it is injected into the tissue or applied locally to mucous membranes.
- The time of onset of anesthesia should be as short as possible
- The duration of action, must be long enough to permit completion of the procedure.
- It should have potency sufficient to give anesthesia without using harmful concentration
- It should be relatively free from producing allergic reactions
- It should be stable in solution and readily undergo biotransformation in the body
- It should either be sterile or be capable of being sterilized by the heat without deterioration.

Review of the nervous system and impulse generation:-

The basic structural unit of the nervous system is the neuron (fig: 1) which is able to transmit messages between the central nervous system and all parts of the body, it consists of three parts: cell body axon and dendrites. The dendrites which end in the free nerve endings respond to stimulation produced in the tissue they lie, provoking an impulse that is transmitted centrally along the axon. The axon which is the single nerve

fiber, is a cable like structure composed of neural cytoplasm and covered by thin sheath which is the nerve membrane; in some nerves an insulating lipid rich layer of myelin covers this membrane. Current theories stated that nerve excitability and conduction are both attributable to changes developing within the nerve membrane.



A, Multipolar motor neuron. B, Unipolar sensory neuron. (From Liebgott B: *Anatomical basis of dentistry*, ed 2, St Louis, 2001. Mosby.)

Fig. 1 A.motor neuron. B.sensory neuron.

Nerve membrane:-

The nerve membrane consists of two layers of lipid molecules (phospholipids) and associated proteins, lipids and carbohydrates (fig:2). All biologic membranes are organized to (1) block the diffusion of water soluble molecules. (2) be selectively permeable to certain molecules via specialized channels and (3) transduce information by protein receptors responsive to chemical or physical stimulation. Since the nerve membrane exhibits selective permeability, therefore significant differences exist for ions between the intracellular and the extracellular concentrations. Accordingly high concentration of K inside while high concentration of Na and CI outside the nerve membrane.

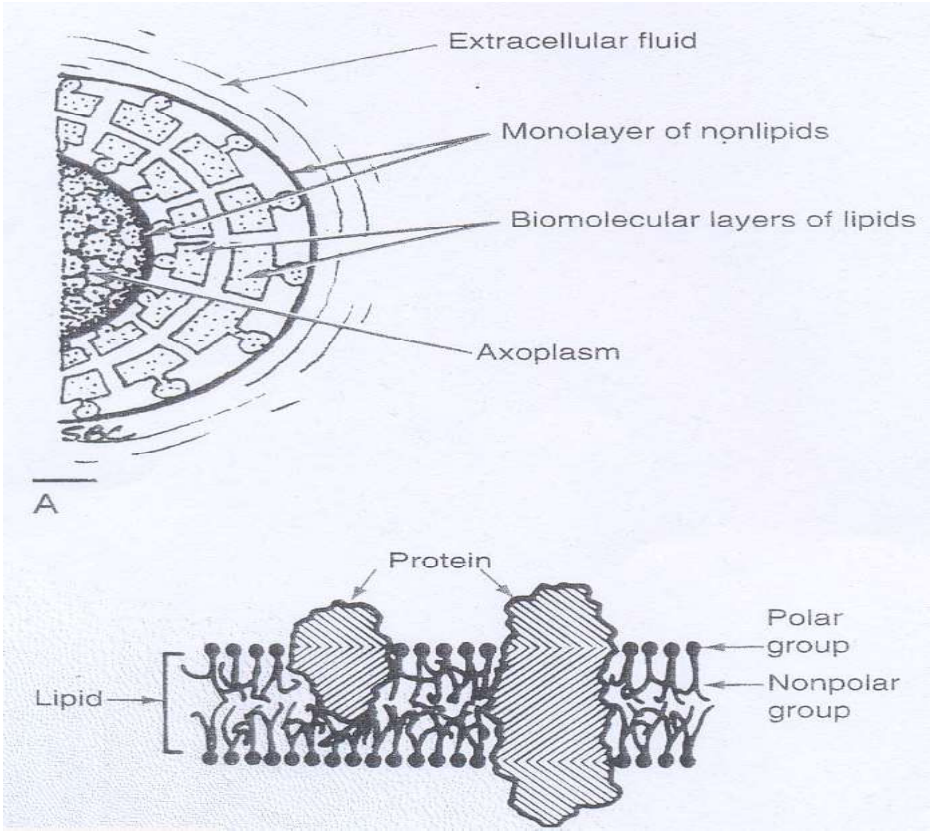


Fig.2 Configuration of the biological membrane.

In some nerves an insulating lipid rich layer of myelin covers this membrane (fig: 3). The outer most layer of myelin consists of the schwann cell cytoplasm and its nucleus. A gap between two adjoining schwann cells and their myelin spirals called node of ranvier at these nodes the nerve membrane is exposed directly to the extracellular medium.

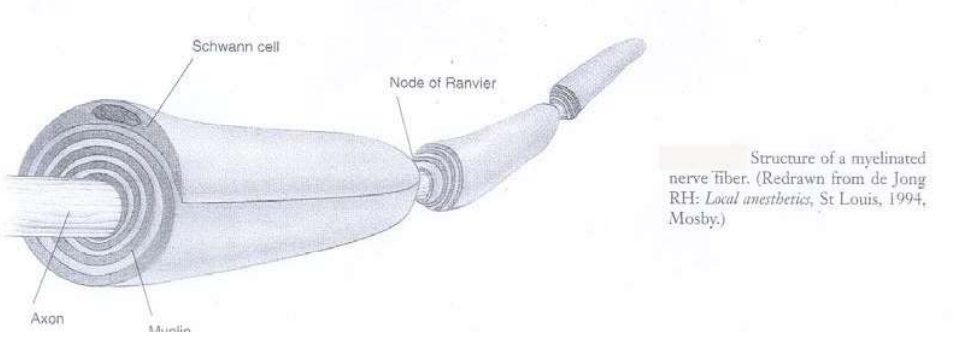


Fig. 3 The structure of a myelinated nerve fiber.

Impulse generation:-

The function of a nerve is to carry messages form one part of the body to another. These messages in the form of electrical action potentials are called impulses. Impulses are initiated by chemical, thermal, mechanical or electrical stimuli.

Resting state:-

(fig 4 step1) In the resting state the nerve membranes possess negative resting potential (-70mv) that comes from different concentrations of ions on either side of the membrane (due to the selective permeability property).

Depolarization:-

(Fig 4 step 2) when a stimulus excites a nerve this will lead to an increase in permeability of the membrane to Na ions, the rapid influx of Na ions to the interior of the nerve will cause depolarization of the nerve membrane from the resting level to its firing threshold of approximately (-50) to (-60) mv. The firing threshold is actually the magnitude of the decrease in the negative membrane potential that is required to initiate an action potential (impulse). When firing threshold is reached permeability of the membrane to sodium increases dramatically and at the end of depolarization the electrical potential of the nerve is reversed an electrical potential of + 40 mv exists. This process takes 0.3 millisecond.

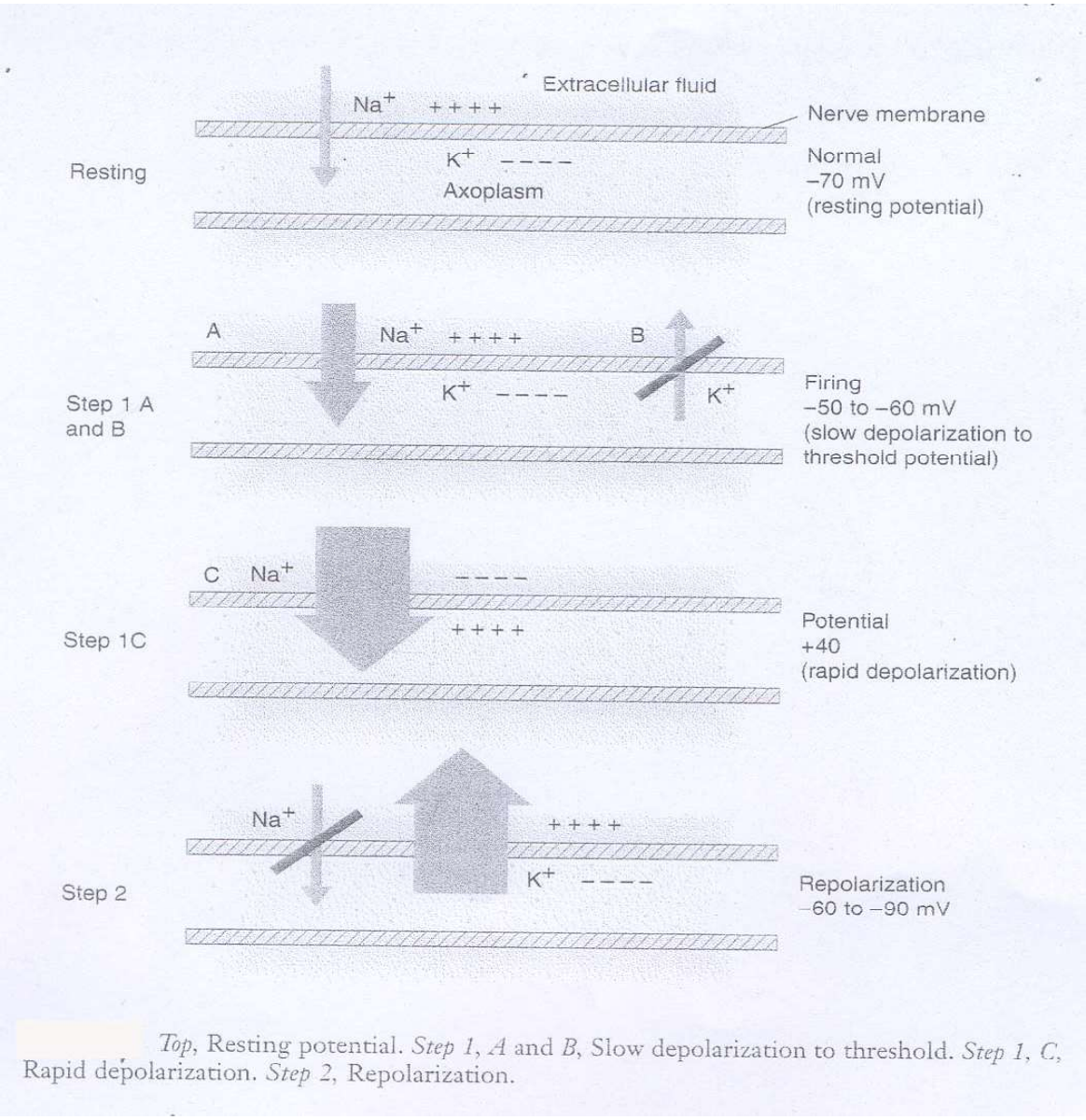
Repolarization:-

The action potential is terminated when the membrane repolarizes (fig 4 step 3) and this is achieved by increase permeability to K ions, resulting in the efflux of K ions (movement to the outside) leading to membrane repolarization and return to its resting potential (-70mv).This process takes 0.7 milliseconds.

The movement of Na ions to the inside of the nerve during depolarization and the subsequent movement of K ions out of the nerve during repolarization are passive process (not requiring energy) since each ion moves along its concentration gradient. After repolarizatino when the nerve return to its resting state a slight excess of Na ions exist within the nerve cell and a slight excess of potassium exists extracellularly, accordingly a period of metabolic activity begins called sodium pump leading to the movement of Na to the outside as well as movement of K to the inside, this pumping mechanism require energy that is coming from oxidative metabolism of adenosine triphosphate (ATP).

Accordingly action potential could be defined as a transient membrane depolarization that result from a brief increase in the permeability of the membrane to sodium and also from delayed increase in the permeability to potassium.

Once an impulse has been initiated it moves along the surface of the axon to the CNS.



Top, Resting potential. *Step 1*, *A* and *B*, Slow depolarization to threshold. *Step 1*, *C*, Rapid depolarization. *Step 2*, Repolarization.

Fig.4 Steps of the action potential.

Mechanism of action of local anesthesia:-

The concept behind the action of L.A. is that it prevents both the generation and the conduction of a never impulse thereby they act like a roadblock between the source of the impulse (ex; surgical incision in the soft tissue) and the brain. The aborted impulse prevented from reaching the brain is not therefore interpreted as pain by the patient.

Many theories have been suggested to explain the mechanism of action of local anesthesia, In general the nerve membrane is the site at which local anesthetic agents exert their pharmacological actions, the most popular theories are:

1. **membrane expansion theory**:- this theory states that local anesthetic molecules diffuse through the nerve membrane producing a general disturbance of the bulk membrane structure

expanding some critical regions in the membrane and thus preventing an increase in the permeability to sodium ions, thus inhibiting both conduction and nerve excitation.

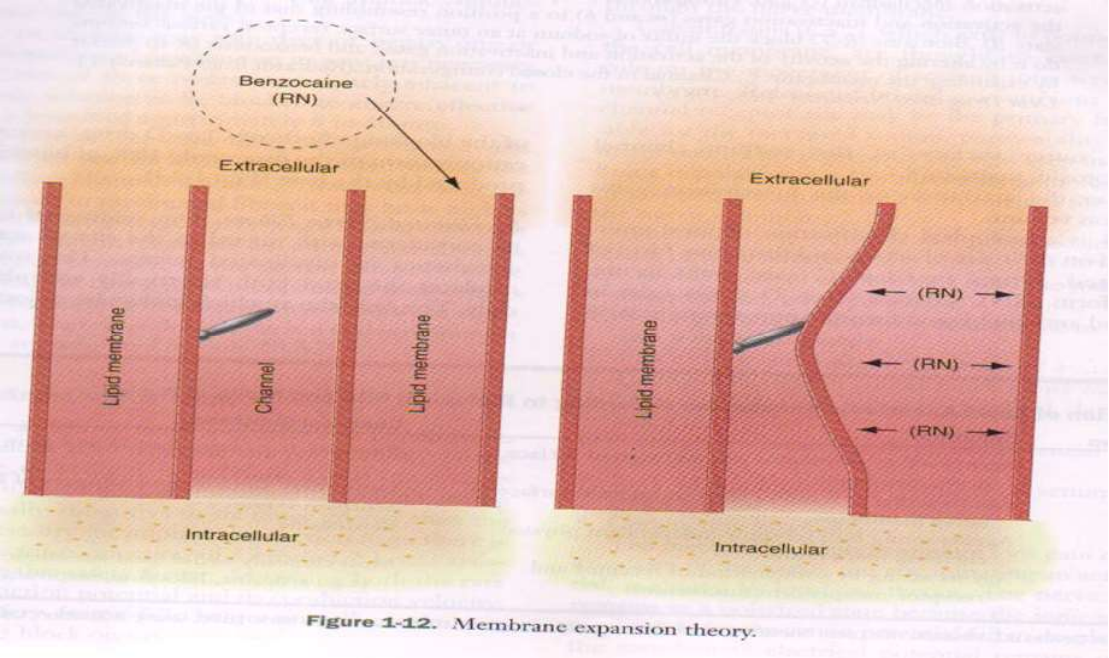


Fig.5 Membrane expansion theory.

2. **specific receptor theory**:- this is most favored one, it proposes that local anesthetics act by binding to specific receptors in the sodium channel (protein channel along the membrane) and the action of the drug is direct not mediated by change in the general properties of the cell membrane. Once the local anesthetic has gained access to these receptors, permeability to Na ions is decreased or eliminated and nerve conduction is interrupted.

***Note*:-**

A peripheral nerve is composed of hundreds to thousands of tightly packed axons (fig: 6) these axons are covered by several layers of fibrous and elastic tissues in which blood vessels and lymphtics course throughout these layers.\

Individual nerve fibers (axons) are covered with perinurium and separated form each other by the endoneurium. The perineurium then binds these nerve fibers together into bundles called fascicule.

The inner most layer of perineurium is the perilemma which represent the main barrier to diffusion of local anesthetic into a nerve. The whole fasciculi are contained within a loose connective tissue called the epineurium which represent 30% to 75% of the total cross section of a nerve.

Local anesthetics are readily able to diffuse through this tissue because of its loose consistency. Nutrient blood vessels and lymphatics

traverse the epineurium. These vessels absorb local anesthetic molecules thus removing them from the nerve.

Induction of local anesthesia

Following the administration of a L.A into a tissue near a nerve molecules of the L.A will move from on site to anther according to their concentration gradient so it will move from site of deposition toward the nerve (this process termed diffusion).

Fasiculi that are located near the surface of the nerve are termed mantle bundles (fig 6) they are first ones reached by the local anesthetic and they are exposed to a higher concentration of it. These bundles will be blocked completely shortly after the injection of a local anesthetic.

Fascisuli that are located near the center of the nerve are called core bundles these bundles are contacted by a local anesthetic only after a much delay and by a lower anesthetic concentration because of the greater distance that the solution must move and the greater number of the barriers it must cross.

As the local anesthetic diffuses into the nerve it becomes increasingly diluted by tissue fluids and is absorbed by capillaries and lymphatics thus the core fibers are exposed to a decreased concentration of local anesthetic a fact that may explain the clinical situation of inadequate pulpal anesthesia developing in the presence of subjective sympotoms of adequate soft tissue anesthesia. Complete block of all nerve fibres in a peripheral nerve requires an adequate volume as well as an adequate concentration of the local anesthetic be deposited.

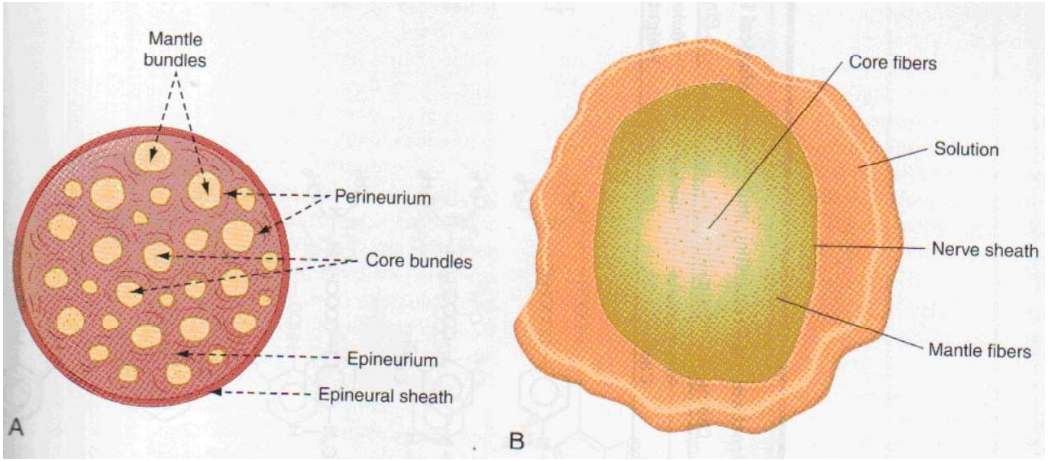


fig. 6 Cross section of a peripheral nerve.

2024 *Academic Year 4*

Pulmonary Patients and Dental Considerations

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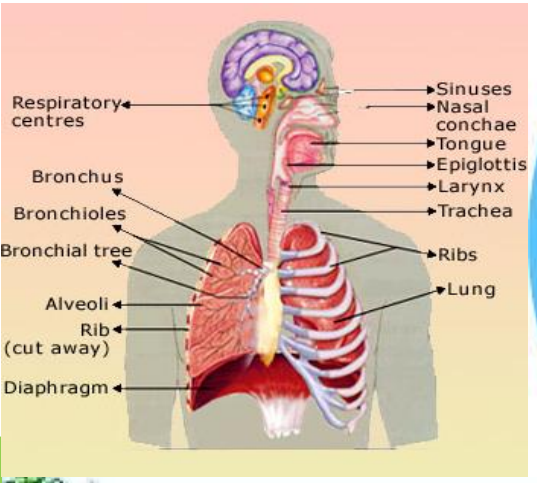
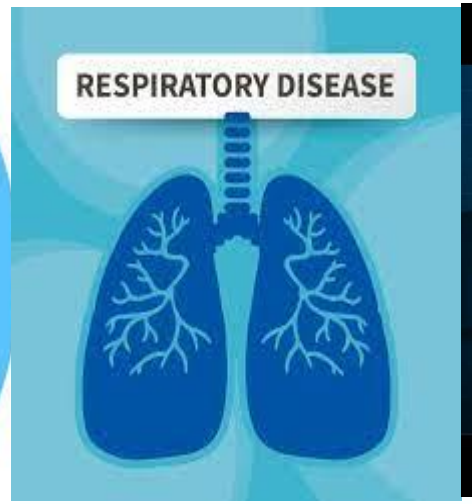
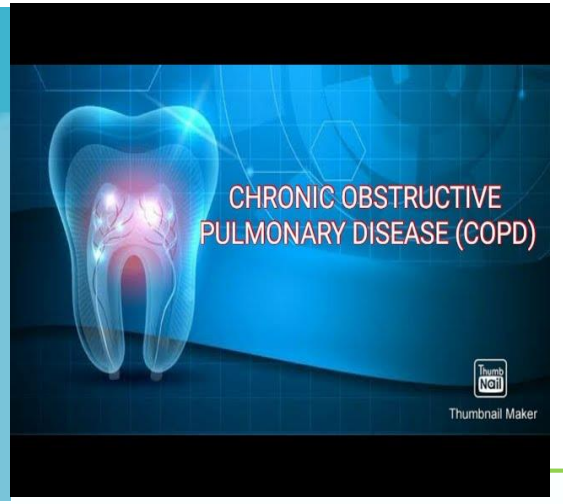
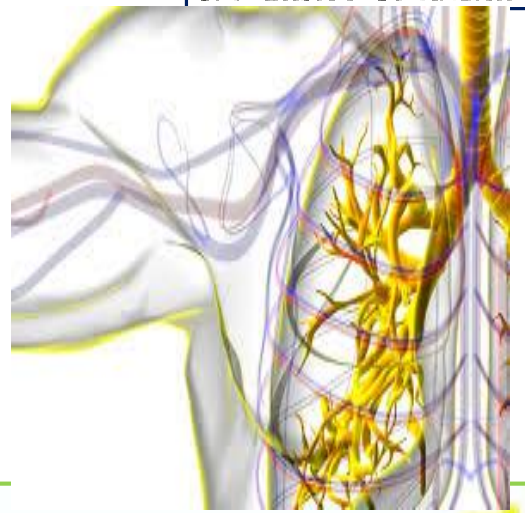








Pulmonary Patients and Dental Considerations

Pulmonary diseases

- Chronic obstructive pulmonary diseases (COPD)
  - Dental management
  - Oral complications and manifestations
- Asthma
  - Dental management
  - Management of asthmatic attack
  - Oral complications and manifestations
- Tuberculosis
  - Dental management
  - Oral complications and manifestations

The respiratory system:

The cells of the human body require a **constant stream of oxygen to stay alive**.
The respiratory system provides oxygen to the body's cells while removing carbon dioxide, a waste product that can be lethal if allowed to accumulate.
There are 3 major parts of the respiratory system: the airway, the lungs, and the muscles of respiration.

The airway

The airway which includes the **nose, mouth**, **pharynx**, **larynx**, **trachea, bronchi,** and **bronchioles**, carries air between the **lungs and the body's exterior.**

The lungs :

The lungs are a pair of large, spongy organs found in the thorax lateral to the **heart** and superior to the diaphragm. Each lung is surrounded by a pleural membrane that provides the lung with space to expand as well as a negative pressure space relative to the body's exterior. The negative pressure allows the lungs to passively fill with air as they relax. The left and right lungs are slightly different in size and shape due to the heart pointing to the left side of the body. The left lung is therefore slightly smaller than the right lung and is made up of 2 lobes while the right lung has 3 lobes.

The interior of the lungs is made up of spongy tissues containing many capillaries and around **30 million tiny sacs** known as **alveoli**. The alveoli are cup-shaped structures found at the end of the terminal bronchioles and surrounded by capillaries. The alveoli are lined with thin simple squamous epithelium that allows air entering the alveoli to exchange its gases with the blood passing through the capillaries.

Muscles of Respiration:

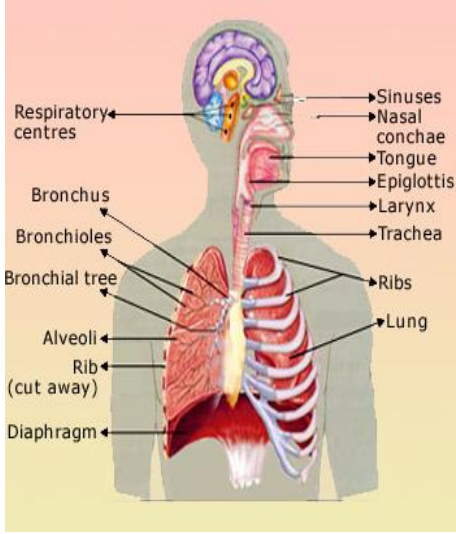
Surrounding the lungs are sets of muscles that are able to cause air to be inhaled or exhaled from the lungs. The principal muscle of respiration in the human body is the **diaphragm**, a thin sheet of **skeletal muscle** that forms the floor of the thorax. When the diaphragm contracts, it moves inferiorly a few inches into the abdominal cavity, expanding the space within the **thoracic cavity** and **pulling air into the lungs**. **Relaxation** of the diaphragm allows air to flow back out the lungs during exhalation.

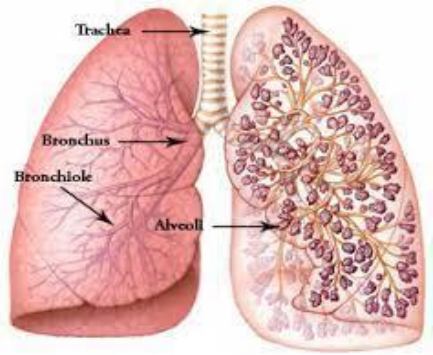
Between the ribs are many small **intercostal muscles** that assist the diaphragm with expanding and compressing the lungs. These muscles are **divided into 2 groups**:

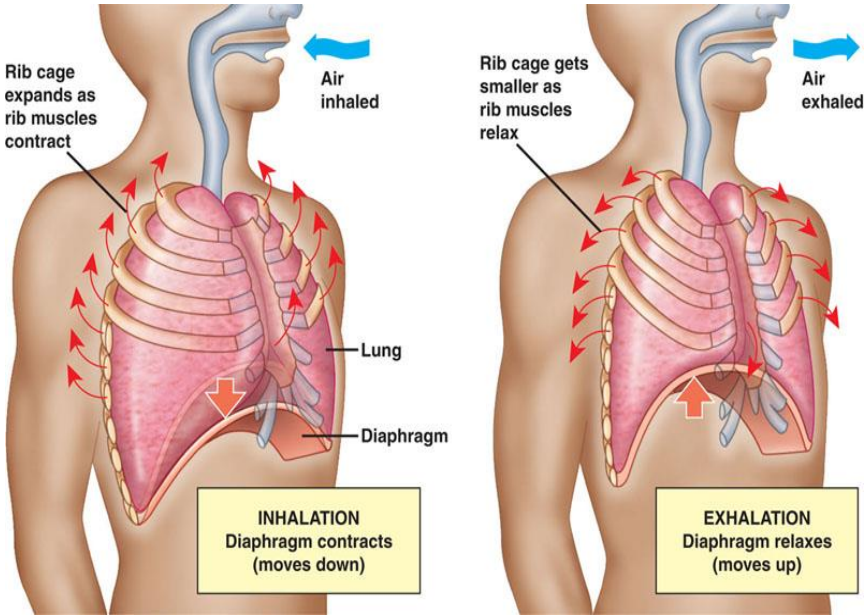
the internal intercostal muscles and **the external intercostal muscles**.

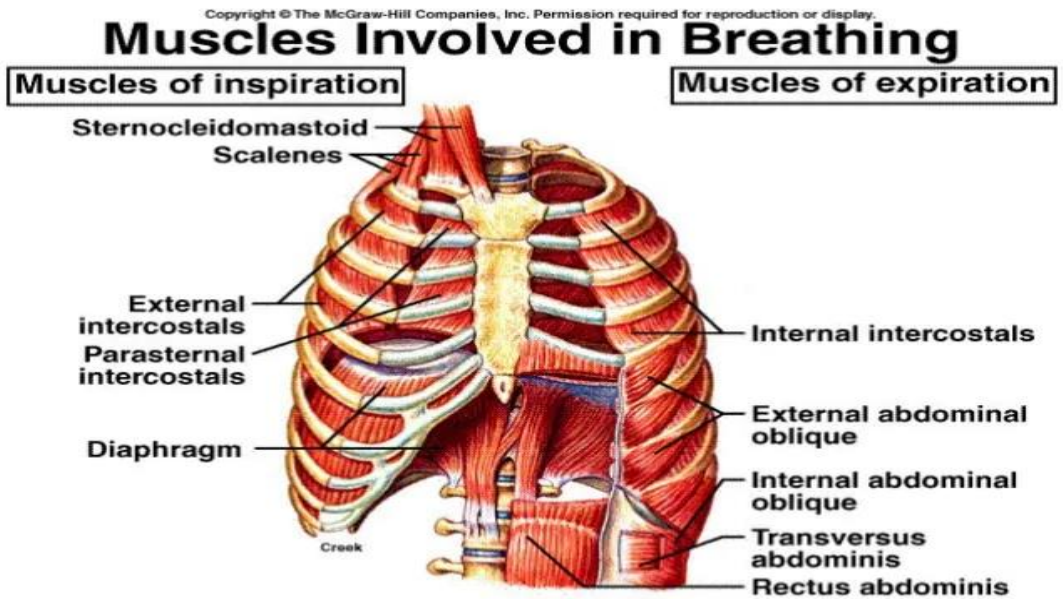
The internal intercostal muscles are the **deeper set of muscles and depress the ribs to compress the thoracic cavity and force air to be exhaled from the lungs**.

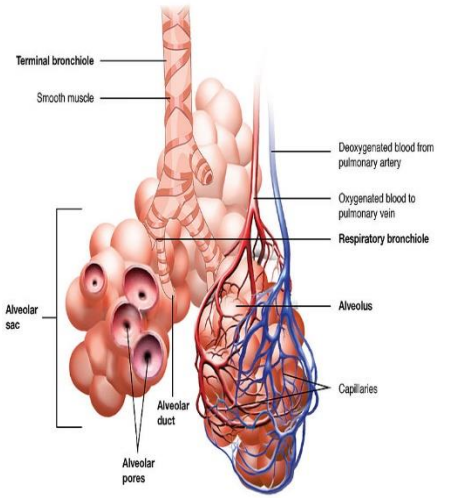
The external intercostals are found superficial to the internal intercostals and function to elevate the ribs, expanding the volume of the thoracic cavity and causing air to be inhaled into the lung.











Chronic obstructive pulmonary disease (COPD)

Chronic obstructive pulmonary disease is defined as "a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to **noxious particles** or **gases.**"

Chronic obstructive pulmonary disease (COPD) is the name for a group of lung conditions that cause breathing difficulties.

It includes: emphysema – damage to the air sacs in the lungs(over-inflation of the lungs and irreversible destruction of alveolar wall) , chronic bronchitis – long-term inflammation of the bronchi coupled with excessive bronchial mucus production and chronic sputum-producing cough.

COPD is a common condition that mainly **affects middle-aged** or **older adults who sm**oke. Many people do not realize they have it.

The breathing problems tend to get **gradually worse over time** and can limit the normal activities, although treatment can help keep the condition under control.

Related signs and symptoms

The main symptoms of COPD are:

•increasing **breathlessness**, **chronic cough**, **sputum (phlegm) production**, and **wheezing**

•a persistent chesty cough with phlegm – some people may dismiss this as just a **"smoker's cough"**

•Essentially, COPD damages the airways and alveoli in the lungs by reducing elasticity, thereby making breathing more difficult.

•Emphysema is more prevalent in older men, correlated with cumulative smoking history. Prevalence is increasing among older women, as the "smoking epidemic" manifests its sequelae. In advanced cases, there may be a "**barrel chest"** appearance, **coupled with shortness of breath** and use of **accessory respiratory muscles** (e.g., sternocleidomastoid).
•Many persons may find it easier to **breathe in a sitting position**, bent over and resting their elbows on their thighs. In end-stage emphysema, signs of respiratory failure (e.g., cyanosis, altered mental state, headache, weakness, and muscle tremor) may occur.
•Chronic bronchitis is more prevalent in females than males, and usually manifests in persons **more than 45 years old**., appear gradually but **intensify in person who continue to smoke** or **when atmospheric pollutants increas**e. Respiratory tract infections become more serious. As airway obstruction increases, there is a prolonged expiratory phase and wheezing.
•Acute attacks of breathing distress involve elevated respiratory rate, labored breathing, intense coughing, and bluish skin (cyanosis due to reduced oxygenation). Recurrent pulmonary infections are common.
•For both emphysema and chronic bronchitis, **dyspnea** is initially brought on only by exertion. Eventually, breathing difficulty **becomes more frequent with minimal effort**.
•Many persons with COPD often experience associated significant non-pulmonary conditions, such as weight loss, muscle wasting, cardiovascular disease, hypertension, anemia , osteoporosis, and depression.
•COPD is a leading cause of death
•Up to 30% of patients with clinical COPD may also have a concomitant diagnosis of asthma.
•There is no cure for COPD, the disease can be managed with **medications**, **immunizations**, and pulmonary **rehabilitation**. Avoidance of pulmonary irritants improves symptomatology and decreases mortality.

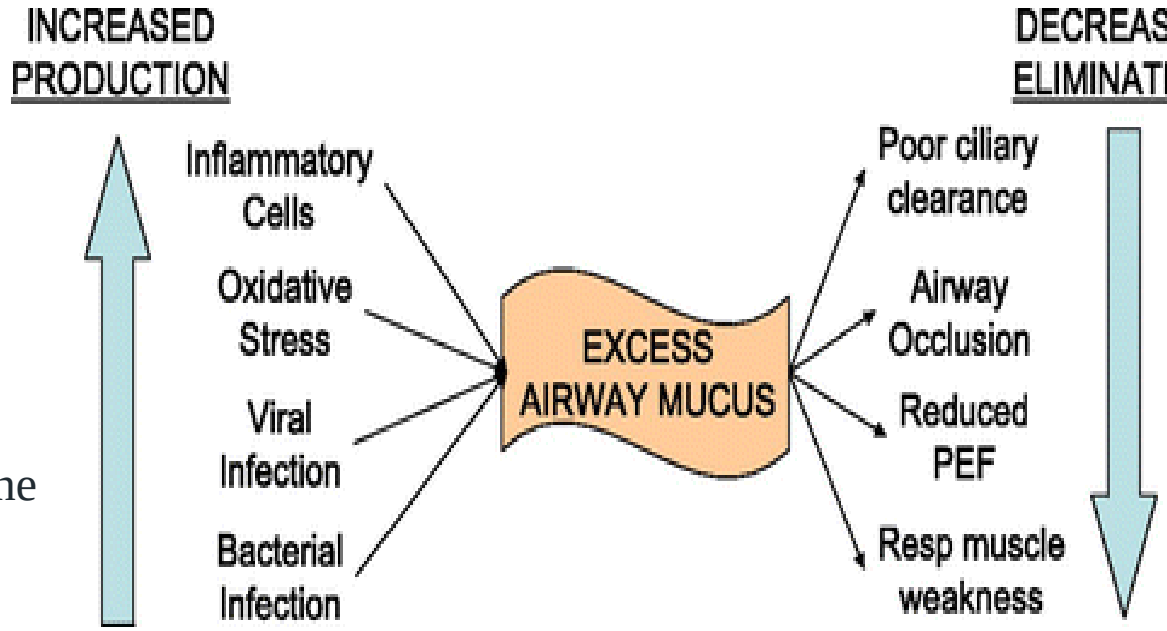
Without treatment, the symptoms usually get progressively worse. There may also be periods when they get suddenly worse, known as a flare-up or exacerbation

Causes of COPD

COPD happens when the lungs become inflamed, damaged and narrowed. **The main cause is smoking**, although the condition can sometimes affect people who have never smoked.

The likelihood of developing COPD increases the more smoke and the longer person smoked.

Some cases of COPD are caused by long-term exposure to harmful fumes or **dust.** Others are the result of a **rare genetic problem** which means the lungs are **more vulnerable to damage**



Causes of excessive mucus in chronic obstructive pulmonary disease.
PEF = peak expiratory flow

Treatments for COPD

The damage to the lungs caused by COPD is permanent, but treatment can help slow down the progression of the condition.

Treatments include:

- stopping smoking – if you have COPD and you smoke, this is the most important thing you can do
- inhalers and medicines – to help make breathing easier
- pulmonary rehabilitation – a specialised programme of exercise and education
- surgery or a lung transplant – although this is only an option for a very small number of people

Oral manifestations :

- COPD does not directly affect the mouth and teeth.
- Medications used to manage COPD – such as inhaled anticholinergics (e.g., ipratropium and tiotropium), β2-adrenergic bronchodilators (long-acting and short-acting), and, in more severe cases, inhaled corticosteroids – can contribute to oral disease. β2-agonist inhalers and **anticholinergics** reduce salivary flow, resulting in xerostomia. Anti-cholinergics can also result in a metallic taste after inhalation, and β2-agonist inhalers cause unpleasant taste sensation, lower plaque pH, and are associated with increased prevalence of dental caries and gingivitis.
- Oral candidiasis, gingivitis, and/or periodontitis occur in some patients/clients who use inhaled corticosteroids for long periods of time or at high dose.

The use of steroid inhalers can also result in throat irritation, voice impairment, cough, dry mouth, and, rarely, tongue enlargement. Patients/clients using inhaled medications may also be at increased risk of dental erosion and periodontal disease.

- Gastroesophageal reflux may be exacerbated by the use of β2-agonists and methylxanthines (e.g., theophylline). This reflux can lead to erosion of enamel.
- Rarely, oral theophylline has been associated with Stevens-Johnson syndrome (SJS), which has manifestations that include blistering of the oral mucous membranes and skin; facial and tongue swelling; hives; and sore mouth and throat. **Stevens-Johnson syndrome(SJS)is a medical emergency that usually requires hospitalization**. Treatment focuses on removing the cause, caring for wounds, controlling pain and minimizing complications as skin regrows. It can take weeks to months to recover
- Chronic smokers are prone to halitosis, tooth staining, nicotine stomatitis, periodontal disease, premalignant lesions, and oral cancer.

Oral management implications

 In order to avoid a significant exacerbation of COPD in the office setting, the dental hygienist should determine the severity and control of the patient/client's COPD via good history-taking. Questions should be asked regarding exacerbating factors, frequency of signs/symptoms, and disease management.

 For severe exacerbations, patients/clients **may use systemic (i.e., oral or intravenous) corticosteroids**. Prolonged use (particularly longer than 2 weeks) **can cause adrenal gland suppression** (i.e., suppression of endogenous corticosteroid production). As a result, the body may have **reduced capacity to respond to stress, including dentist /dental hygiene visits**.
Therefore, dentist/dental hygienists **should enquire about recent systemic steroid use**; steroid supplements may be required before dental/dental hygiene care is administered.
At a minimum, the dentist /dental hygienist should ensure that patients/clients taking **systemic corticosteroids have taken their usual dose on the day of the appointment** – supplemental steroids are usually **not needed to perform routine dental hygiene care**.

 Oral theophylline (generally reserved for the management of severe COPD, and to a large degree supplanted by advances in drug treatment) can **manifest toxicity**, which is sometimes **triggered by concurrent use of certain antibiotics**.
The dentist /dental hygienist should be aware of signs/symptoms of toxicity; namely, anorexia, nausea, insomnia, agitation, anxiety, thirst, vomiting, headache, cardiac arrhythmias, and convulsions.

 Narcotics and barbiturates should generally be avoided prior to treatment due to the risk of respiratory depression. However, a low-dose (preferably short-acting) benzodiazepine may be a consideration for dentist or physician prescription to reduce appointment-associated stress.
Antihistamines and anticholinergic drugs should also generally be avoided pre-appointment due to their drying properties and resultant increase in mucus tenacity.

 If the patient/client uses **oxygen at home**, he/she should be directed to bring a full portable oxygen tank to the clinic with him/her appointment. Patients/clients with severe COPD may require oxygen and oximetry monitoring during the appointment, and specialized clinics are able to offer oxygen equipment and personnel trained in its use. Low flow (2 to 4 L/min.) supplemental oxygen via nasal prongs should be considered when **oxygen saturation** is less than 95% and may be necessary when **saturation drops below 91%.**

 Some patients/clients require dental chair adjustments, because breathing is compromised in the supine position. Semisupine or upright chair positions are usually best tolerated.
Short appointments should be planned to decrease stress if the patient/client does not tolerate prolonged sitting in a dental chair.

 Rubber dam use should be modified in some cases – and avoided if possible – because this may further obstruct breathing, and patients/clients may complain of a suffocating sensation.

 Dental materials with a powder component (e.g., alginate or powdered gloves) should be used sparingly, if at all, because they may worsen the patient/client's airway obstruction if inhaled.

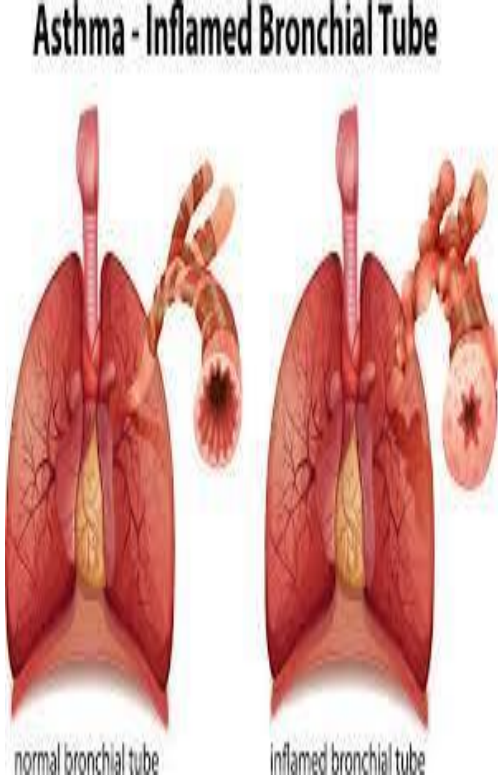
 Pre-procedural antimicrobial rinse and high-speed suction should be used to reduce contaminated dental aerosols that may be inhaled when using an ultrasonic scaler. Persons with COPD (particularly those hospitalized) can suffer infectious lung infection secondary to inhalation/aspiration of microorganisms associated with periodontal disease. Power-driven polishers should be avoided, because they may exacerbate breathing problems.

 Ambulatory general anaesthesia and nitrous oxide-oxygen inhalation sedation should generally be avoided, because they may produce apnea (cessation of breathing).

 Patients/clients using COPD medications should receive prophylactic attention. This includes instruction on rinsing their mouth after using a steroid inhaler to reduce the incidence of oral candidiasis. Occurrence can also be reduced if a “spacer” (aerosol-holding chamber) is attached to the metered-dose inhaler.

 Smoking is the major cause of COPD, as well as an important risk factor for periodontitis. Dental hygienists should counsel patients/clients who smoke to stop smoking

What is asthma?



Asthma is a chronic inflammatory respiratory disease characterized by reversible episodes of **airway** reactivity **manifesting as bronchial smooth muscle spasm**, inflammation of bronchial mucosa, mucus hypersecretion, and sputum plugging. **Asthma** is the most common chronic respiratory condition characterized by **airway inflammation** and **obstruction.**
The clinical manifestations are **heterogeneous** and **variable over time** and **consist of wheezing**, **shortness of breath**, **chest tightness** and **coughing**
Our increased knowledge and understanding of the etiology and pathogenesis of this condition has widely assisted us in **delivering effective therapies**

There are three types of asthma:
allergic (extrinsic),
non-allergic (intrinsic), and
mixed (combination of extrinsic and intrinsic).

Attacks may be provoked by environmental allergens (e.g., pollen, ragweed, molds, foods, **cockroaches**, and **dust mites**), **environmental pollutants** and **irritants** (e.g., smoke and chemicals such **scent** and **house sprays**), **respiratory tract infections**, **cold air**, **exercise, certain medications** (ASA, **nonsteroidal anti-inflammatory drugs**, **cholinergic drugs**, and **β-adrenergic blocking drugs**), and **highly emotional states** (i.e., anxiety, stress, and excitement).

 Asthma deaths occur most often in persons aged more than 45 years of age and largely preventable, often being associated with delays in delivery of appropriate medical care.

Related signs and symptoms :

Asthma Onset may occur in childhood or in adulthood, with 2/3 of all cases being diagnosed before age 18 years. Prevalence has greatly increased worldwide since the 1960s.

Symptoms and signs tend to improve in adulthood, and in some children asthma resolves spontaneously after puberty.

 Typical signs and symptoms of **asthma** include **cough** that is **worse at night** and **chest tightness.** Onset is usually sudden, with peak signs/symptoms occurring **within 10 to 15 minutes**.

Respirations become **difficult** and are **accompanied by expiratory wheezing**. **Tachypnea** (fast breathing) and prolonged expiration (due to narrowing of airways) are characteristic. Episodes are usually self-limiting, but severe attacks necessitate medical assistance.

 Exposure by oral healthcare personnel to **methacrylates found in dental restorative** and **sealant materials** has been linked to **occupational asthma**

 Rhinosinusitis and obesity are common comorbid conditions.

Physicians strive to provide the best treatment modality to achieve symptom-control and minimize the adverse effects of medication use.

Nonetheless, patients continue to endure oral complications from the use of asthma medications.

As dentists, it is prudent to address these oral complications and promote the oral health of these patients by way of early preventive and therapeutic dental intervention. This must be accomplished by adhering to certain precautionary measures for the sake of avoiding intraoperative problems while optimizing oral care.

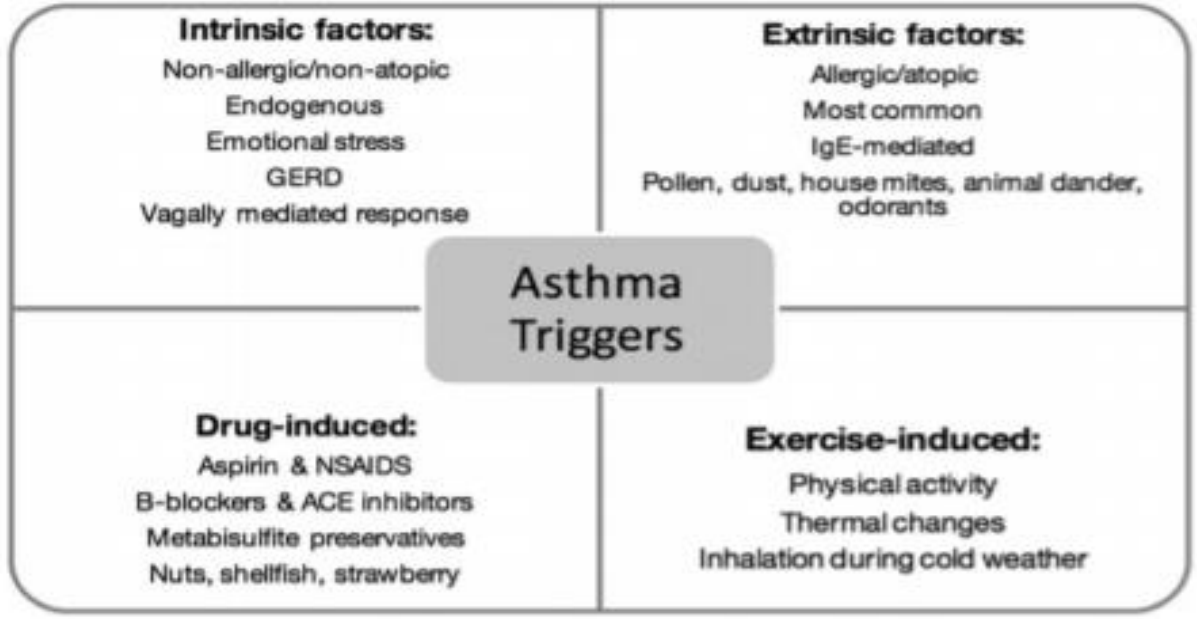
ETIOLOGY :

Asthma is a heterogeneous **chronic inflammatory** condition of the lungs, characterized by **narrowing** and **hypersecretion** of the airway with **potential for acute exacerbation**.

Its **heterogeneity** in nature refers to the **inter-individual variability in risk factors**, **triggers**, **severity**, **symptoms**, and **response to treatment**.

Studies have consistently demonstrated a strong **genetic basis** for the development of asthma.

Many genes on designated loci of **chromosomes** have been identified as contributory **factors for patient susceptibility to the onset** of asthma.



Classical triggers of asthma that may provoke an attack

Other cases stem from the **gene-environment interaction**. **Particularly**, **environmental influencers alter gene** transcription factors and lead to increased expression of **inflammatory cytokines**, **T cell differentiation**, and other **inflammatory cells** (ie**, eosinophils**) that partake an **important role in the pathophysiology of asthma**.

Allergic sensitization is an **environmental influencer** that has been reported as the most common cause of asthma in **children and adults**.

Sensitization occurs from **prolong exposure of aeroallergens** or **pollens to the respiratory system**.

Our immune system overreacts to these **allergens** and **recognizes them** as "**foreign particles**."

This manifests as the **clinical symptoms of asthma**, such as **coughing**, **wheezing**, and **difficulty breathing**.

Other less common **risk factors associated** with the onset of asthma include **viral infections**, **obesity**, **smoking**, **air pollution**, **occupational exposures**, **stress**, **gastroesophageal reflux disease (GERD),** and **sex hormones**

MEDICAL MANAGEMENT

The primary goal of asthma management is to achieve **good daytime** and **nighttime symptom control**, **perform normal daily activities**, **diminish the side effects of medication** use, and minimize the probability of exacerbations.These objectives may be accomplished by employing **nonpharmacological** and **pharmacological therapies**.
Therapeutic **approaches may differ depending** on the **etiology of asthma**.

The most important **nonpharmacological approach involves the avoidance of allergens**, **foods**, **medications**, and any **triggers** that may **worsen the symptoms of asthma**. Other lifestyle changes that are proven to **assist in improving the symptoms** include **physical activity**, **smoke cessation**, **weight reduction**, a **healthy diet**, and **stress management strategies**.

Nonpharmacological approaches alone may not be sufficient to achieve symptomatic relief. As a result, **physicians** will prescribe **pharmacological treatment** and **adjust medications** based on **patient assessment** and **response to previous therapy**.

The concept of pharmacological therapy is **based on a stepwise approach** in the **classification system** ,aiming to **prevent exacerbations** and to **reduce the symptoms of airway obstruction** and **inflammation**, **using the lowest possible dose of medication** with the **fewest side effects**.
The medications for asthma are categorized as **relievers** or **controller agents**.

Reliever medications are **inhalers** used as-needed for short term relief of acute exacerbations, while **controllers** are **indicated** for **long-term regular** use to **reduce airway inflammation** and to **prevent the risk of future exacerbations**.
Moreover, additional drugs may be used as "**add-on**" therapies for patients with severe asthma and persistent symptoms despite using their regular and preferred method of treatment. depicts the different classes, examples, and side effects of asthma medications

Summary of the most common medications used for the treatment of asthma

Class of drug	Examples	Side effects
Reliever		
Short-acting β2-agonist (SABA)	Albuterol Levalbuterol Pirbuterol	Tremor, tachycardia, headache, pharyngitis, nervousness
Short-acting muscarinic antagonist (SAMA)	Ipratropium	Bronchitis, dyspnea, headache
Controller		
Inhaled corticosteroids (ICS)	Fluticasone, Budesonide, Mometasone, Ciclesonide	Dysphonia, oropharyngeal candidiasis, cough, upper respiratory tract infection
Leukotriene receptor antagonist (LTRA)	Montelukast, Zafirlukast, Zileuton	Headaches, abdominal pain, dyspepsia, mood changes
Long-acting muscarinic antagonist (LAMA)	Tiotropium	Dry mouth, upper respiratory tract infection, sinusitis, chest pain
Combined ICS/LABA	Fluticasone/salmeterol inhaler, Fluticasone/salmeterol HF, Budesonide/formoterol Fluticasone/vilanterol	Nasopharyngitis, headache, sinusitis, influenza, back pain
Theophylline	Methylxanthine	Cardiac arrhythmia, seizures, high potential for drug interaction
Other therapies		
Oral corticosteroid	Prednisone Methylprednisolone	Weight gain, increased appetite, mood changes, insomnia, hypertension, diabetes, adrenal insufficiency, cataract, glaucoma
Novel biologic	Anti-IL-5 → Omalizumab Anti-IL-5 → Mepolizumab, Reslizumab	Injection site reaction, pharyngitis, sinusitis, anaphylaxis, headache, back pain, throat pain

ORAL MANIFESTATIONS OF ASTHMATIC PATIENTS:

Asthmatic patients using daily doses of **B2-agonists** and **corticosteroid inhalers** are at a **higher risk of developing oral complications**.

These patients experience **xerostomia** due to **decreased salivary flow rate** from **inhaler use**, and developed **mouth breathing habits** from **impaired nasorespiratory function**.

The lysozymes and **antibodies present in saliva serve as a protective agent or buffer against cariogenic bacteria**, bacteria by-products, and **acidic content** (ie, acid reflux) in the **oral cavity**.

Decreased salivary flow enables **bacteria by-products** and acidic contents to deteriorate tooth structure and lead to the **development of dental caries** and **erosion**.

In addition to reduced salivary flow, the immunosuppressive properties of inhaler corticosteroids promote the growth and proliferation of candida, resulting in oropharyngeal candidiasis of the soft tissues.30–34 Xerostomia can also make oral mucosal tissues more susceptible to trauma which can lead to the development of oral ulcerations and burning sensation that can be extremely uncomfortable for the patients.30 Mouthbreathing habits not only causes drying effects in the oral cavity but also impairs the function of the nasorespiratory system that induces orofacial abnormalities and malocclusion.

The association between **asthma and periodontal disease** has been widely discussed in the literature. **Many studies** have confirmed a similar increase in certain **biomarkers,** namely immunoglobulin Type E (IgE) and histamines, as an **immunological reaction** in both **periodontal disease and asthma**. It has also been noted that reduced salivary flow rate and changes in the **oral pH** from **antiasthmatic medications**, have increased **biofilm** accumulation and **calculus formation**, resulting in inflammation and periodontal breakdown.

Evidence suggests that corticosteroid use (systemic or inhaled) is linked to a generalized reduction in bone **mineral density**, which can manifest in the periodontal region and lead to periodontal bone loss.
Below summarizes all the possible oral manifestations of asthma.

The oral manifestations of inhaler use in asthmatics and the preventive approaches to address the oral complications of this **disease**

Oral manifestation	Preventive measures
▪ Dental caries	❖ Educate patients about risks of inhaler use on oral disease
▪ Dental erosion	❖ Schedule regular dental check-ups including professional fluoride application and scaling root planning
▪ Oral candidiasis	❖ Instruct patient to rinse mouth with water or fluoridated mouthwash after inhaler use each time
▪ Gingivitis	❖ Consider using inhalers via spacer device
▪ Periodontitis	❖ Instruct proper oral hygiene care and provide dietary advice
▪ Xerostomia	❖ Prescribe daily home fluoride application (neutral1.1% fluoride gel)
▪ Ulceration	❖ Prescribe sugar-free xylitol gums, mints, or lozenges to increase salivary flow rate
▪ Burning mouth sensation	❖ Treat oral candidiasis with topical nystatin suspensions
▪ Taste alteration	❖ Evaluate the need to refer GERD patients to specialist for acid suppressive therapy
▪ Halitosis	❖ Assess orthodontic needs and intervene or refer accordingly
▪ Increased upper anterior facial height	
▪ Increased total anterior facial height	
▪ Higher palatal vault	
▪ Increased overjet	
▪ Posterior crossbite	

DENTAL MANAGEMENT OF ASTHMATIC PATIENT:

A dental office can be a **stress-inducing environment** and contains materials that may provoke asthma attacks. Asthma contributes to **5%** of all medical emergencies in a dental practice.

Identification, **risk assessment**, and **prevention of asthmatic attacks should be the primary goal of dentists during dental procedures**.

Dentists should also be trained to respond promptly in case of an asthma-related emergency .

Before the beginning of the **first dental appointment**, dentists should obtain a **complete medical history of the patient**.

The medical history should be **updated during each appointment**.

Information obtained from the **patient that will guide the dentist in assessing the risk of acute asthma attacks**, includes the **type of asthma (ie, allergic vs nonallergic), stability of disease**, **frequency and severity of attacks**, **date of the most recent attack**, **precipitating factors**, **times of the day when attacks are most likely to occur**, and **history of hospitalizations from asthma attacks**.

Also, the dentist **should record the type**, **dosage**, and **frequency of medications** used to **control asthma**. It is also helpful to discuss the **strategies used by the patient to prevent acute exacerbations**.

Severe and poorly controlled asthma requires consultation with the patient's physician (see Figure 3 to determine what entails uncontrolled asthma).

Elective dental treatment should be postponed until the patient's condition is stable and controlled.

Efforts should be made by both the dentist and the patient to prevent the occurrence of asthmatic attacks.

Appointments should be booked when attacks are least likely to occur. For instance, late morning appointments are best suitable for nocturnal asthmatic patients.

Dentists should instruct their patients to use their medications regularly, especially before **dental appointments**.

Prophylactic use of inhalers and daily medications are effective in preventing acute exacerbations, especially in **moderate and severe asthma.**

Patients should be instructed to bring their **bronchodilator inhalers** to every dental appointment and **inhalers** should be readily accessible.

If patients experience any **signs or symptoms** of an asthma attack, they should **immediately inform their dentist**. It is prudent for dentists to implement precautionary strategies and modify their **dental treatment in accordance** with the **etiology**, **severity**, and **stability** of the patient's condition.

Certain asthmatic patients may not tolerate prolonged appointments in a supine position. Therefore, it is important to book **shorter appointments** and **incline the dental chair in a semisupine position for patient's convenience**.

Certain dental materials (ie, alginate, latex gloves, methyl methacrylate & tooth enamel dust) and **odorants may provoke an allergic response and the worsening of asthmatic symptoms** and thus should be avoided or used with **extreme caution**. The use of **rubber dam** can be an effective strategy in preventing the **aspiration of foreign objects that may cause cough reflex**, and avoid the **inhalation of aerosols** or **bacteria** and **viruses** that may aggravate the airways.

However, the **dentist** must ensure that the patency of the airway is kept at all times and the rubber dam does not pose as a barrier for breathing. Dental anxiety and stress can trigger or exacerbate asthma attacks in susceptible patients. Efforts should be taken to reduce dental-related stress for patients through rapport and trust-building, deep breathing and relaxation techniques, and cognitive behavior therapy.Pain reduction using profound **local anesthesia** can also aid in the reduction of **dental anxiety**. Although rare, but certain asthmatic patients may elicit an allergic response to **sulfite preservatives in local anesthetics**.

Dentists should avoid the use of **local anesthetics** with **sulfite containing vasoconstrictors** (ie, epinephrine & levonordefrin).

Lidocaine directly relaxes airway smooth muscle by decreasing [Ca2+]i. In addition, lidocaine inhibits the ACh-induced increase of Ca2+ sensitivity of the contractile apparatus, although it has little effect on Ca2+ sensitivity during high K+ depolarization.

It is presumed that drugs able to prevent bronchial spasm and/or inflammation may have therapeutic potential to control asthma symptoms. The local anaesthetic lidocaine has recently received increased attention as an alternative form of treatment for asthmatic patients.

Alternatively, dentists should use **3% mepivacaine** or **4% prilocaine** to **achieve local anesthesia**.
If patients continue to experience **dental anxiety despite stress reduction protocols** and **local anesthesia**, **dentists should consider the use of sedatives**.
Nitrous oxide-oxygen sedation is the preferred method of **conscious sedation** for mild to moderate **asthmatic children** and **adults**.
However, **nitrous oxide sedation is contraindicated for severe asthma**, and dentists should obtain **medical consultation regarding its use for such patients**.
Oral premedication with **hydroxyzine** and **benzodiazepines** are effective s**trategies for managing dental anxiety of asthmatics**.
Patients may receive **minimal to moderate levels of conscious sedation** through oral premedication.Particularly, **small doses of short-acting benzodiazepines** are preferred. **Midazolam** can be used for **asthmatic children with no adverse effects and good results**. Furthermore, **hydroxyzine** has been beneficial for both **pediatric and adult asthmatics** due to the **antihistaminic** and **sedative properties**.
Other **antihistamines** such as **promethazine** and **diphenhydramine** also demonstrate **antihistaminic** and **sedatives benefits**, but are less often used due to their drying effects.
Conversely, **narcotics**, and **barbiturates** should be **avoided at all cost due to their histamine-releasing properties that may provoke asthma attacks**, and **pose the risk** of respiratory depression.
Intravenous moderate sedation may be performed **with O2 nasal administration**; however, it is advised to be performed in a **hospital setting due to the** limitations in airway control. 33,43,44 **General anesthesia** should be avoided in asthmatics due to the increased risk of bronchospasm, if warranted, it should be performed under controlled settings such as a hospital or surgery center.

Dentists must monitor the **vital signs of patients under any form of sedation**.
Certain postoperative medications prescribed by the **dentist may precipitate acute asthma attacks for susceptible individuals**.
Aspirin and **nonsteroid anti inflammatory drugs** should be **avoided in patients with aspirin-induced asthma**, which comprises a small percentage of asthmatics.
Alternatively, **acetaminophen** should be the analgesia of choice for postoperative pain. **Recently**, studies have evaluated the effects of **selective COX-2 inhibitors** on **aspirin-sensitive asthmatics**. They concluded that selective COX-2 inhibitors do not demonstrate substantial bronchoconstriction effects on aspirin-induced asthmatics. For that reason, stable mild to moderate asthmatic patients who possess aspirin sensitivity may safely use therapeutic doses of selective **COX-2 inhibitors** for the **treatment of pain** and **inflammation**.**Opioid and codeine-containing drugs are contraindicated** due to the **respiratory depression** and **histamine-releasing effects** which may **aggravate bronchospasms**, especially in **severe asthmatics.**
The use of drugs containing **epinephrine**, **macrolides**, and ciprofloxacin in patients taking theophylline can endure drug interactions leading to toxic levels of **methylxanthines in the blood**, and thus should be avoided.'

Prolong use of high doses of systemic corticosteroid impacts the intrinsic production of corticosteroid by the adrenal gland, referred to as adrenal insufficiency. This phenomenon poses the risk of life-threatening events due to the lack of presence of "stress hormone" or corticosteroid in handling stressful dental procedures. In this scenario, the dentist should obtain medical consultation regarding the need for supplemental corticosteroid before the start of dental treatment.
Inhaled corticosteroids rarely cause adrenal suppression.

The preoperative, intraoperative, and postoperative dental considerations and modifications needed to treat asthmatic patients. In the event of an emergency **asthma attack**, the dentist must immediately stop the procedure and remove all the instruments from the patient's mouth. The patient should be positioned in a comfortable and upright position.
Two puffs of short-acting **B2 agonist inhaler** should be administered with **30-60 seconds** space between each puff; repeated doses of the inhaler may be necessary as needed.

Dentists with advanced training may administer **100 mg or 1.5-3 mg/kg of intravenous hydrocortisone**.
However, the effects of **hydrocortisone** during the acute phase of emergency treatment is debatable due to its **slow onset of action**.
Oxygen should be supplied via full facemask at a flow rate of **6-10 L per minute** for conscious patients experiencing asthmatic attacks.However, patients **who are** in a life-threatening situation from a ***severe asthma attack*** or **become unconscious**, should receive **oxygen at a flow rate of 15 L per minute** using a **positive pressure device**, such as a **bag-valve-mask awaiting EMS arrival**.

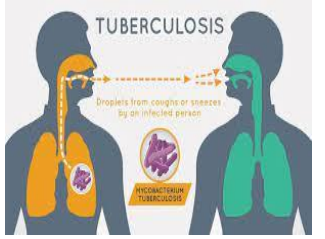
Additionally, for **nonbreathing unconscious patients**, cardiopulmonary resuscitation (CPR) should be initiated until **the EMS arrives**.
Knowledge of the **patient's medical history** and **recognition of the signs and symptoms of asthma AS MENTIONED BEFORE** are paramount in its **diagnosis and management**, mainly because many other **local or systemic diseases demonstrate similar symptoms as asthma**

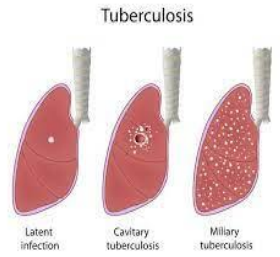
Dentists must educate patients regarding the oral consequences of inhaler use, and implement preventive and therapeutic measures in improving the oral health of such patients.
Dentists should first assess the current state of the patient's oral condition and schedule regular recall examinations according to the patient's needs.
Frequent professional fluoride application and scaling is advised to **prevent the progression of dental caries** and **periodontal disease**.
Patients should also be **instructed to rinse their mouth with water or fluoridated mouth washes after each inhaler** use to counteract the **acidic pH of inhalers**, **minimize oral mucosal changes**, and **reduce xerostomia.**
Administration of inhalers using a spacer device is effective in reducing medication deposits in the oral cavity by delivering it directly to the lungs.

Moreover, patients should be educated regarding proper **oral hygiene measures** and the **risk associated with the dietary intake of carbohydrates.**
Home application of neutral 1.1% fluoride gel is encouraged via fluoride tray or gentle brushing.
The daily use of **xylitol gums**, **mints**, and/or **lozenges** is recommended for the **stimulation of salivary flow**.
Oral candidiasis, most commonly pseudomembranous (thrush), should be treated with **topical antifungal agents** such as **nystatin suspensions**.
Asthmatic patients who suffer from GERD should be referred to gastroenterologist for the potential need **fortic intervention**. These patients should be referred to orthodontists, as early treatment of dentofacial abnormalities can render better long-term results




Tuberculosis:





Tuberculosis is caused by infection with ***Mycobacterium tuberculosis*** **(*M. tuberculosis*)**.
Infection occurs through **inhalation of airborne** droplets containing viable *M. tuberculosis*, which then travel to the alveoli of the lungs. Only people with active disease can **spread the infection**.

M. tuberculosis is transmitted through **infectious airborne particles**, known as **"droplet nuclei,"** which can be **generated** when people with **pulmonary** or **laryngeal tuberculosis sneeze**, **cough**, **speak** or **sing**.
These small particles (**1 to 5 micrometers in diameter**) can stay suspended in the air for hours. Non-coughing individuals who are suspected of having tuberculosis cannot be presumed to be non-infectious because ***M. tuberculosis*** **transmission may still occur without the presence of coughing.**
According to one study, up to 77% of respiratory bio-aerosol samples from newly diagnosed patients may contain *M. tuberculosis* organisms.

If a susceptible person **inhales aerosolized droplet nuclei containing *M. tuberculosis*, infection may begin if the organisms reach the alveoli**. Within two to 12 weeks, the **body's immunological response** to *M. tuberculosis* usually prevents further multiplication and spread.
The mycobacterium can **live in the lungs of an infected person for years**, even a lifetime, without the person **exhibiting any symptoms**; this state is **called latent infection**.A person with latent tuberculosis is **generally asymptomatic** and **not infectious to others** but the **infection can develop into active tuberculosis** in the future and usually exhibits a **positive reactive tuberculin skin test**.

Most people who have latent tuberculosis infection never develop **active disease**, but if they do not receive treatment for latent infection, **about 10 percent of people** with latent infections can develop **active disease over a lifetime**.
This can happen when the **person's immune system is weakened**, allowing the mycobacteria to cause active tuberculosis infection (e.g., individuals with **HIV**, **diabetes**, **certain hematologic disorders** such as **leukemias** and l**ymphomas**, **prolonged corticosteroid** use, and other conditions).

Only a person with active tuberculosis can transmit the disease. People with active tuberculosis infection generally have symptoms (e.g., **persistent**, **productive cough**; **night sweats**, **fever**, **weakness or fatigue**; **weight loss**; **pain in the chest**); and can have a **positive tuberculin skin test reaction**

Oral Manifestations of Tuberculosis

Oral TB lesions may be either **primary** or **secondary in occurrence**.
Primary lesions are **uncommon**, seen in younger patients, and present as **single painless ulcer** with **regional lymph node enlargement**.
Primary oral TB can be present as painless ulcers of long duration with enlargement of the regional lymph nodes.




Primary oral TB

The secondary lesions are common,often associated with **pulmonary disease**, usually present as a **single**, **indurated**, **irregular**, painful ulcer covered by **inflammatory exudates** in patients of **any age group** but relatively more common in **middle-aged and elderly patients**.

Oral TB may occur at **any location on the oral mucosa**, but the **tongue is most commonly affected**. Other sites include the **palate**, **lips**, buccal mucosa, gingiva, palatine tonsil, and floor of the mouth. Salivary glands, tonsils, and uvula are also frequently involved.

The oral lesions may be present in a variety of forms, such as ulcers, nodules, tuberculomas, and periapical granulomas.

The oral manifestations of TB can also be in the form of **superficial ulcers**, patches, indurated soft tissue lesions, or even lesions within the jaw that may be in the form of TB osteomyelitis or simple bony radiolucency.

The gingival margin to the depths of the adjacent vestibule and is often associated with enlarged cervical lymph nodes.

They may be single or multiple, painful or painless and usually appear as irregular, well-circumscribed ulcers with surrounding erythema without induration. **Satellite lesions are commonly found**.

When oral TB occurs as a **primary lesion**, an ulcer is the most common manifestation usually developing along **the lateral margins of the tongue** which rest **against rough**, **sharp**, or broken teeth or at the site of other irritants. Patients with oral tubercular lesions often have a history of pre-existing trauma. Any area of chronic irritation or inflammation may favour localization of the Mycobacterium associated with the disease

Deep tubercular ulcers of the tongue are typical in appearance with a thick mucous material at the base. These tongue lesions are characterized by severe unremitting and progressive pain that profoundly interferes with proper nutrition and rest.

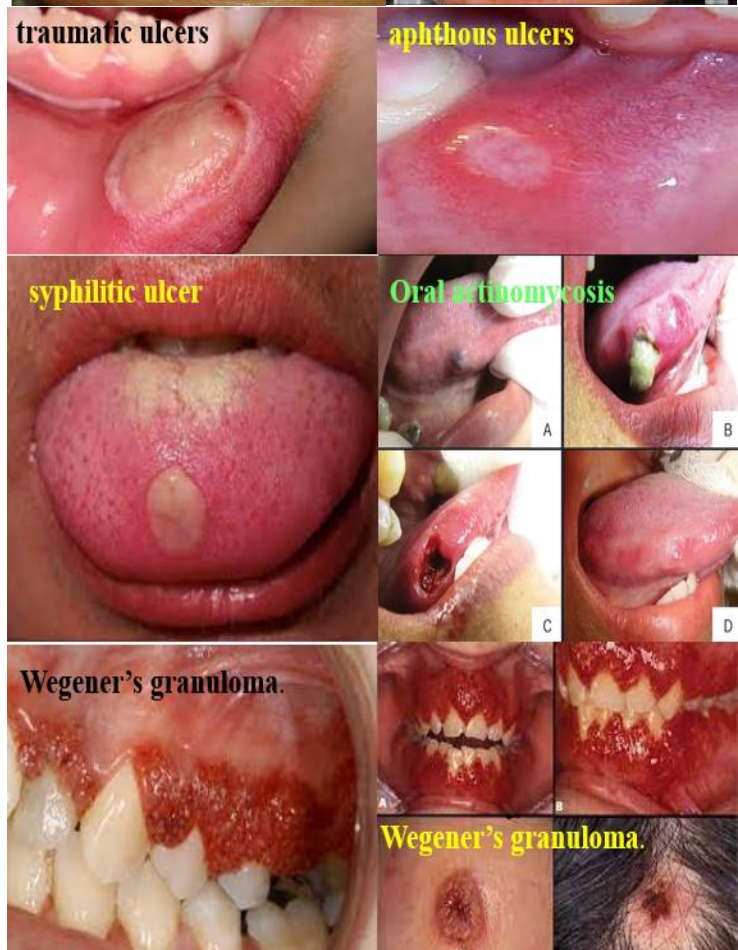
Classically, tubercular ulcers of the tongue may involve the **tip**, **lateral margins**, **dorsum**, **the midlin**e, and **base of the tongue**.

They are irregular, pale, and indolent with inverted margins and granulations on the floor with sloughing tissue.

With the increasing number of TB cases, unusual forms of the disease in the oral cavity are more likely to occur and be misdiagnosed.

Although rare, dentists should be aware of the **oral lesions of TB** and **consider them in the differential diagnosis of suspicious oral ulcers**.

TB of the oral cavity frequently simulates cancerous lesions and other problems **such as traumatic ulcers**, **aphthous ulcers**, **actinomycosis**, **syphilitic ulcer**, or **Wegener's granuloma**.



The traumatic ulcer, which occurs in areas of chronic irritation from either sharp cusps or prosthesis, is acute in presentation and exquisitely tender. Also, the source of irritation is usually evident on examination. The chronic indurated ulcer has to be carefully distinguished from a carcinoma, for, as with other TB lesions of head and neck, they can resemble each other and frequently coexist.

Precautions for Dental Health Care:

Professional Clinical Dental Practice has a **potential for transmission of various infections** from **patient to Dentist**, **patient to patient** as well as **Dentist to patient** due to close proximity to the **nasal and oral cavities of the patient**.

Thus, a barrier should be created to prevent the transmission of infections and to make the clinical procedures safe from the threat of cross infections**A detailed history of TB** should prompt the dental practitioner to **discern** whether the **person is an active case under treatment**, **active case without treatment** or **previously infected but currently disease free**. **The non-treated active cases pose maximum risk to the dental healthcare personnel**. **Dental healthcare professionals** are at the constant risk of being exposed to TB by means of splatter, aerosols or infected blood. **Dental treatment for those with active tuberculosis should be limited to urgent and essential procedures**.

As numerous serious diseases are air-borne, blood-borne or can spread through the contact of other body fluids, and it is impossible to know which **certain patients are infected**, it is pertinent to **avoid direct contact with blood**, **body fluids** and **mucous membranes**. **High standards of operatory disinfection and instrument sterilization should be maintained.** **Rubber dams** can be used to minimize **aerosol contact however**, **if coughing is evident**, rubber dam **should not be used.**

Maintenance of proper hand hygiene, **personal protective equipment (eye shields, face masks, headcaps, gloves and surgical gowns)** and **proper sterilization procedures should be followed**.

Standard surgical face masks **do not protect against** TB transmission; **dental healthcare personnel should use particulate face masks**. Masks should be changed at regular intervals, inter-appointments (between patients) and intra-appointments (during patient treatment) if the mask becomes wet.

The history reported by the patient and the **clinical** and **radiological examination** play an **important part** in the **diagnosis of TB**. However, **laboratory confirmation** and **thorough histopathological examination is most essential for the diagnosis**, with culture of **microorganisms taken as the absolute proof of the disease.**

Although there are **many patients with pulmonary tuberculosis**, lingual form is not frequently met with despite of the fact that tongue is frequently exposed to heavy concentration of tubercular bacilli from the sputum of patients with pulmonary tuberculosis.

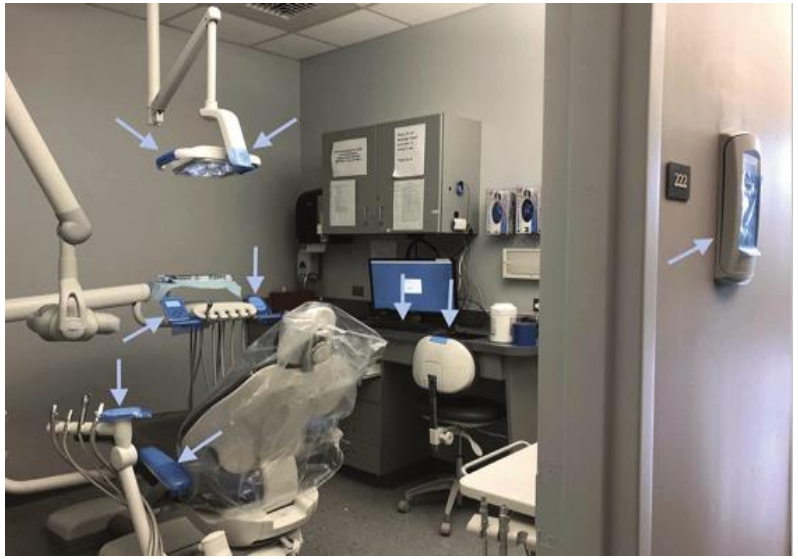
This **local resistance** of the tongue may be due to the stratified squamous epithelium, **regular cleaning by saliva**, **presence of skeletal muscle** and **paucity of lymphoid tissue in anterior part of tongue.**

Similar to the other body parts clinical manifestations of **oral tuberculosis are varied**. In the oral cavity, it usually manifests as **non healing ulcers** but may also occur as **nodules**, **granulomata** or **fissures**, as **tuberculous osteomyelitis of the jaws** .

Reusable facial protective equipment (protective eyewear or face shields) should be cleaned and disinfected between patients.

Handpieces and other oral instruments should be cleaned and autoclaved regularly.

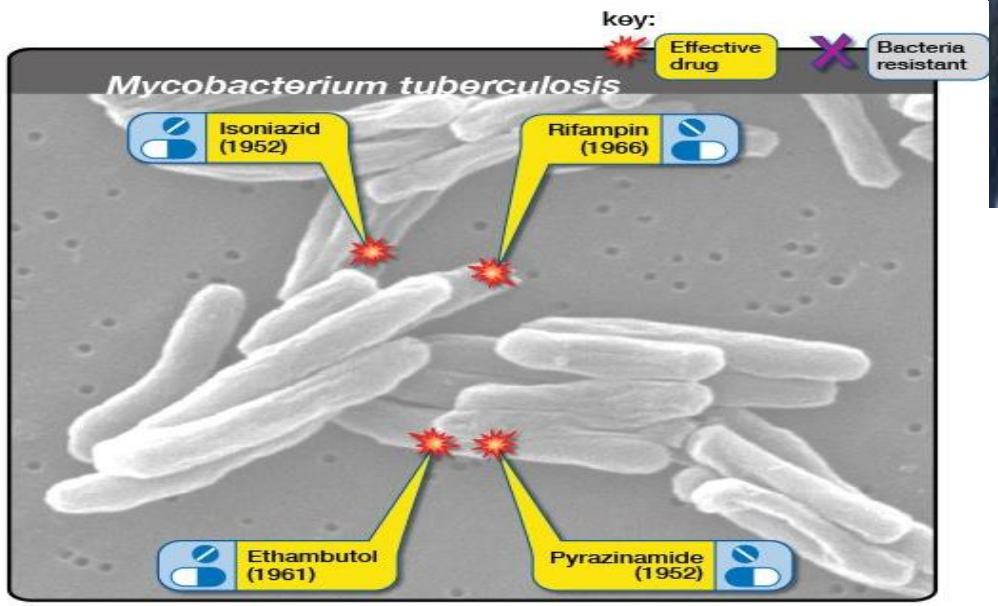
The goal of the dental infection-control program is to provide a **safe working environment** that **reduces the risk of both healthcare-associated infections among patients and occupational exposures among dental team members**



Treatment for TB Disease

Treatment The treatment of oral tuberculosis lesions is the same as the systemic tuberculosis. Currently, the most effective regimens require a combination of four drugs (isoniazid, rifampicin, pyrazynamide, and ethambutol) administered daily for the first two months, followed by an additional four months with only two drugs (isoniazid and rifampicin)

- isoniazid (INH)
- rifampin (RIF)
- ethambutol (EMB)
- pyrazinamide (PZA)



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2024

Academic Year 4

Cardiovascular Patients and Dental Considerations

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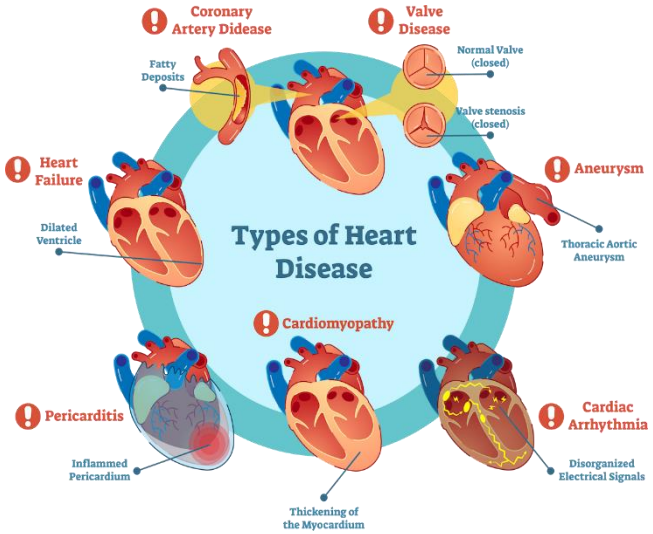
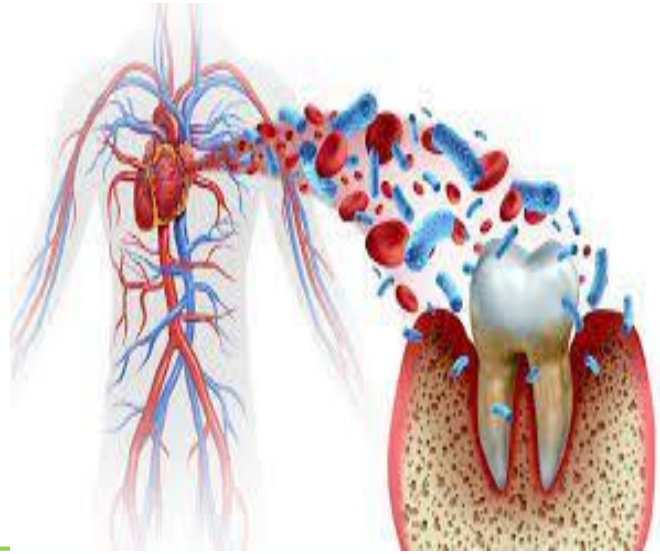
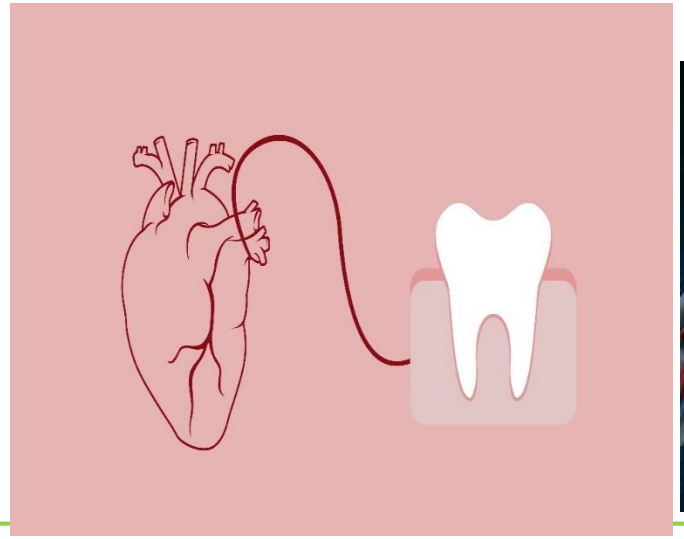
Ph.D in Oral & Maxillofacial Surgery



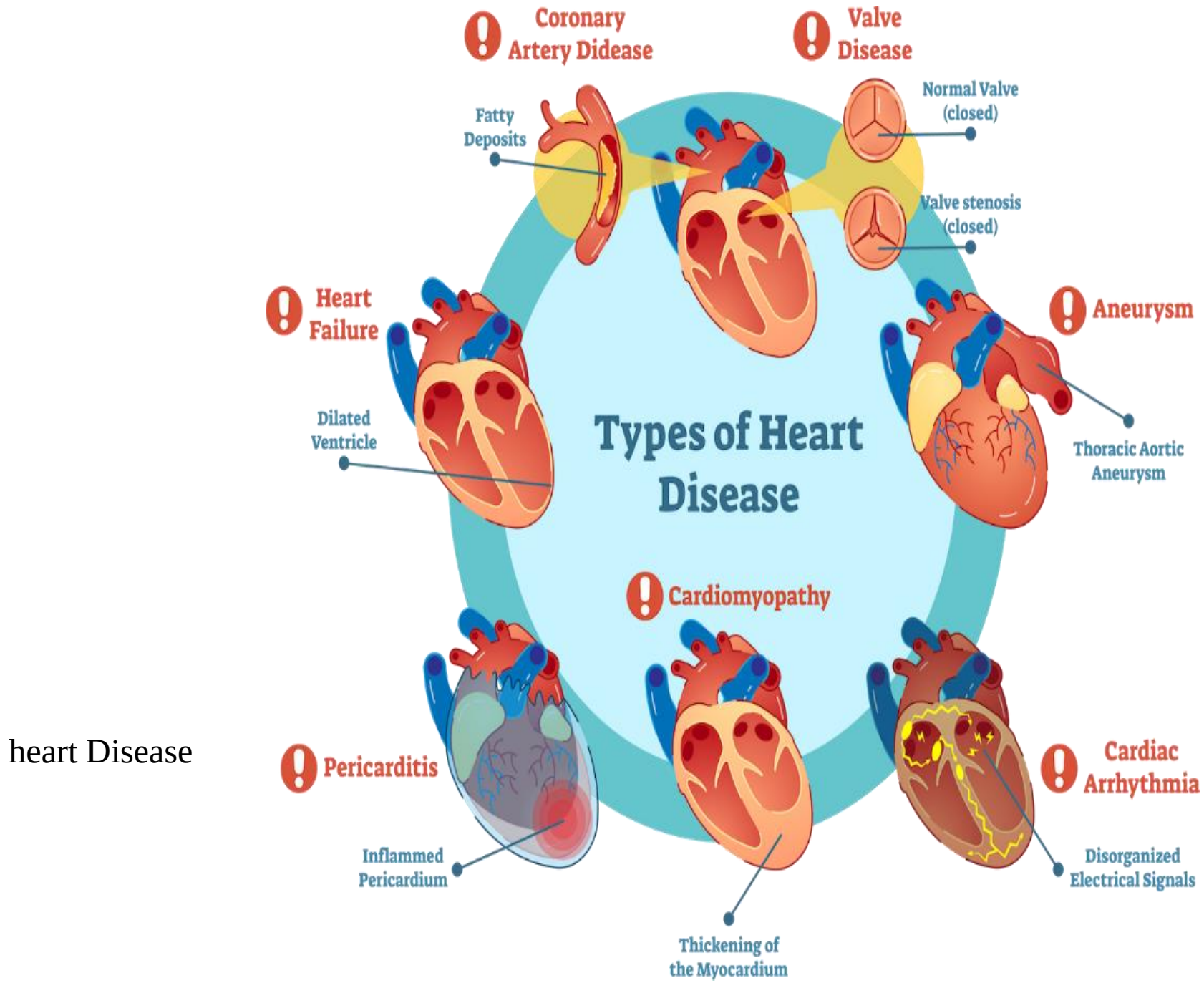




Cardiovascular diseases

- Hypertension
  - Dental management
  - Oral Manifestations
- Ischemic heart diseases
  - Angina pectoris
  - Myocardial infarction (MI)
  - Dental management
- Heart failure
  - Dental management
  - Oral manifestations

- Cardiac arrhythmia
  - Dental management
- Infective endocarditis
  - Dental management
- Rheumatic fever and rheumatic heart Disease
  - Dental management
- Congenital heart disease
  - Dental management
  - Oral manifestations



❖ Cardiovascular Patients and Dental Considerations

Overview. Cardiovascular diseases (CVDs) are the leading cause of death globally, taking an estimated 17.9 million lives each year. CVDs are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, rheumatic heart disease and other conditions.

- A dentist must first check for and eliminate any present or potential sources of infection, including gum disease, severe tooth decay, tooth abscess or any soreness in the mouth. Prior to heart surgery, you will need a dental clearance exam, including X-rays to help your dentist detect damage and disease not visible during a regular dental examination.

- Left untreated, bacteria in the mouth can travel through the bloodstream to the surgery site, causing complications such as infective endocarditis — a potentially life-threatening infection of the inner tissues of the heart, including the heart valves.

Hypertension :

Blood pressure is the measurement of the pressure or force of blood pushing against blood vessel walls. When patient have hypertension (high blood pressure), it means the pressure against the blood vessel walls in your body is consistently too high. High blood pressure is often called the "**silent ki**ller" because patient may not be aware that anything is wrong, but the damage is still occurring within your body.

The blood pressure reading has two numbers. The top number is the **systolic blood pressu**re, which measures the pressure on the blood vessel walls when your heart beats or contracts. The bottom number is the diastolic blood pressure, which measures the pressure on your blood vessels between beats when your heart is relaxing.

How is high blood pressure diagnosed?

High blood pressure **usually has no symptoms**. So the only way to find out if person have it is to get regular blood pressure checks from patient's health care provider. The provider will use a gauge, a stethoscope or electronic sensor, and a blood pressure cuff. He or she will take two or more readings at separate appointments before making a diagnosis.

Blood Pressure Category	Systolic Blood Pressure		Diastolic Blood Pressure
Normal	Less than 120	**and**	Less than 80
High Blood Pressure (no other heart risk factors)	140 or higher	**or**	90 or higher
High Blood Pressure (with other heart risk factors, according to some providers)	130 or higher	**or**	80 or higher
Dangerously high blood pressure - seek medical care right away	180 or higher	**and**	120 or higher

For children and teens, the health care provider compares the blood pressure reading to what is normal for other kids who are the same age, height, and sex.

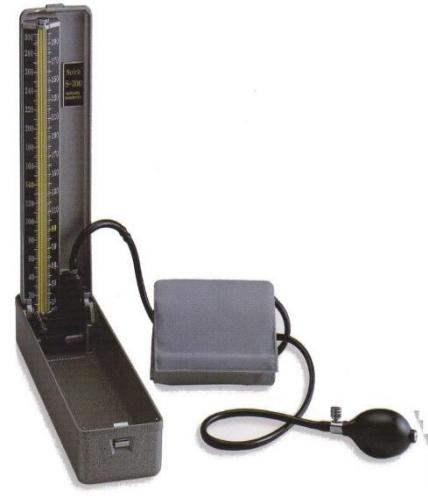
What are the different types of high blood pressure?

There are two main types of high blood pressure: primary and secondary high blood pressure.:

•**Primary,** or essential, high blood pressure is the most common type of high blood pressure. For most people who get this kind of blood pressure, it develops over time as you get older.

•**Secondary** high blood pressure is caused by another medical condition or use of certain medicines. It usually gets better after you treat that condition or stop taking the medicines that are causing it.

When the blood pressure stays high over time, it causes the heart to pump harder and work overtime, possibly leading to serious health problems such as **heart attack, stroke, heart failure**, and **kidney failure.**

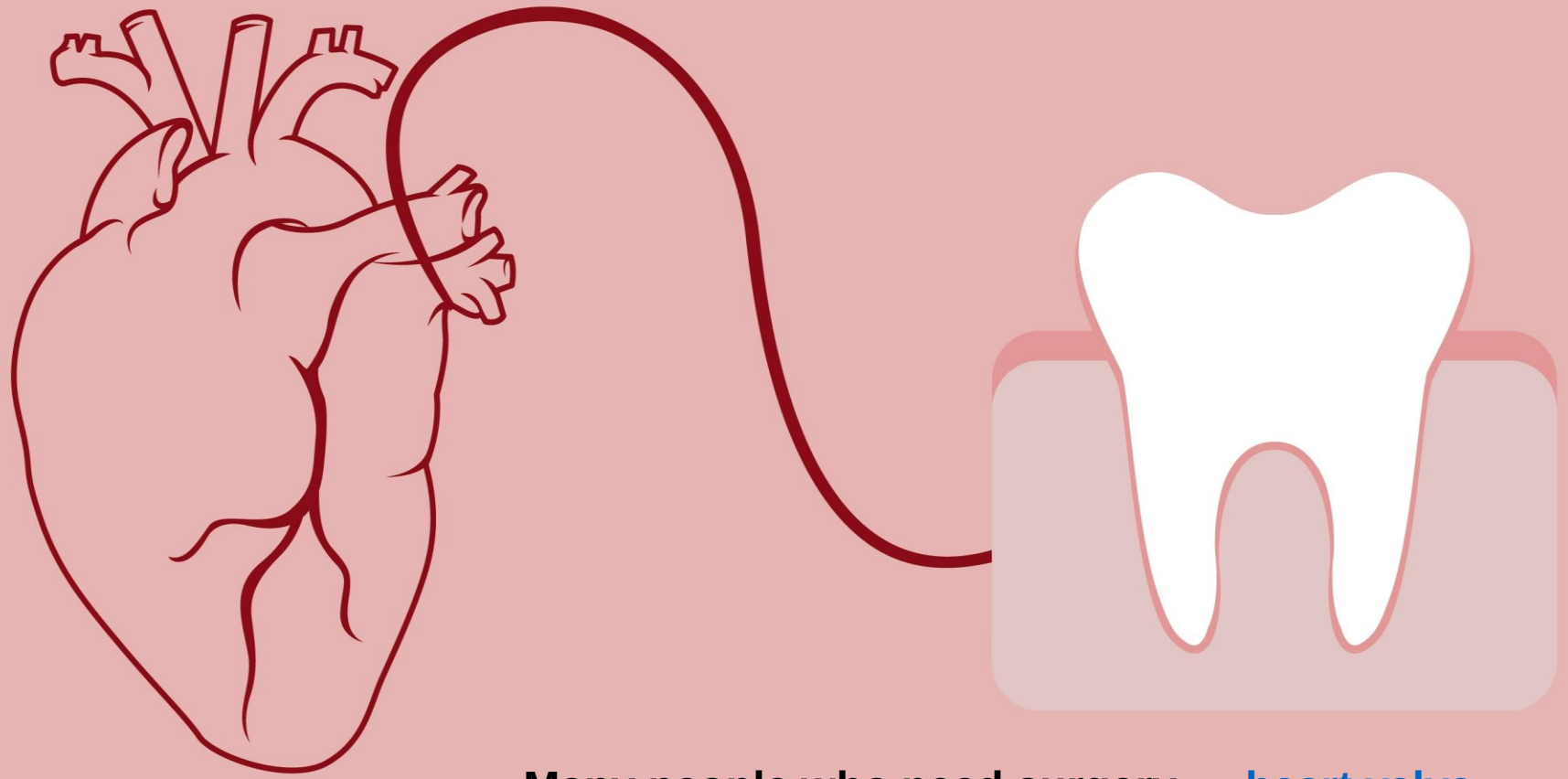


What are the treatments for high blood pressure?

Treatments for high blood pressure include **heart-healthy lifestyle changes** and **medicines.** Patient will work with health provider to come up with a treatment plan. It may include only the lifestyle changes. These changes, such as heart-healthy eating and exercise, can be very effective. But sometimes the changes do not control or lower your high blood pressure. Then you may need to take medicine. There are different types of blood pressure medicines. **Some people need to take more than one type.**

If the high blood pressure is caused by **another medical condition** or **medicine**, **treating that condition** or **stopping the medicine may lower the blood pressure.**

Having Heart Surgery? Why Good Dental Health Matters



Many people who need surgery — heart valve replacement in particular — might have to delay the procedure for weeks, or even months, because of poor dental health

Arterial hypertension

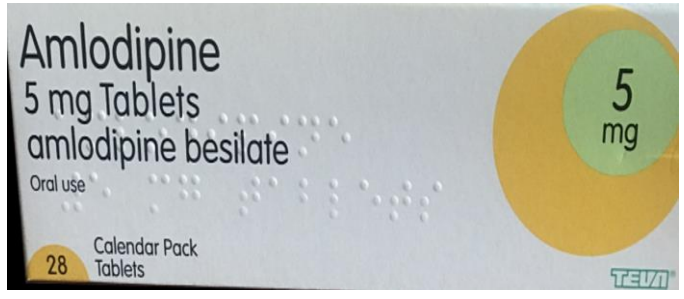
Oral manifestations

No oral complications have been associated with **hypertension itself**. Patients with **malignant hypertension** have been reported to occasionally develop **facial palsy**. Patients with severe hypertension have been reported to bleed excessively after **surgical procedures** or **trauma**; however, excessive bleeding in patients with hypertension is not common and is controversial.

Oral manifestation of Antihypertensive drugs

Antihypertensive drugs are able to induce a series of adverse effects with the oral cavity, these includes:

Xerostomia (Diuretics like furosemide)
Lichenoid reactions (adrenergic blocking agents like propanolol)
Burning mouth sensation (angiotensin -converting enzyme inhibitors like Captopril)
Loss of taste sensation (angiotensin -converting enzyme inhibitors like Captopril)
Gingival hyperplasia, (calcium antagonists Nifedipine 'Adalat')
Extraoral manifestations such as sialadenosis (adrenergic blocking agents)



Dental management

- A well controlled hypertensive patients does not pose a risk in clinical practice.
- Consultation with the supervising physician is advisable in order to know the degree of hypertension control and the medication prescribed at that time.
- The patient is to be instructed to take his or her medication as usual on the day of dental treatment.
- Prior to such treatment, the patient blood pressure should be recorded, and if the values are found to be high (≥ 180/110) , the visit should be postponed until adequate pressure control is achieved
- **Cautious** use of epinephrine in local anesthetic in patients taking **non-selective b-beta blockers or peripheral adrenergic antagonists.**
- Because some antihypertensive agents tend to **produce orthostatic hypotension**, sudden changes in chair position during dental treatment should be avoided.
- It is preferable for the visits to be brief and in the morning.

- The prescription of anxiolytic agents may prove necessary in particularly anxious patients (5-10 mg of diazepam the night before and 1-2 hours before the appointment) before dental treatment, or altaernatively sedation with nitrous oxide may be considered.

- Vasoconstrictor use should be limited, taking care not to exceed 0.04 mg of adrenaline (2 carpules containing 1.8 ml of anesthetic with adrenalin 1: 100,000)

- **A good local anesthetic technique should be performed**, avoiding intravascular injection and using a maximum of two anesthetic carpules with vasoconstrictor. If more anesthesia is needed, it **should be provided without vasoconstrictor**. **Absorbable suture are to be avoided with adrenalin**.
- When the patient does not present good blood pre-control, it is best to refer him or her to the physician in order to ensure adequate control before dental treatment.

- In the case of emergency dental visits, **treatment should be conserv**ative, with the use of analgesics and antibiotics.

- **Surgery is to be avoided until adequate blood pressure control has been secured.**
- Certain nonsteroidal antiinflammatory drugs (NSAIDs), such as **ibuprofen**, **indomethacin** or the **naproxen**, can interact with **antihypertensive drugs** (beta-blockers, diuretics), thereby lowering their antihypertensive action. Normally more than five days of treatment with both types of drugs are required for interactions to manifest; as a result, NSAIDs should not be prescribed for longer than this five-day period.

- Avoid NSAID because of their renal effects which cause retention of sodium and water that lead to raise in the blood pressure.

In the case of a hypertensive emergency (>120/210 mmHg), the emergency management done by furosemide should be administered (40 mg, via the oral route).

If this proves insufficient to restore pressure control, captopril should be administered (25 mg via the oral or sublingual route).

If the blood pressure fails to decrease within 30 minutes after these measures, the patient should be referred to the nearest Hospital Emergency Department.

Box 1-9 General Anxiety-Reduction Protocol

Before Appointment

- Hypnotic agent to promote sleep on night before surgery (optional)
- Sedative agent to decrease anxiety on morning of surgery (optional)
- Morning appointment and schedule so that reception room time is minimized

During Appointment

Nonpharmacologic Means of Anxiety Control

- Frequent verbal reassurances
- Distracting conversation
- No surprises (clinician warns patient before doing anything that could cause anxiety)
- No unnecessary noise
- Surgical instruments out of patient's sight
- Relaxing background music

Pharmacologic Means of Anxiety Control

- Local anesthetics of sufficient intensity and duration
- Nitrous oxide
- Intravenous anxiolytics

After Surgery

- Succinct instructions for postoperative care
- Patient information on expected postsurgical sequelae (e.g., swelling or minor oozing of blood)
- Further reassurance
- Effective analgesics
- Patient information on who can be contacted if any problems arise
- Telephone call to patient at home during evening after surgery to check whether any problems exist

Ischemic heart disease:

Ischemic heart disease is the main cause of death in the developed world.

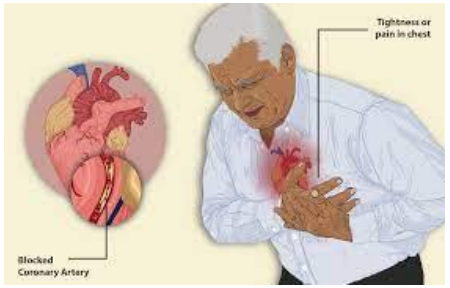
Ischemic heart disease is characterized by a reduction (partial or total) in coronary blood flow. In 90% of all cases, this occurs following thrombus formation secondary to an atheroma plaque that occludes the arterial lumen, though other factors such as cold, physical exercise or stress can act as co-adjuvant factors or (less frequently) trigger the event themselves.

Chest pain (*angina*):

Chest pain (*angina*) occurs when coronary occlusion is partial and no myocardial necrosis is produced,

while ***acute myocardial infarction*** is observed when coronary occlusion is total and necrosis is produced as a result. In turn, sudden death may also occur, generally as a result of *arrhythmias*.

The dental environment increases the likelihood of an anginal attack because of associated fear, anxiety or pain.



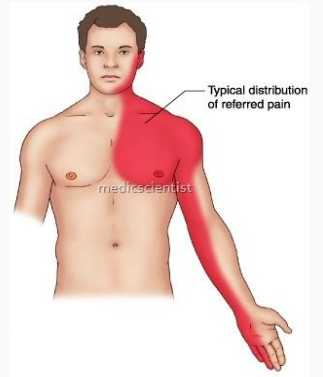
Angina pectoris

stable angina==========unstable angina

1. Angina pectoris

Stable angina: it is described as an aching, heavy, squeezing pressure or tightness in the mid chest region (1-3 minutes). The area of discomfort often is described to be approximately the size of the fist and may radiate into the left or right arm to the neck or lower jaw. preceded by physical exertion or emotional stress. This pain subsides with rest and/or the administration of sublingual nitroglycerin.

Unstable angina: it typically manifests under resting conditions, is characterized by more intense pain with a duration of no more than 20-30 minutes, and a poorer response to nitrates. This presentation can soon evolve towards myocardial infarction.

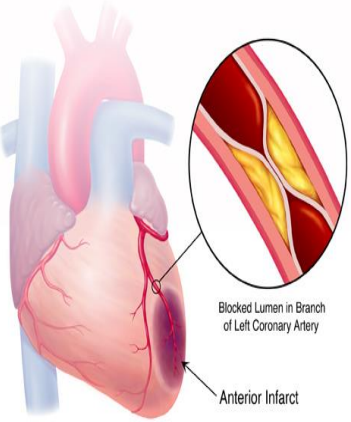


Prinzmetal angina: is a syndrome typically consisting of angina at rest that occurs in cycles. It is caused by vasospasm, a narrowing of the coronary arteries caused by contraction of the smooth muscle tissue in the vessel walls rather than directly by atherosclerosis (buildup of fatty plaque and hardening of the arteries).

2. Myocardial infarction (AMI)

Acute myocardial infarction is characterized by acute, sudden onset and intense pain, of an oppressive nature, located in the retrosternal or precordial region, and can irradiate to the arms, neck, back, jaw, palate or tongue.

The duration is over **half an hour**, and the pain does not subside with rest. The condition is accompanied by intense perspiration, nausea, vomiting, dyspnea and imminent death sensation, though it can also manifest as sudden loss of consciousness, mental confusion or weakness.



The triggering stimuli are emotional stress, intense physical exercise or the existence of concomitant disease or surgery.

The drugs used to treat AMI and administered for secondary prevention purposes comprise beta-blockers, calcium antagonists and the angiotensin-converting enzyme inhibitors.

Acute myocardial infarction (AMI)

Oral manifestations

If the patient is receiving anticoagulant or antiplatelet treatment, bleeding may occur, manifesting as hematomas, petechiae or gingival bleeding.

Dental management

-A patient who has suffered acute myocardial infarction is at a high risk of suffering another infarction episode or severe arrhythmias. It has been reported that over 70% of all recurrences take place in the first month after the initial vascular event.

-In dental practice a minimum safety period of 6 months has been established before any oral surgical procedure can be carried out. However, studies in recent years have underscored the need to revise these criteria. No ideal minimum time has been established, though many authors consider 4-6 weeks after infarction to be wise period.

-In this time, dental treatment should be limited to emergency procedures aimed at affording pain relief: extractions, the drainage of abscesses and pulpectomies, preferably carried out in the hospital setting.

-If more than 6 months have elapsed or physician clearance is obtained, the management of the patient who has had an MI is similar to care of the patient with angina.

- Consultation with the **supervising physician is advised** in order to know the type of heart disease (angina or infarction), its severity, the time elapsed from the cardiological event, the clinical complications, and the treatment received by the patient.

- The patient should continue taking the prescribed medication as usual. If **nitrates are used**, the patient should bring them to each visit to the dental clinic, in case chest pain develops.

-Some authors mention the possibility of administering nitrite as a preventive measure before local anesthesia.

- In the case of very anxious patients, premedication can be administered to lessen anxiety and stress (5-10 mg of diazepam the night before and **1-2 hours before treatment**).

- The visits should be brief (**less than 30 minutes**) and should be programmed for during the day – avoiding the early morning hours, which is when heart attacks are most frequent, as well as the late afternoon hours, when tiredness and stress are greater.

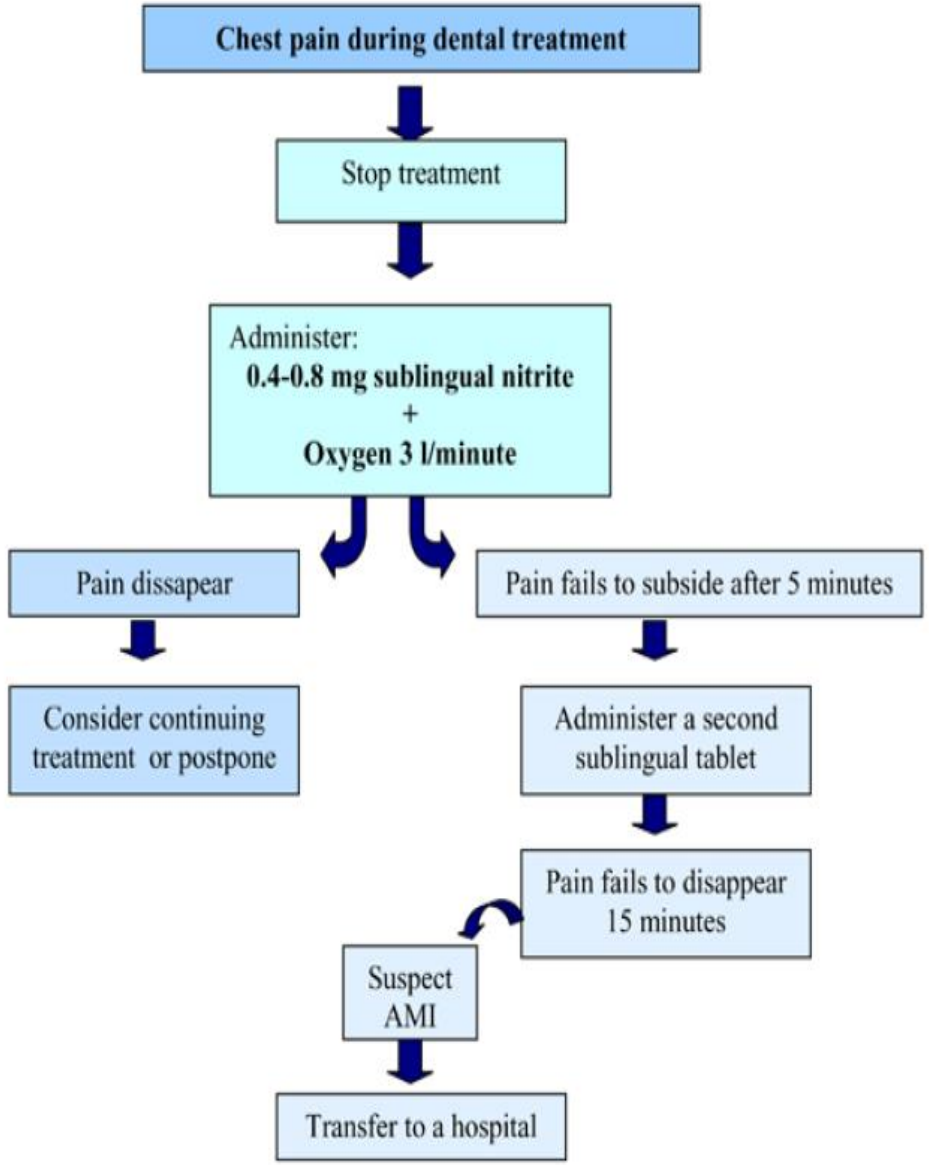
- A good anesthetic technique is required, taking care not to inject the solution into a blood vessel, and using a maximum of **two carpules** with vasoconstrictor. In turn, if anesthetic reinforcement is needed, it should be provided without a vasoconstrictor.

- The patient should be placed in the position most comfortable for him or her (semi supine), and should get up carefully in order to avoid orthostatic hypotension.

- Depending on the patient, blood pressure and pulsioxymetric monitoring may be required before and during dental treatment.

-If the patient is receiving anticoagulants, the international normalized ratio (INR) on the day of treatment should be determined, and treatment should be provided within the recommended limits (< 3.5), with local hemostasis if surgery is planned.

- If the patient develops chest pain during dental treatment, the procedure should be suspended immediately, and a sublingual nitrite tablet should be administered (0.4-0.8 mg), together with nasal oxygen (3 liters/minute). If the pain subsequently subsides, continuation of treatment can be considered, or alternatively an appointment can be made for some other day. If the pain fails to subside after 5 minutes, a second sublingual tablet should be administered. If the pain fails to disappear 15 minutes after onset, acute myocardial infarction is to be suspected, and the patient must be transferred to a hospital center.



Heart failure:

- Heart failure (HF) is defined as the incapacity of the heart to function properly, pumping insufficient blood towards the tissues and leading to fluid accumulation
within the lungs, liver and peripheral tissues.

- Heart failure in turn is the end stage of other diseases such as ischemic heart disease or arterial hypertension.

- The most common causes are severe and prolonged arterial hypertension, valve disease, ischemic heart disease and serious pericardial diseases.

Oral manifestations

Due to the drug treatments used by patients with heart failure, a series of **oral manifestations can be observed.** In this context, ACEIs (captopril) can produce **lichenoid reactions**, burning mouth sensation and a loss of taste sensation, while diuretics **(furosemide)** can produce xerostomia.

Dental management

- Consultation with the supervising physician is advised in order to know the current condition of the patient and the medication prescribed. The patient should be receiving medical care, and heart failure should be compensated.
- Dental treatment is to be limited to patients who are in stable condition, since these individuals are at an important risk of developing serious arrhythmias and even sudden death secondary to cardiopulmonary arrest.
- In patients with heart failure, including those presenting palpitations, asthenia or dyspnea, it is important to only provide emergency care, and to do so in the **hospital setting.**

- Anxiety and stress are to be avoided during the visits, which in turn should be brief (less than 30 minutes) and are to be programmed for the morning hours. The patient should be placed in the semi-supine position in a chair, with control of body movements (which should be slow), in order to avoid orthostatic hypotension.

- In patients administered digitalis agents (digoxin, methyldigoxin), the **vasoconstrictor dose is to be limited to two anesthetic carpules**, since this drug combination can favor
the appearance of arrhythmias. **Aspirin can lead to sodium and fluid retention**, and therefore should not be prescribed in **patients with heart failure.**

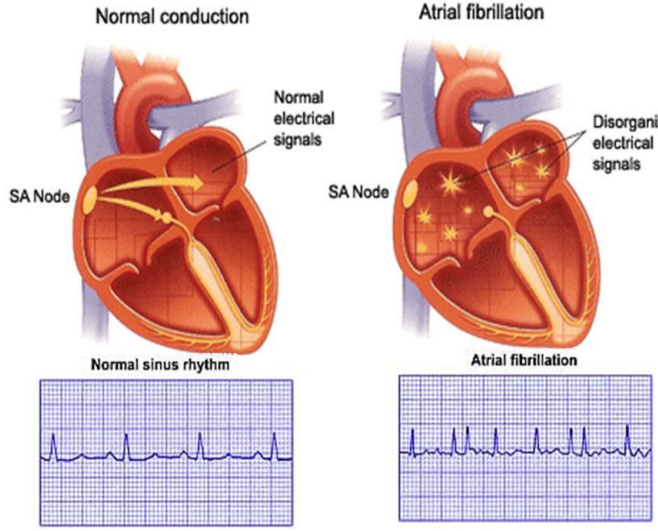
ARRHYTHMIAS

- Arrhythmias are variations in normal heart rate due to disorders of (1) cardiac rhythm, (2) frequency or (3) contraction.

Atrial fibrillation is the most common type of cardiac arrhythmia.

The frequency of electric pulse generation in the sinus node ranges from 60-80 beats per minute (bpm) under resting conditions and can increase to 200 bpm during physical exercise.

Arrhythmias are generated when electric pulse generation proves defective.



Oral manifestations

Many antiarrhythmic drugs have side effects such as gingival hyperplasia or xerostomia.

Dental management

Consultation with the supervising physician is advised in order to know the current condition of the patient and the type of arrhythmia involved, as well as the medication prescribed.

It must be checked that the patient uses the medication correctly.

Anxiolytics can be used to lessen stress and anxiety.

Short visits in the morning are to be preferred.

Patient monitoring, with recording of the pulse, is indicated before starting treatment.

It is very important to limit the use of a vasoconstrictor in local anesthesia, with the administration of no more than two carpules.

The treatment planned should not be too long or complicated.

Endocarditis

Myocarditis, pericarditis, and endocarditis might sound very similar, but even though all three are types of heart inflammation, they affect different areas of the heart. **The Structure of the Heart**

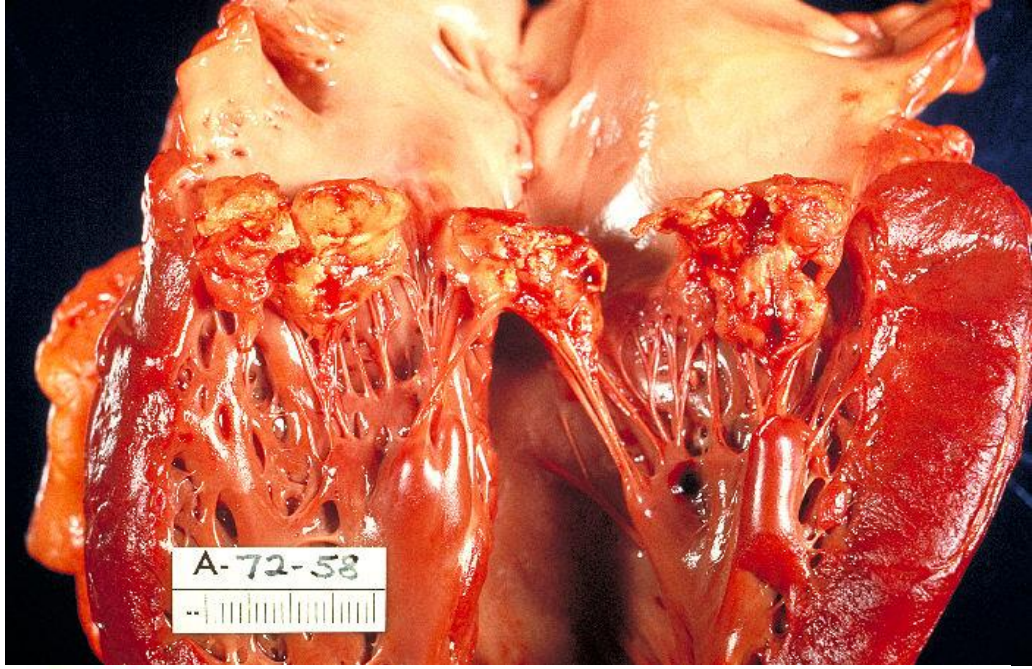
•To understand the difference between these types of heart inflammation, you must first understand the heart's structure.

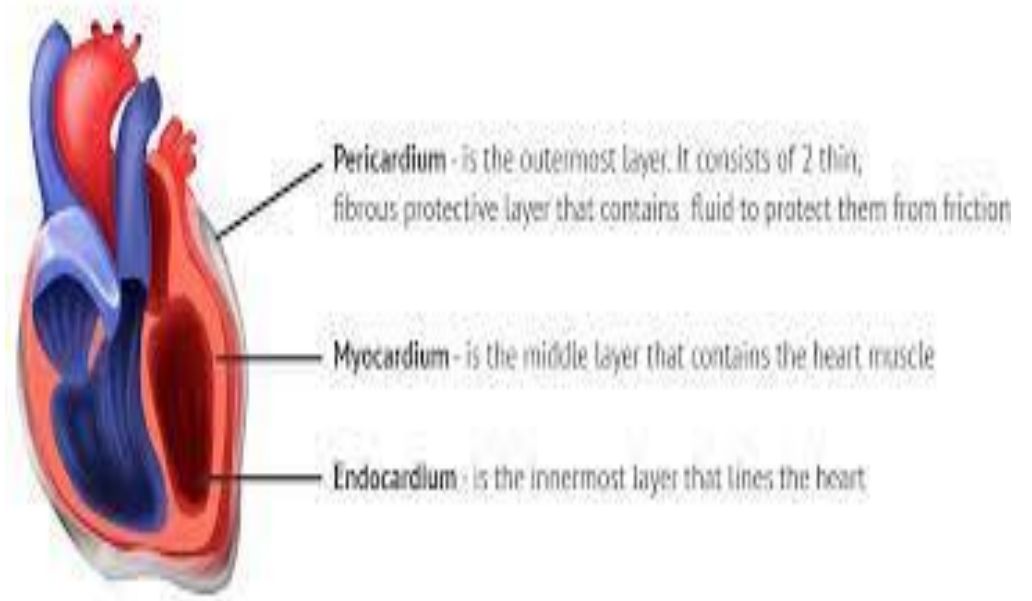
•A human heart has three layers. Working from the outside inward, the **layers are as follows:**

•Pericardium:

•Myocardium:

•Endocardium:





Dental management:

Infective endocarditis (IE) is an infectious, potentially life-threatening disease of the heart valves or endocardium, which is caused by bacteria that can affect different organs. Its incidence is estimated to be 1 to 5 cases per 100,000 inhabitants . It is often found in **high-risk groups** with **congenital or acquired cardiac defects**.

Invasion of the bloodstream by microbes that can colonize the damaged sites can result in IF. Episodes of short bacteraemia can trigger IE in at-risk patients. For this reason, many studies have focused on prevention or on decreasing the magnitude and duration of bacteraemia caused by dental procedures using antimicrobial agents. **Antibiotic prophylaxis (AP)** prior to invasive dental procedures remains the recommended management for **'high-risk' patients in most countries of the world.**

Rheumatic fever and rheumatic heart Disease

Rheumatic fever is an inflammatory disease that can develop when **strep throat** or **scarlet fever isn't properly treated**.
Strep throat and **scarlet fever are caused by an infection with streptococcus (strep-toe-KOK-us) bacter**ia.

Rheumatic fever most often affects **children ages 5 to 15**. But it can develop in **younger children and adults.**
Although strep **throat is common**, rheumatic fever is rare in the and other developed countries.
Rheumatic fever can cause **permanent damage to the heart**, including **damaged heart valves and heart failure**.
Treatment can **ease pain**, **reduce damage from inflammation and prevent a recurrence of rheumatic fever**
Rheumatic fever symptoms result from inflammation in the heart, joints, skin or central nervous system. There may be few symptoms or several. Symptoms can change during the course of the disease. The onset of rheumatic fever usually occurs about 2 to 4 weeks after a strep throat **infection.**

Antibiotic prophylaxis

For invasive dental procedures, **dental defense organizations recommend the dental team:**

It should be performed 60 minutes before dental procedures with a high probability of bacteremia, including **manipulation of gingival tissue**, **manipulation of periapical regions of teeth and perforation of the oral mucosa**.
The guidelines recommend patients attend the **practice 60 minutes prior to appointment** to take their antibiotic prophylaxis and remain in the practice once taken.

However, if they wish to take the antibiotic at home, and they have not previously had an adverse reaction, this can be permitted, once they confirm with the practice prior to taking antibiotic, their procedure is going ahead .

If the patient has taken the antibiotic in the **previous 6 weeks for medical or dental infection**, select a drug from a **different class. If amoxicillin or clindamycin are unsuitable regimes**,

contact a consultant microbiologist or community pharmacist for advice on an alternate drug regime. Such cases should be referred to **local special care dental services**. For patients who require sequential invasive procedures in a short time period, the same antibiotic may be used.

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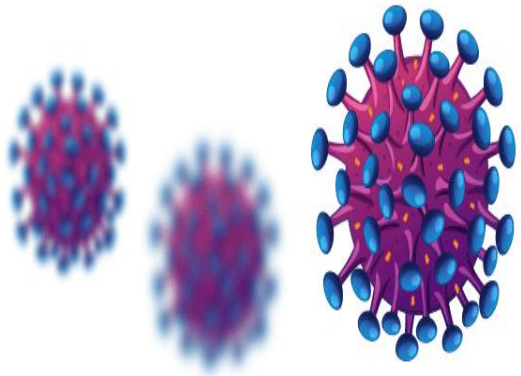
PhD
Oral & Maxillofacial Surgery

Academic Year 4

AIDS and HIV infection

Assistant Prof Dr. Hamid Hammad Enezei

Ph.D in Oral & Maxillofacial Surgery



AIDS and HIV infection

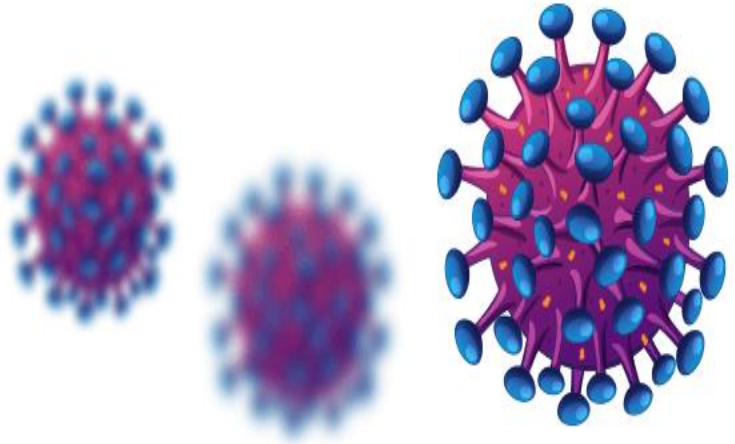
- Oral manifestations
- Dental managements:

✓ Asymptomatic patient.

✓ Symptomatic patient.

✓ Patient with severe symptoms

What is HIV/AIDS?:



HIV (human immunodeficiency virus) is the virus that causes AIDS (acquired immunodeficiency syndrome).
HIV (*human immunodeficiency virus*) is a virus that attacks cells that help the body fight infection, making a person more vulnerable to other infections and diseases.

It is spread by **contact with certain bodily fluids of a person with HIV**, most commonly **during unprotected sex (sex without a condom** or **HIV medicine to prevent or treat HIV)**, or **through sharing injection drug equipmentf left untreated**, **HIV can lead to the disease AIDS (*acquired immunodeficiency syndrome*).**
The human body can't get rid of HIV and no effective HIV cure exists. So, once any person have HIV, will have it for life.
Luckily, however, effective treatment with HIV medicine **(called antiretroviral therapy or ART)** is available. If taken as prescribed, HIV medicine can reduce the amount of HIV in the blood (also called the viral load) to a very low level. This is called viral suppression.
If a person's viral load is so low that a standard lab can't detect it, this is called having an undetectable viral load. People with HIV who take HIV medicine as prescribed and get and keep an undetectable viral load can **live long and healthy lives** and **will not transmit HIV to their HIV-negative partners through sex**
This virus is passed from **one person to another through blood-to-blood contact (blood** transfusions, HIV-infected needles) and is a sexually transmitted disease or STD. Also, an infected pregnant woman can pass HIV to her baby during pregnancy and delivery and even through breastfeeding.
AIDS occurs when the HIV infection has weakened one's immune system to the point that it has difficulty fighting off certain illnesses and infections.
"Opportunistic" infections also occur, taking the opportunity to cause **illness in a weakened immune system**.

Sign and symptom of infection with HIV:

Rapid weight loss ,Dry cough , Recurring fever or profuse night sweats, Profound and unexplained fatigue Swollen lymph glands in the armpits, groin, or neck, Diarrhea that lasts for more than a week, White spots or unusual blemishes on the tongue, in the mouth, or the throat, Pneumonia, Red, brown, pink, or purplish blotches on or under the skin or inside the mouth, nose, or eyelids, Memory loss, depression, and other neurological disorders

Most people infected with HIV experience a short, flu-like illness that occurs 2-6 weeks after infection. After this, HIV may not cause any symptoms for several years.

It's estimated up to 80% of people who are infected with HIV experience this flu-like illness.

The most common symptoms are:

•raised temperature (fever) , sore throat , body rash, tiredness, joint pain , muscle pain ,swollen glands

The symptoms usually last 1-2 weeks, but can be longer. This should be supported with an HIV test.

After the initial symptoms disappear, HIV may not cause any further symptoms for many years.

During this time, the virus continues to be active and causes progressive damage to the immune system.

This process can vary from person to person, **but may take up to 10 years**, *during which person will feel and appear well.*

Once the immune **system becomes severely damaged, symptoms can include:**

•weight loss ,chronic diarrhoea ,night sweats ,skin problems,recurrent infections, serious life-threatening illnesses,

Earlier diagnosis and treatment of HIV can prevent these problems.

Oral manifestation of HIV patient

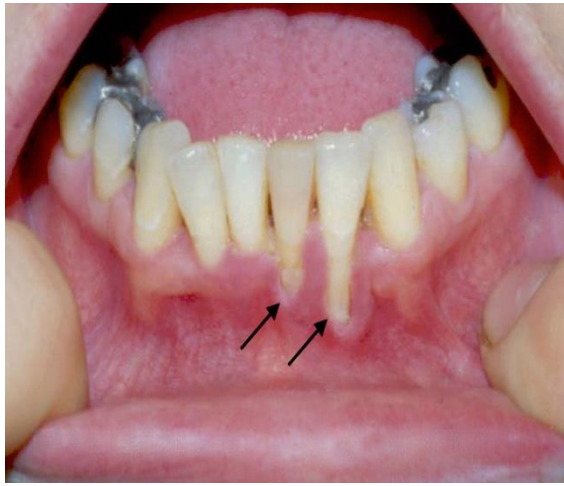
The oral manifestations of HIV disease are manifold, prevalent, and clinically significant.
The recognition and management of HIV-related oral manifestations remains an important area of study for clinicians who provide medical care to persons with HIV.
Oral lesions may be the first clinical sign of HIV and can cause significant morbidity.

ORAL EXAMINATION

A comprehensive oral examination should include **both** visual and **tactile** components, beginning with careful :
1-**Inspection** of the **face, neck**, **lips** and mouth (including the roof, floor, and sides of the mouth; the tongue, tonsillar pillars, and back of throat) and followed by
2-Manual palpation.
A detailed patient history is often helpful in directing the examiner to explore a particular area in greater detail.
With the advent of effective antiretroviral therapy, the overall prevalence of HIV-related oral manifestations has decreased.
In addition, with the improved long-term health of persons with HIV, there has been a renewed focus on the importance of preventative oral health through regular dental care.[

Good oral health increases quality of life as measured by self-confidence, social acceptance, and employability.
Dental decay, gingivitis, and periodontal disease are common problems for individuals with HIV. In addition, persons with HIV have an increased incidence of more severe manifestations of periodontal disease, particularly linear gingival erythema ,necrotizing ulcerative gingivitis ,

Linear Gingival Erythema



Necrotizing Ulcerative Gingivitis

and necrotizing ulcerative periodontitis.
Multiple factors that likely contribute to higher rates of dental decay and periodontal disease in persons with HIV include inadequate dental hygiene, poor diet, xerostomia, changes in immune cells in the salivary glands, and overgrowth of atypical bacterial pathogens.
In addition, profound oral changes can occur with chronic methamphetamine use and is often referred to as “meth mouth”.
Persons with HIV may have barriers to receiving oral health care and prevention services, most notably lack of insurance coverage for dental care and a shortage of dentists who are trained or willing to see individuals with HIV, even for routine periodontal care.

ORAL CANDIDIASIS

Oropharyngeal candidiasis is seen frequently among individuals with HIV and is an indicator of immune suppression.
It occurs most often in **patients with CD4 cell counts less than 200 cells/mm^3**.
Candida albicans is the most common species involved, but non-*albicans* species (*C. dubliniensis*, *C. glabrata*, *C. tropicalis*) can also cause disease.
The introduction and widespread use of effective antiretroviral therapy has led to a marked decrease in the prevalence of oral candidiasis. Although HIV-related immune suppression is typically the most important risk factor for developing oral candidiasis, other causes for oral candidiasis include antibiotic use, corticosteroids, chemotherapeutic drugs, and diabetes.
By maximizing immune status with effective antiretroviral therapy, most cases of candidiasis can be avoided.

Pseudomembranous Candidiasis

Among individuals with HIV, there are four different manifestations of oral candidiasis: pseudomembranous candidiasis (thrush),
atrophic (erythematous) candidiasis,
angular cheilitis (perleche) and rarely,
hyperplastic candidiasis.

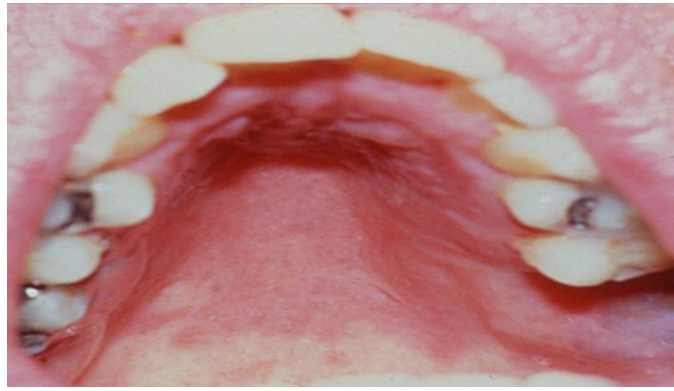
Pseudomembranous candidiasis manifests as painless, creamy white plaques or patches that may involve any oral mucosal surface, including the palate , buccal mucosa , gingiva , and tongue ; the pseudomembranous plaques can be easily scraped off with a tongue blade.

Erythematous candidiasis typically presents as flat red patches most commonly on the hard palate and surface of the tongue .

Patients with either pseudomembranous or erythematous disease often complain of a burning sensation and altered taste.

Angular cheilitis manifests as erythema and splitting of the corners of the mouth ; if not treated, this can progress to a chronic, non-healing lesion

Pseudomembranous Candidiasis on Buccal Mucosa



Erythematous Candidiasis on Palate

Erythematous Candidiasis on Tongue

Angular Cheilitis

Diagnosis

A presumptive diagnosis of oropharyngeal candidiasis is based on typical clinical appearance or on a favorable response to an empiric trial of antifungal medication.

A definitive diagnosis of oropharyngeal candidiasis requires obtaining a direct smear and performing a potassium hydroxide (KOH) wet mount or Gram's stain and seeing characteristic yeasts. Fungal cultures are reserved for patients who do not respond to first-line therapy or for cases of suspected antifungal resistance.

Treatment

Treatment of Oropharyngeal Candidiasis: Initial Episodes,

In the Adult and Adolescent Opportunistic Infection Guidelines,

Oral fluconazole is the drug of choice for treating oropharyngeal candidiasis based on its efficacy,

Convenience, and tolerance Treatment duration is **for 7 to 14 days**, regardless of which type of medication is used

•**Preferred Therapy**: Oral fluconazole is not recommended for pregnant persons, especially those in the first trimester. Topical therapies include miconazole buccal tablets, clotrimazole lozenges (troche), miconazole mucoadhesive buccal tablets, nystatin suspension, nystatin lozenges (pastille), and a topical gentian violet application; topical therapy reduces the risk of systemic drug exposure and adverse events, but they are not as effective and thus all are considered alternative therapies.

•**Alternative Therapy**: Alternative systemic therapy consists of either itraconazole oral solution, or posaconazole oral solution. Episodic treatment of clinical episodes is strongly preferred over chronic suppressive therapy, mainly because of the risk of developing antifungal drug resistance with chronic therapy. Chronic suppressive therapy is not recommended unless the individual has frequent or severe recurrences of mucosal candidiasis. In addition, routine primary prophylaxis is not recommended because oral candidiasis has relatively low attributable morbidity and acute treatment is highly effective.

Fluconazole-resistant candidiasis

Refractory oropharyngeal candidiasis in persons with HIV and advanced immunosuppression emerged in response to the widespread and frequent use of fluconazole; in earlier years of the epidemic, it occurred in approximately 5% of persons with HIV.

There are multiple risk factors for the development of **fluconazole-resistant candidiasis**, including greater number of fluconazole-treated episodes, longer median duration of fluconazole therapy, and advanced immunosuppression (especially a CD4 count less than 50 cells/mm^3).

For persons who have clinically refractory oropharyngeal candidiasis and/or azole-resistant candidiasis, expert consultation is advised.

ORAL HAIRY LEUKOPLAKIA(OHL)

Oral hairy leukoplakia (OHL) **occurs in up to 20% of individuals with HIV**, typically among those with moderate to advanced immune suppression.

As with other opportunistic infections, the prevalence of OHL has decreased with the advent of effective antiretroviral therapy.

Epstein-Barr virus (EBV) has been strongly associated with OHL although the mechanism by which EBV infects the oral epithelium has not been fully elucidated.

Clinical Manifestations Individuals with OHL

Typically present with raised, white, corrugated lesions most often on the lateral aspect of the tongue .

Less often, OHL can manifest with extensive oral mucosal involvement, including the buccal mucosa and pharynx.

The OHL lesions are adherent and not removed when scraping the lesion with a tongue blade.

This feature serves to distinguish **OHL from oral candidiasis**, since pseudomembranous candidiasis lesions typically are easily removed by scraping with a tongue blade.

Typically, OHL does not cause symptoms, but some individuals may **complain of glossodynia** (burning mouth syndrome).

Diagnosis :

The diagnosis of OHL is usually made based on clinical findings.
A histologic confirmation of the diagnosis is **rarely required**, but if a biopsy is performed, characteristic histopathologic findings include cellular nuclear changes (acanthosis, Cowdry type A inclusions, ground glass and nuclear beading), absence of an inflammatory infiltrate, regions of **ballooning cells**, and **epithelial hyperplasia.** Additional confirmation can be made by **demonstrating replicating EBV** in the histologic sample, but this is rarely done.

Treatment :

In most persons with HIV, antiretroviral therapy will cause OHL lesions to resolve. Thus, other than using antiretroviral therapy, no specific therapy for OHL is generally required. If an individual requested immediate treatment due to symptoms or cosmetic reasons, reports have described benefit from **valacyclovir** and from topical therapy (podophyllin resin combined with acyclovir cream).

Guidelines :
For the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents with HIVTreatment of Oropharyngeal Candidiasis: Initial Episodes
Preferred Therapy (Duration: 7-14 Days)
•Fluconazole 100 mg PO once daily (**AI**)

Alternative Therapy:

•Clotrimazole one 10-mg troche PO 5 times daily (**BI**), *or*
•Miconazole one 50-mg mucoadhesive buccal tablet once daily. Apply to mucosal surface over the canine fossa (do not swallow, chew, or crush tablet). Refer to product label for more detailed application instructions (**BI**), *or*
•Itraconazole oral solution 200 mg PO daily (**BI**), *or*
•Posaconazole ;oral suspension 400 mg PO twice daily for 1 day, then 400 mg daily (**BI**), *or*
•Nystatin suspension 4–6 mL 4 times daily or 1–2 flavored pastilles 4-5 times daily (**BII**), *or*
•Gentian Violet (0.00165%) topical application twice daily (**BI**)

Rating of Recommendations:

A = Strong; B = Moderate; C = Optional
Rating of Evidence:
I = Data from randomized controlled trials;
II =Data from well-designed nonrandomized trials, observational cohort studies with long-term clinical outcomes, relative bioavailability/bioequivalence studies, or regimen comparisons from randomized switch studies;
III =Expert opinion

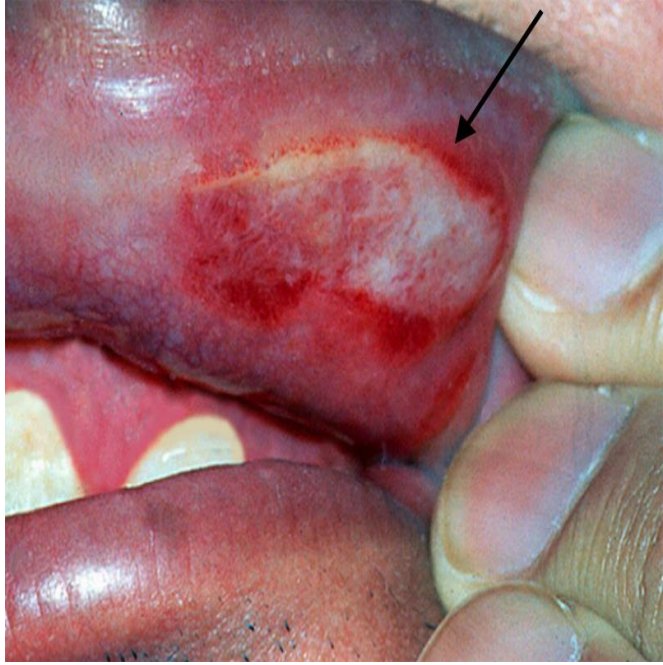
Source:

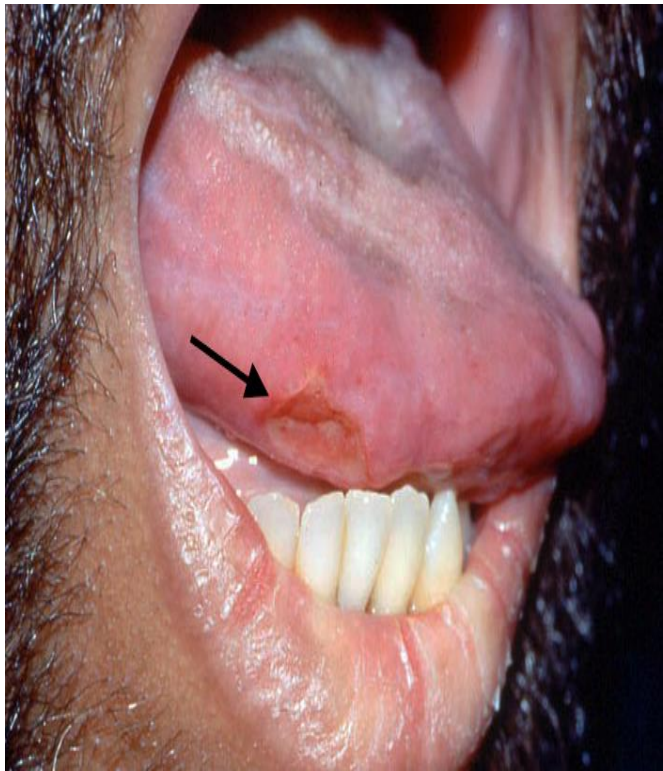
Panel on Opportunistic Infections in Adults and Adolescents with HIV.
Guidelines for the prevention and treatment of opportunistic infections in adults and adolescents with HIV: recommendations from the Centers for Disease Control and Prevention, the National Institutes of Health, and the HIV Medicine Association of the Infectious Diseases Society of America. Candidiasis (mucocutaneous).

Aphthous Stomatitis:

Background

Aphthous stomatitis affects up to 15% of persons with HIV and the incidence has not significantly changed
since the advent of effective antiretroviral therapy.
The cause of these ulcers remains unclear, but may
represent an overstimulation of tumor necrosis factor, perhaps stimulated by an unidentified pathogen. Other
possible etiologies include trauma and stress, systemic disease, nutritional deficiencies, and food
allergies.
When compared with aphthous lesions in immunocompetent individuals, patients with HIV typically have oral ulcers that are more extensive, more frequent in occurrence, and slower to heal.





Clinical Manifestations

Aphthous stomatitis manifests as round to oval lesions with a raised red halo on nonkeratinized mucosal
surfaces in the mouth, including the lip , and tongue , often with a yellow-gray pseudomembranous covering.

Aphthous stomatitis lesions are characterized as minor, major, or herpetiform based on the size and number of lesions. Minor lesions are 0.2 to 0.5 cm in diameter and typically persist for 7 to 10 days; major lesions are greater than 0.5 cm in diameter and often persist for weeks.
Herpetiform lesions manifest as a crop of lesions with each lesion smaller than 1 to 2 mm in diameter, but these small lesions can coalesce into large lesions.

Aphthous stomatitis lesions often can cause intense pain,
particularly when patients ingest spicy, salty or acidic foods or beverages. This disorder is referred to as recurrent aphthous stomatitis in patients who have repeated episodes.

Diagnosis:

No causative agent has been identified for aphthous stomatitis. The diagnosis of aphthous stomatitis is based on clinical presentation and exclusion of other possible causes, including HSV, syphilis, neoplasm, or drug reaction.

Treatment

Treatment of aphthous lesions in persons with HIV typically consists of a combination of symptomatic relief and anti-inflammatory medications.
Topical anesthetics are helpful for pain control of all lesions.
Minor lesions can be treated with a mucosal binding agent and topical corticosteroid, ideally combined in a dental paste preparation.
In contrast, more severe lesions may require systemic or intralesional corticosteroids, or the immunomodulator, thalidomide.

Antiretroviral therapy is an important component in treating **aphthous stomatitis**.
Objective evidence shows **most efficacy from corticosteroids** and **antimicrobials used topically**.
In general, treatment of aphthous ulcers should focus on **both acute ulcer cont**rol and also on **preventing recurrences**, and treatment **algorithms should follow a stepwise progression**, starting with topical preparations and proceeding if necessary to first- and second-line systemic therapies.

The following summarizes several key aspects of treatment options.

•Chlorhexidine: Bioadherent oral rinse gel and chlorhexidine gluconate mouth rinses reduce the severity and pain of ulceration but not the frequency.
•Anti-Inflammatory Agents: In patients with mild to moderate aphthous lesions, anti-inflammatory agents, such as benzydamine hydrochloride mouthwash and topical amlexanox paste, may provide symptomatic benefit with transient pain relief.
•Topical Corticosteroids: The use of topical corticosteroids remains the mainstay of treatment, with a recent randomized placebo-controlled trial showing a statistically significant improvement in healing ratio in patients treated with dexamethasone ointment compared with placebo. A spectrum of different topical corticosteroids can be used. Although package inserts for most topical steroids have a warning “not for internal use”, extensive experience over several decades has shown efficacy and safety with the use of topical steroids for aphthous stomatitis. Topical corticosteroids usually reduce painful symptoms, but they do not impact the rate of ulcer recurrence. The patient should avoid eating or drinking anything for at least 30 minutes after the topical agent has been applied. The commonly used preparations are as follows:

- Fluocinonide 0.05% ointment rubbed into the affected area three times daily, or
- Hydrocortisone mucoadhesive buccal tablets 2.5 mg used 4 times daily, or
- Triamcinolone acetonide 0.1 dental paste applied to ulcer 4 times daily, or
- Betamethasone sodium phosphate as a 0.5 mg tablet dissolved in 15 mL of water to make a mouth rinse, used 4 times daily for 4 minutes each time.

Safety of Topical Corticosteroids: Hydrocortisone and triamcinolone topical preparations are popular because neither causes significant adrenal suppression, but ulcers typically recur unless effective antiretroviral therapy is also used.
Betamethasone, fluocinonide, fluocinolone, fluticasone, and clobetasol are more potent and more effective than hydrocortisone and triamcinolone, but they carry an increased risk for adrenocortical suppression and a predisposition to candidiasis. All corticosteroids, even when given in non-oral formulation, have the potential to induce serious complications, such as Cushing's syndrome in persons with HIV taking ritonavir or cobicistat, as well as with some protease inhibitors.[33] Corticosteroids should be used with caution in these patients.

- **Tetracyclines:** Topical tetracyclines may reduce the severity of ulceration, but they do not alter the recurrence rate.

A doxycycline capsule of 100 mg in 10 mL of water administered as a mouth rinse for 3 minutes or tetracycline 500 mg plus nicotinamide 500 mg administered 4 times daily may provide relief and reduce ulcer duration. Avoid tetracyclines in children younger than 12 years who might ingest them and develop tooth staining.

- **Thalidomide**: In patients with severe aphthous lesions, the medication thalidomide (200 mg per day for 4 weeks) has been shown to significantly improve healing and resolution. The use of thalidomide is hampered by its pregnancy category X classification and the requirement that clinicians need to enroll in a special thalidomide distribution program.

Herpes simplex virus

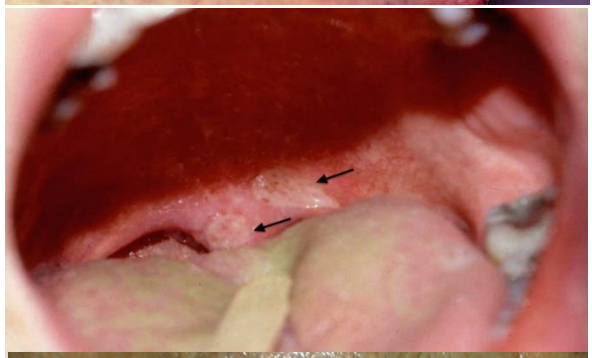
Infections with herpes simplex virus (HSV) occur frequently in persons with HIV and more than 95% of individuals with HIV test seropositive for either HSV-1 or HSV-2.
Infection with HSV is characterized by periodic reactivation, during which shedding from mucosal surfaces is increased. Shedding of HSV persists despite highly active antiretroviral therapy among persons coinfected with **HIV and HSV**

Clinical manifestation:

Oral herpes manifests most often as lesions on the outer mouth region inner lips ,tongue or palate; oral herpes is usually caused by infection with HSV-1, but HSV-2 can also cause oral lesions. Individuals with their first episode of oral HSV may have more severe and extensive lesions .

Oral infection with HSV-1 and HSV-2 are indistinguishable from a clinical perspective. Patients classically experience a sensory prodrome followed by evolution of the lesion(s) from papule to vesicle to crusting stage.

If untreated, symptoms **persist 5 to 10 days**; antiviral therapy initiated at onset of the prodrome can shorten the symptomatic period or even abort the outbreak. Patients with HIV infection and a CD4 count less than 100 cells/mm^3 may have deep, extensive and non-healing ulcers and are more likely to develop acyclovir-resistant HSV



Diagnosis

The clinical diagnosis of oral HSV can be challenging since HSV lesions can mimic many other infections, particularly when present in the ulcerated form. Therefore, establishing the diagnosis via laboratory testing is recommended.Performing HSV DNA PCR testing is the most sensitive method for diagnosis, but viral culture and antigen detection are also frequently used for diagnostic purposes

The recommended therapy for **Oral HSV lesions** in persons with HIV consists of a 5- to 10-day course of **oral valacyclovir 1 g twice daily**, **famciclovir 500 mg twice daily,** or **acyclovir 400 mg three times daily**;

intravenous acyclovir 5 mg/kg every 8 hours may be required for severe mucocutaneous disease

Long-term suppressive therapy reduces the number of recurrences of mucocutaneous HSV disease in persons with HIV. For individuals who have severe outbreaks or who want to minimize the frequency of recurrences, suppressive therapy can be initiated using valacyclovir 500 mg twice daily, famciclovir 500 mg twice daily, or acyclovir 400 mg twice daily.

Kaposi's Sarcoma:

Kaposi’s sarcoma is a vascular tumor caused by human herpes virus-8 (HHV-8), also known as KS-associated herpes virus (KSHV). Kaposi’s sarcoma remains the most frequent HIV-associated oral malignancy, with a peak incidence occurring among men who have sex with men aged 25 to 59 years. In the current era of the HIV epidemic, as patients are living longer, the overall frequency of non-AIDS malignancies has increased while rates of Kaposi's sarcoma have dramatically decreased.Research suggests a relationship between immunodeficiency and malignancy, possibly through a mechanism of decreased immune surveillance

CLINICAL MANIFESTATIONS

When Kaposi’s sarcoma involves the mouth, lesions are usually located on the gums or hard palate and and can appear macular, nodular, raised, or ulcerated, with color ranging from red to purple. Individuals with Kaposi's sarcoma frequently present with both intraoral and cutaneous lesions. In addition, persons with HIV who have intraoral Kaposi's sarcoma may also have lesions in the lower gastrointestinal tract

Diagnosis

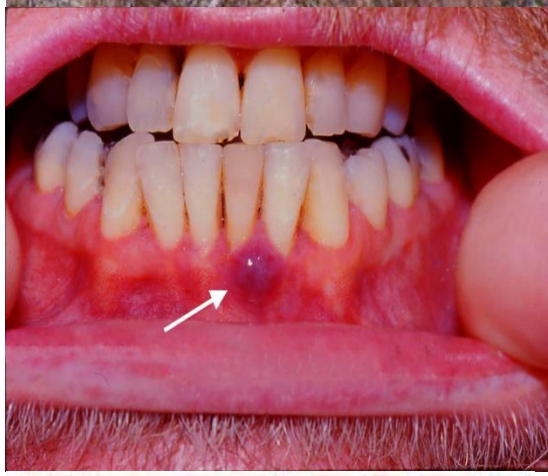
The diagnosis of oral Kaposi's sarcoma is usually suspected based on characteristic clinical findings. A definitive diagnosis requires biopsy of the oral lesion(s). Classic findings on pathology include neovascularization with aberrant proliferation of small vessels, atypical spindle-shaped cells with leukocytic infiltration, and hemosiderin-laden macrophages.

Treatment:

Combination antiretroviral therapy is recommended for all persons with HIV-related Kaposi’s sarcoma and these lesions often regress with antiretroviral therapy alone. When lesions do not resolve or the initial manifestations are severe, additional treatment may involve a combination of radiation, intralesional chemotherapy, topical therapy, or surgical excision. Systemic cytotoxic chemotherapy is generally reserved for treatment of disseminated disease beyond the oral cavity. The liposomal anthracyclines either **liposomal doxorubicin or liposomal daunorubin** are typically used when systemic cytotoxic chemotherapy is required.

Human Papilloma virus

Despite current widespread use of effective antiretroviral therapy for persons with HIV, oral lesions associated with human papillomavirus (HPV) have increased in recent years. Oral HPV infection is common among individuals with HIV, particularly men who have sex with men, and these infections more frequently involve the oncogenic subtype

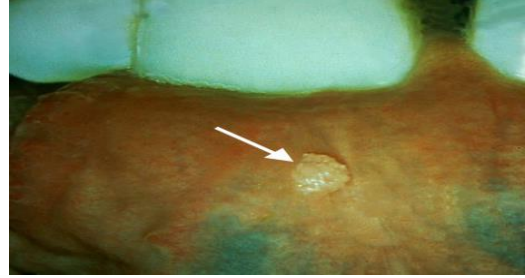


Previous studies have shown an oral HPV prevalence **of 20 to 40%** among men with HIV compared to an overall prevalence of **6.9% among men and women without HIV.**

A recent analysis of pooled data from prospective studies in the North American AIDS Cohort Collaboration on Research and Design (NA-ACCORD) between 1996 and 2009 found that HPV-related and HPV-unrelated head and neck squamous cell cancers are both elevated in individuals with HIV, **possibly due to immunosuppression.**

The increased risk of HPV-related **oral complications in persons with HIV persists even with use of effective antiretroviral therapy.**

Although there are no clinical trial data to demonstrate efficacy **of HPV vaccination** in reducing incidence of HPV-related oral cancers, the 9-valent **HPV (9vHPV) vaccine may have some efficacy in preventing oral vaccine-type HPV infections**



- **CLINICAL MANIFESTATIONS**

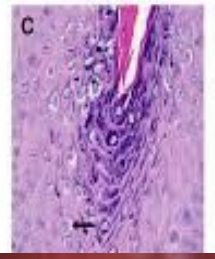
Oral warts can be cauliflower-like, spiked, or raised with a flat surface. Lesions may be white, red, or the color of normal mucosa. Oral warts often arise at the base of the tongue or tonsillar region, where they can easily be missed on routine oral examination .In addition, oral warts may appear on the lips or gingiva. It is difficult to differentiate benign and malignant lesions based on visual examination alone.

Diagnosis

The diagnosis of HPV-related oral disease is often made on the basis of a typical clinical appearance; if needed, biopsy can confirm the diagnosis. Due to the increased frequency of oral lesions and oral cancers in immunocompromised patients, clinicians should maintain a low threshold for performing a biopsy on any suspicious lesion. It is important to note that lesions, including malignant lesions, may not be readily visible on routine oral examination and may remain asymptomatic until they are at later stage.

Treatment

No clear standard for the treatment of HPV-related oral lesions has been established, but approaches to therapy may involve surgery, laser therapy, or cryotherapy. The specific treatment chosen is usually based on the location of the lesions, extent of disease, and whether the lesions are malignant.



dental managements of patient with HIV:

There are three types of patients with HIV

Asymptomatic patient.

Symptomatic patient.

Patient with severe symptoms

Oral lesions are among the earliest and most common clinical signs of HIV, and detection of oral lesions may signal progression of HIV disease or increase in the plasma HIV-1 RNA level.Still, oral abnormalities alone are not diagnostic of HIV infection.

HIV infection can be diagnosed by **serologic tests** that detect antibodies against HIV-1 and HIV-2 and by virologic tests that detect HIV antigens or ribonucleic acid (RNA).

Infection control is very important stage in patient's management

•Infection with human immunodeficiency virus (HIV) predisposes people to certain oral health problems.

•Patients who are HIV-positive can receive routine dental care.

•Obtaining and reviewing a comprehensive medical history may help identify patients who may require treatment plans adapted to their unique medical condition(s).

•Dentists and all staff with direct patient contact should comply with all standard precautions (e.g., wearing appropriate personal protective equipment and disinfecting all equipment and surfaces after each patient) for all patients.

Infection Control:

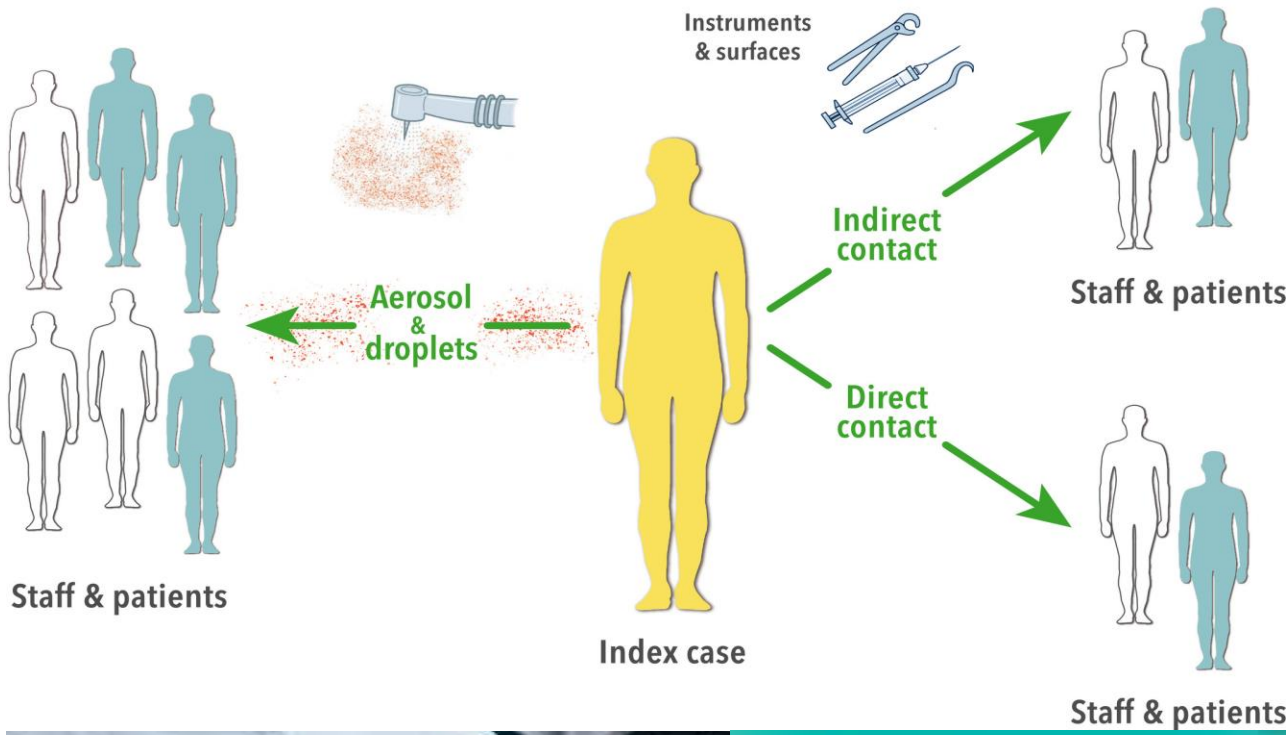
HIV is a bloodborne pathogen and avoiding exposure to blood and bodily fluids is the primary way to prevent transmission of HIV in dental care settings.

Blood has the greatest proportion of infectious viral particles but all bodily fluids, secretions, and excretions other than sweat may contain transmissible infectious agents.

During dental procedures, saliva tends to become contaminated with blood, increasing the risk of HIV transmission from saliva.

Standard precautions should be followed with all patients, Dental personnel should wear barrier precautions (e.g., **gloves, masks, and protective eyewea**r) .
whenever there is potential for contact with body fluids, non-intact skin, or mucous membranes.
Personal protective equipment must be removed after leaving work areas, and remember that gloves are never to be reused.
Although the occupational source of greatest risk of HIV transmission is percutaneous injuries, it is good to understand that after a needlestick exposure to HIV-infected blood, the average risk of HIV transmission is approximately 0.3% per exposure.

Dental health care personnel can reduce their risk of percutaneous injuries by following standard precautions, having engineering controls and work-practice controls for all sharps, and following safe injection practices.
Any direct contact with potentially infectious material is considered an exposure that requires clinical evaluation.



If an exposure incident occurs to material known or suspected to be infected with HIV, the incident should be **reported to a supervisor** (if applicable) and **the exposed individual should consult with a doctor immediately**.Antiretroviral drugs may be prescribed as post-exposure prophylaxis (PEP) within the first 72 hours of exposure in order to help prevent HIV infection.The sooner PEP is started, the more effective it is

Dental Patient Management

A comprehensive intraoral soft tissue, periodontal and hard tissue examination should be conducted at an HIV-positive patient's initial assessment.

Dentists should continuously monitor dental and oral health for disease progression. If any oral manifestations of HIV are present, the first priority is to relieve pain and treat infections.
To help prevent further disease, dentists can provide counseling about modifiable risk factors, such as use of tobacco, alcohol, or other drugs that may increase risk of oral abnormalities or complications, as well as work with the patient to implement oral hygiene regimens.
Prevention is even more important for HIV-positive patients, who are more susceptible to oral disease.
All dental practices should be able to provide routine dental care for adult or pediatric HIV-positive patients.
Nearly all patients with HIV are able to tolerate routine dental care and procedures, including oral surgery.
Still, ***dental treatment planning must be done on an individual basis***, in **conjunction with consultations with the patient and their physician as appropriate**.

HIV and antiretroviral therapies may be associated with **abnormal bleeding**, **glucose intolerance**, or **hyperlipidemia,** which may be identified through **consultation with the patient and their physician**.

Other conditions that may require modification of dental treatment are reduced platelet count <60,000 cells/mL, which may affect clotting, or white-blood-cell neutrophil counts <500 cells/mL, which may require antibiotic prophylaxis.

However, antibiotic use may predispose patients to adverse drug reactions, superinfection and drug-resistant microorganisms, so antibiotics should be used judiciously, **not routinely**.

In select circumstances, it may be appropriate to consult with the patient's physician to determine if there are any recent abnormal laboratory findings (e.g., low platelet count) that may require dental treatment modification or the provision of invasive procedures in a hospital setting.

Indications for dental extractions and other oral surgical procedures are the same for HIV-positive patients as for any other patient.
Preoperative scaling may be performed to help reduce the risk of postoperative complications. All procedures must be performed in a manner to minimize bleeding and avoid bringing oral pathogens into the deeper fascial planes and oral spaces

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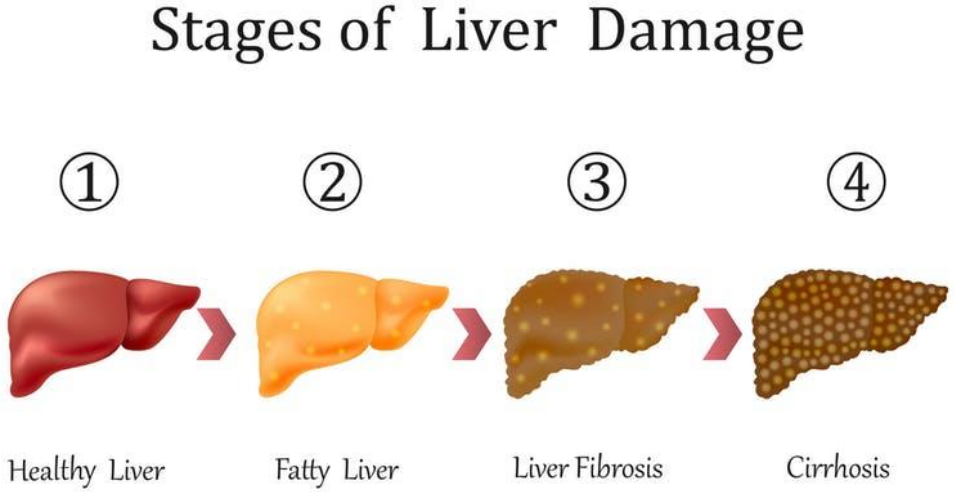
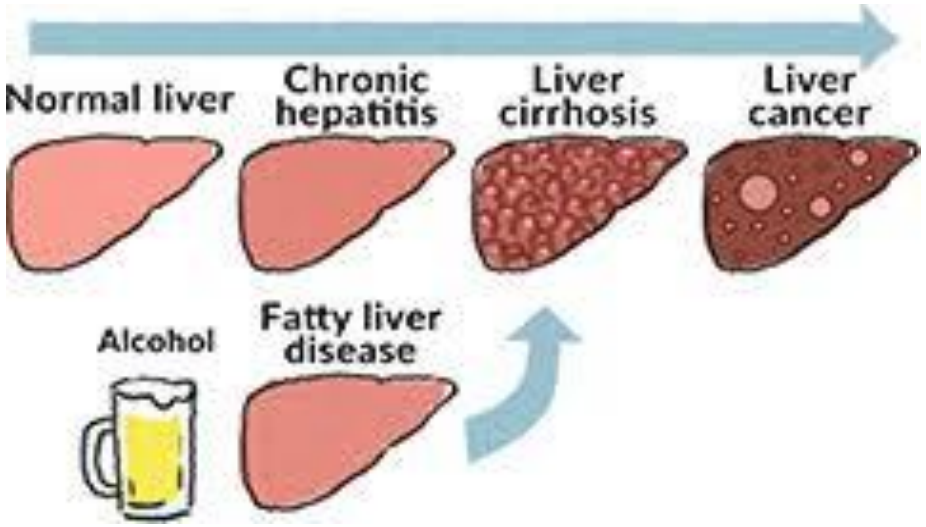
Academic Year 4

Liver Diseases and Dental Considerations

Assistant Prof Dr. Hamid Hammad Enezei

Ph.D in Oral & Maxillofacial Surgery





Liver Diseases

- **Viral hepatitis**

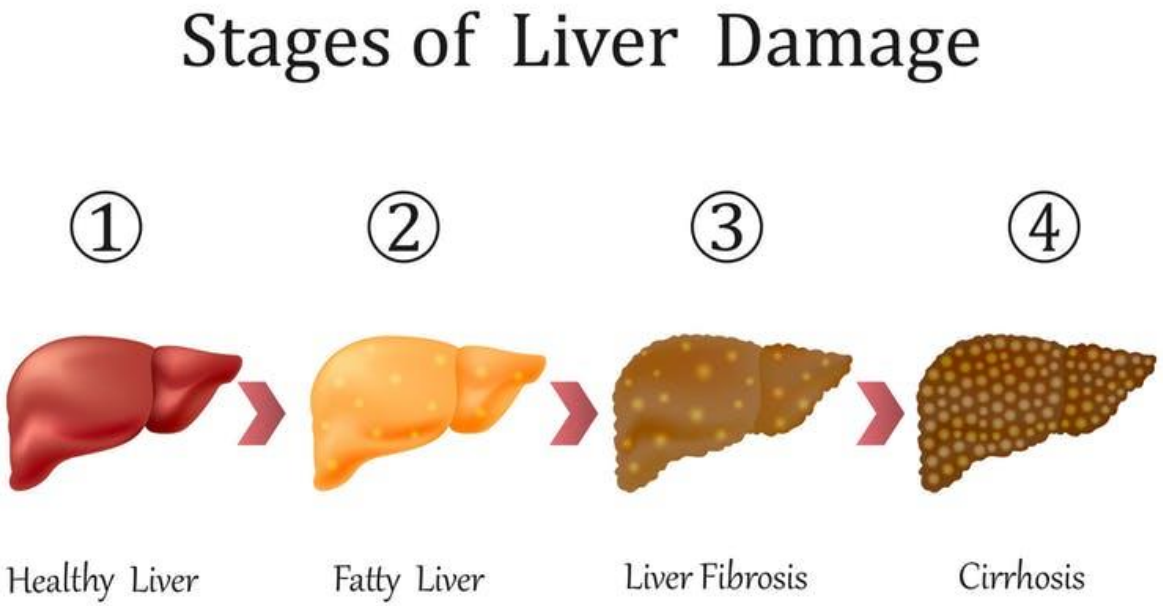
• Dental management

• Oral manifestations and complications

- **Alcoholic liver disease**

• Dental management

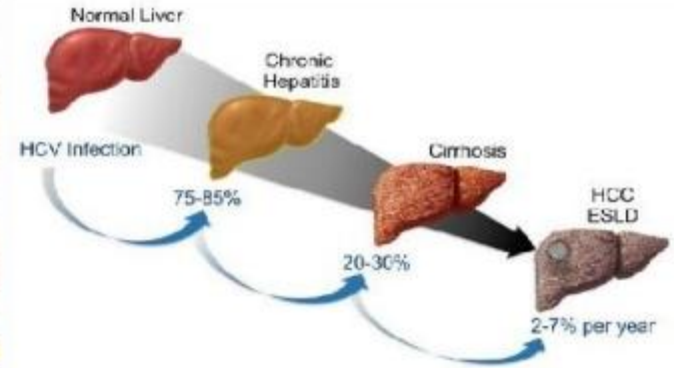
• Oral complications and manifestations



PLEASE READ THIS CAREFULLY:

Hepatitis B vaccine is made from parts of the hepatitis B virus. It cannot cause hepatitis B infection. The vaccine is usually given as **2, 3, or 4 shots** over 1 to **6 months**. Infants should get their first dose of hepatitis B vaccine at birth and will usually complete the series at **6 months** of age

Vaccination of Hepatitis B virus for the students is mandatory before starting any clinical exposure or dealing with the patients

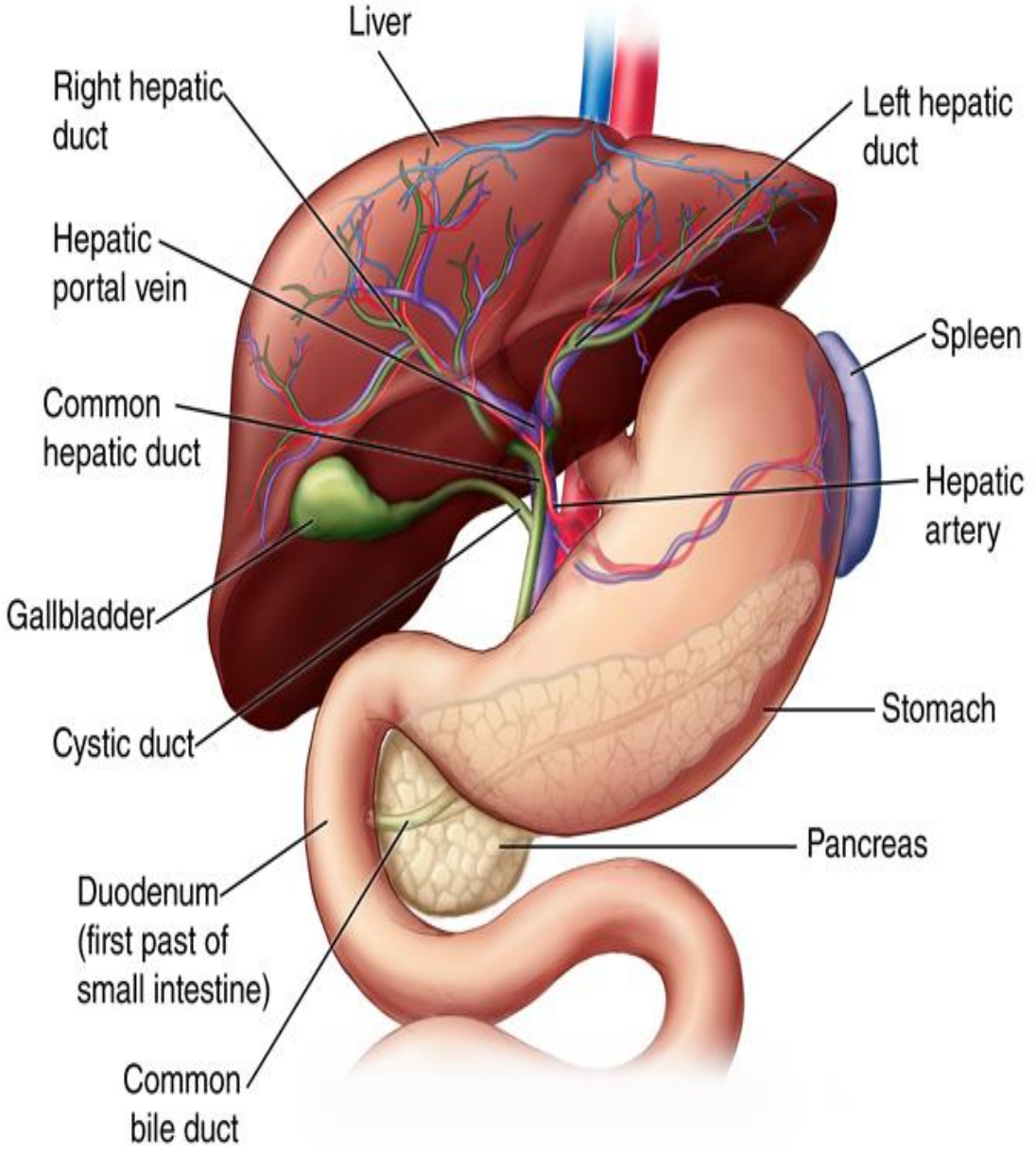


The liver

The liver is a large, meaty organ that sits on the right side of the belly. **Weighing about 3 pounds**, the liver is reddish-brown in color and feels rubbery to the touch. Normally you can't feel the liver, because it's protected by the rib cage.

The liver has two large sections, called the right and the left lobes. The gallbladder sits under the liver, along with parts of the pancreas and intestines.

The liver and these organs work together to digest, absorb, and process food



Functions of the liver

The liver regulates most chemical levels in the blood and excretes a product called bile. This helps carry away waste products from the liver. All the blood leaving the stomach and intestines passes through the liver.

The liver processes this blood and breaks down, balances, and creates the nutrients and also metabolizes drugs into forms that are easier to use for the rest of the body or that are nontoxic.

More than 500 vital functions have been identified with the liver. Some of the more **well-known functions include the following:**

•Production of bile, which helps carry away waste and break down fats in the small intestine during digestion
•Production of certain proteins for blood plasma
•Production of cholesterol and special proteins to help carry fats through the body
•Conversion of excess glucose into glycogen for storage (glycogen can later be converted back to glucose for energy) and to balance and make glucose as needed
•Regulation of blood levels of amino acids, which form the building blocks of proteins
•Processing of hemoglobin for use of its iron content (the liver stores iron)
•Conversion of poisonous ammonia to urea (urea is an end product of protein metabolism and is excreted in the urine)
•Clearing the blood of drugs and other poisonous substances
•Regulating blood clotting
•Resisting infections by making immune factors and removing bacteria from the bloodstream
•Clearance of bilirubin, also from red blood cells. If there is an accumulation of bilirubin, the skin and eyes turn yellow.

When the liver has broken down harmful substances, its by-products are excreted into the bile or blood. Bile by-products enter the intestine and leave the body in the form of feces. Blood by-products are filtered out by the kidneys, and leave the body in the form of urine.

Viral hepatitis

Today, viral hepatitis has become a silent epidemic worldwide. It is the major cause of liver cirrhosis and liver carcinoma. In a dental office, infections can be expedited through several routes, including direct or indirect contact with blood, oral fluids, droplet splatter, aerosols, etc.

Viral hepatitis is **an infection that causes liver inflammation and damage**. Inflammation is swelling that occurs **when tissues of the body become injured** or **infected**. **Inflammation can damage organs**. Researchers have discovered several different viruses link that cause hepatitis, including **hepatitis A, B, C, D, and E**

The dental management of hepatitis patients is very important. Also, as most dental professionals are aware, infection control practices are developed to minimize infection to the caregiver.

Knowing which hepatitis a patient has or had will help determine if any additional precautions are needed.

According to the American Dental Association, dental providers are at a three- to four-fold risk of contracting the hepatitis B virus compared to the general population.

The hepatitis B vaccine that we are required to have as dental professionals and the precautionary methods we take greatly decreases the risk of obtaining the virus.

According to the Centers for Disease Control and Prevention, completing the series of **vaccine shots for the hepatitis B virus protects us from becoming infected.**

This then leaves us more at occupational risk of infection from hepatitis C. In dentistry, hepatitis C is mainly incurred by a percutaneous injury such as from a needle stick or sharp instrument. With this risk, there's a 1.8% risk of getting an infection. **Hepatitis C has been detected in saliva**, but there hasn't been a documented case of salivary transmission.

Implementing proper infection and sterilization measures and documenting a thorough medical history will increase the greatest results when dealing with these infectious viruses.

Severity of Hepatitis

Hepatitis is either **acute** or **chro**nic. This is a global disease, and World Hepatitis Day is observed **on June 28th to raise global awareness of hepatitis**.

Acute hepatitis – Acute hepatitis is generally caused by **viral infections** and **resolves within six months**. It will usually resolve on its own, **progress** to a **chronic state**, or **result in acute liver failure**. It's characterized by affecting many different **body systems**.

1-The initial phase includes flu-like symptoms: fatigue, nausea, vomiting, poor appetite, joint pain, and headaches, which are similar symptoms to other viral infections.
Fever tends to be more common in **hepatitis A** and **E**. Late in this phase, **liver-specific symptoms** such as **dark urine** and **clay-colored stools** may be experienced.

2-The second phase is **jaundice** after about **one to two weeks** from the **initial phase** and may **last up to four weeks**.
An **enlarged liver and right upper abdominal pain may increase**.
Unintentional weight loss is likely.

3-The recovery phase is the resolution of all clinical symptoms, but **increased liver lab values** and a **persistently enlarged liver remain.**

Fulminant hepatitis – **quick and sudden liver failure** – is rare and mainly occurs in **hepatitis B, D, and E**. About one to **two percent of hepatitis E can lead to fulminant hepatitis**, and **pregnant women are more susceptible**, **occurring in 20% of cases.**

Chronic hepatitis – Chronic hepatitis is **inflammation that continues for more than six months**, **presenting similar to acute hepatitis** but **mainly manifests signs and symptoms specific to the liver.**
Having chronic hepatitis may not initially expose symptoms since the **virus can lay dormant in cells**. It may not reveal symptoms until years after contracting hepatitis. It causes dysfunction of the liver and long-term inflammation and eventually damages the liver or leads to death. **Chronic hepatitis is most common with hepatitis B and C.**

Infectious hepatitis – Viral hepatitis infections are the common ones we hear about, such as A, B, C, D, and E. The symptoms for viral hepatitis are generally the same throughout:

- Fatigue
- Sudden nausea and vomiting
- Abdominal pain, especially on the right side beneath the lower ribs near the liver
- Clay-colored bowel movements
- Dark urine
- Loss of appetite
- Low-grade fever

Hepatitis A (HAV) – Hepatitis A is a highly contagious liver infection that infects liver cells and causes inflammation. It is found globally and tends to lead to outbreaks since it's correlated with contaminated water and food source
Hepatitis A is also spread when fecal matter is ingested from contact with foods, drinks, or objects through improper handwashing or sanitary issues. Eating raw shellfish from a polluted source, being in close contact and sexually involved with an infected person also spreads the virus
Symptoms last between a few weeks to a few months. The hepatitis A virus, unlike other hepatitis viruses, is mainly acute and does not cause long-term liver damage

Hepatitis B (HBV) –

Hepatitis B is a vaccine-preventable liver infection. **This is spread** through **infected blood** by **sharing needles**, **syringe**s, other **drug-injection equipment**, and **even toothbrushes** and **razors.**

Hepatitis B is also spread through **sexual contact** and may be passed from **mother to baby during pregnancy** and **childbirth.**

Jaundice may be present in this form of this virus.

Hepatitis B can **last a few weeks** or **lead to a serious chronic condition**.

It's a short-term illness for many people, although it may be **chronic and life-threatening** with **cirrhosis** or **liver cancer for others**.

The risk for **chronic infection determines** with **age**; **two to six percent of infected adults will become chronically infected,** and **90% of infants will develop a chronic condition**

Hepatitis C (HCV)

Hepatitis C causes **liver inflammation** and is the **major cause of liver cirrhosis** and **hepatocellular carcinoma**.

Causes include being **exposed to infected blood through high-risk sexual behavior**, **needles**, **blood transfusions** or **transplants**, **unclean and unsterile equipment for drug injections**, and **tattoos** or **piercings.**

Additional symptoms from the general ones listed above are **jaundice**, **abdominal fluid buildup**, **weight loss**, **spider-like blood vessels on the skin**, **easy bruising** and **bleeding**, and **confusion**. By the time symptoms are noticed, the **virus is usually into the advanced stage**.

Hepatitis C starts in the acute phase and may progress to a serious chronic infection if not treated early.

This is a **silent virus**, and people will be asymptomatic and not realize they have it **until decades** later when liver complications start to happen.

Hepatitis C is still contagious even if symptoms are not present. The **earlier this virus is detected**, the **higher the success rate of treatment and recovery**.
For this reason, the U.S. Preventative Services Task Force recommends adults ages 18-79 be screened for hepatitis C.
The largest risk group comprises people born between **1945-1965, and they are five times more likely to have this virus**.
HIV patients and prison inmates, present or previously, are at a higher risk of contracting hepatitis

Hepatitis D (HDV) :

Hepatitis D is **liver inflammation** and **infection that only affects people who are already infected with hepatitis B.**
This virus can be contracted at the **same time hepatitis B** is or **after the fact.** It is spread through **infected blood** or other **bodily fluids.**
The virus may be an **acute**, **short-term infection**, or it **can become a chronic**, **long-term infection** leading to **lifelong liver damage** and **even death**.
Hepatitis E (HEV) −Hepatitis E is a liver infection and is similar to hepatitis A by manifestation from contaminated fecal and water sources. This virus is found in the stools of an infected person. It's commonly spread in the United States by eating raw or undercooked pork, venison, wild boar meat, or shellfish. In developing countries, it's commonly spread from drinking water contaminated with feces.
Most people fully recover from this virus without any complications. Children who are infected with hepatitis E rarely even have symptoms

Type of Hepatitis

	A	B	C	D	E
Source of virus	Feces	Blood Blood derived Body fluids	Blood Blood derived Body fluids	Blood Blood derived Body fluids	Feces
Route of Transmission	Feco-oral	Percutaneous Permucosal	Percutaneous Permucosal	Percutaneous Permucosal	Feco-oral
Chronic Infection	No	Yes	Yes	Yes	No
Prevention	Pre Post Exposure Immunization	Pre Post Exposure Immunization Blood donor screening	Blood donor screening	Pre Post Exposure Immunization	Ensure Safe Drinking water

Hepatitis Treatment:

Hepatitis is diagnosed by a physical exam and risk factors involved. The medical doctor will look for jaundice, feel for an enlarged liver, and check for pain or tenderness in the abdominal area. Liver function tests involving blood work are also used and checked for high liver enzymes, which may indicate the liver is stressed, damaged, or improper liver function. Other blood tests will check for hepatitis viruses or antibodies with autoimmune hepatitis.

Hepatitis Vaccinations

Hepatitis A, B, and D are **preventable with vaccinations**. For **hepatitis A and B**, **vaccinations** are given at any age. Vaccinations are recommended for people **with higher risk lifestyles** and **activities which may contract these viruses**.

These lifestyles **include unprotected** and **multiple sex partners**, **drug use especially intravenous**, **regular international travel**, **inmates**, and **sharing personal items with an infected person**.

There are a series of **two vaccines for hepatitis A and B**, and they can be combined. Although there is no vaccination **for hepatitis D**, it can be addressed by **having the** hepatitis B vaccination.

There is no vaccination for hepatitis C

Antiviral Hepatitis Medications:

Antiviral medications are recommended with **chronic Hepatitis B and C**. **Several antiviral medications** including **entecavir (Baraclude), tenofovir (Viread), lamivudine (Epivir), adefovir (Hepsera) and telbivudine (Tyzeka)** — can help fight the virus and **slow its ability to damage patient's live**

Oral clinical manifestations :

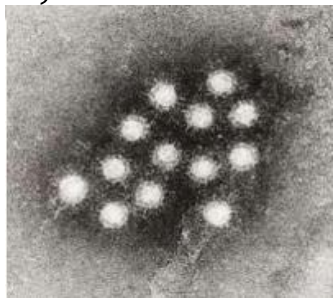
Oral manifestations of hepatitis B and C infection Manifestations in the oral cavity include lichen planus, Sjögrens syndrome, and sialadenitis, some forms of oral cancers may also be seen.
Furthermore, **cirrhotic patients may have thrombocytopenia** due to **hypersplenism** or **treatment with interferon**.

In patients with **liver disease**, the **resultant impaired hemostasis** can be manifested in the **mouth as petechiaes** or excessive **gingival bleeding with minor trauma**. This is especially suggestive if it occurs in the **absence of inflammation**.
Therefore, special care must be **taken during any type of surgery, oral or otherwise**; **severe hemorrhage can ensue as a result of the paucity of clotting factors**.

An interesting correlation exists between the increased prevalence of diabetes in patients with chronic liver disease due to the severity of liver disease or to the treatment with interferon.

HCV may act as an independent diabetogenic factor.

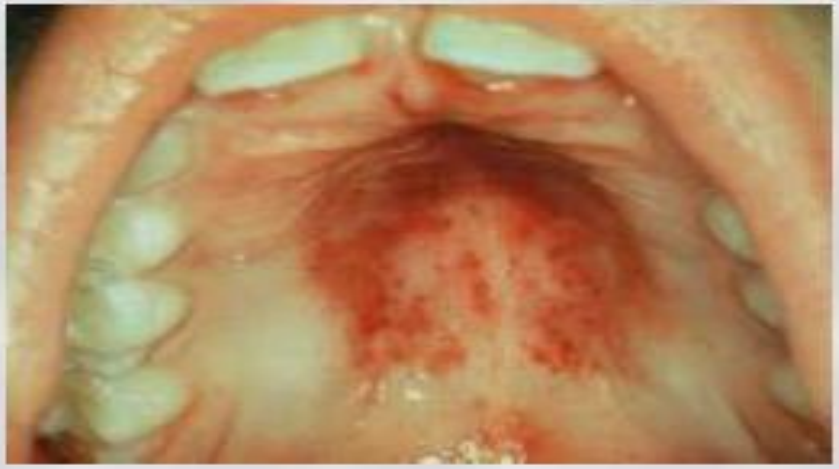
For the dentist this association has important implications because diabetes is associated with significant changes in the **oral cavity** such as **increased frequency of periodontal disease, stomatitis**, **candidiasis**, **cheilitis**, **oral leukoplakia**, and **dental caries**



Dental Management of Liver Patients

Oral Manifestations of Liver Disease

- Oral candidiasis – Immunotherapy
- Angular cheilitis – Immunotherapy
- Atrophic glossitis – Anemia
- Petechiae – Thrombocytopenia
- Lichen planus – HCV
- Oral metastases of HCC primarily manifest as hemorrhagic expanding masses located in the premolar and ramus region of the mandible



Management of patients with hepatitis B and C infection in **dental office**

The most important and frequent problems associated with hepatitis B and C in dental settings include the risk of viral contagion on the part of the dental professionals and rest of patients (cross-infection),

the risk of bleeding in patients with **serious liver disease**, and **alterations in the metabolism of certain drug substances that increases the risk of toxicity**.

It has been found that HBV and HCV **exist on various surfaces in the dental operatory even many days after treating patients positive with hepatitis B and C.**

HCV can remain **stable at room temperature for over 5 days**.

Therefore, standard precautions, i.e., the **use of barrier methods**, with **correct sterilization** and **disinfection measures**, must be followed.

The conventional sterilization techniques usually eliminate specific proteins and nucleic acids (HBV DNA and HCV RNA) from dental instruments previously infected with HBV and HCV.

In case there is an accidental exposure, follow **these steps:**

1. Carefully wash the wound without rubbing, as this may inoculate the virus into deeper tissues, for several minutes with soap and water, or using a disinfectant of established efficacy against the virus (iodine solutions or chlorine formulations). Some authors suggest that pressure should be applied beneath the level of the wound to induce bleeding and thus help evacuate any possible infectious material.However, no such fact has been strongly validated. The rationale behind these measures is to reduce the number of viral units to below the threshold count required to cause infection (the infectious dose). In this sense, dilution with water may lower the viral count to below this threshold.

2. A complete detailed medical and clinical history of the patient must be recorded to rule out possible risks

Diagnosis of the disease :

The disease can be diagnosed by quantifying the levels of **HBV DNA, HBs Ag**, and the **antigen/antibody ratio** by **means of immuno-enzymatic assays.**

Different enzyme-linked immunosorbent assay and recombinant immunoblot assay techniques have been developed for the diagnosis, though the diagnostic gold standard remains detection of the viral genome using real time-polymerase chain reaction (RT-PCR) technology.

When the disease has developed and the infection is well established, **a liver biopsy must be performed to establish the amount of fibrosis and the severity of the inflammation**.

These findings help the hepatologist determine the treatment needs of the patients and help establish wise treatment decisions

Management of exposures to hepatitis B virus

Any **blood** or **body fluid exposure to an unvaccinated person** should lead to the **initiation of the hepatitis B vaccine series (Recombivax HB® 10 mcg** or **Energix-B® 20 mcg IM at 0, 1, and 6 months**).
When hepatitis B Immune Globulin (HBIG) is indicated, it should be administered as soon as **possible after the exposure (preferable within 24 h**, but it is recommended **up to 1 week following an occupational exposure).**

Hepatitis B vaccine can be administered simultaneously **with HBIG but at a separate site**.
Test for anti-HBs must **be performed 1-2 months after the last dose of vaccine**.
Anti-HBs cannot be ascertained if HBIG has been administered within the **previous 6 weeks**

Management of exposures to hepatitis C virus

On exposure to HCV, test for anti-HCV must be carried out for the source.
Baseline testing for anti-HCV and Alanine aminotransferase activity (ALT) should be carried out for the exposed person.
The most recent assays are based on the use of RT-PCR). They can **detect minute amounts** of HCV RNA (down to 10 international units (IU)/ml) and accurately quantify HCV RNA levels up to approximately 107 IU/ml.

Follow-up testing for anti-HCV and ALT activity and HCV RNA by PCR at **4-6 weeks must be carried out for**early detection.
Results reported positive by enzyme immunoassay with supplement test (e.g., recombinant immunoassay or HCV RNA by PCR) should be confirmed.
ns

Before treating a patient infected with hepatitis B or C, a compilation of a detailed clinical history is essential before dental treatment to identify patients posing possible risks,together with a thorough oral examination.

Consultation with the **patient's physician** or **specialist is advisable to establish a safe and adequate treatment plan adapted to the medical condition of the patient, considering the degree of liver functional impairment involved**.

Examination of the oral cavity **should assess** any **signs alerting to the existence of systemic disease**.
The patient should receive an explanation of the risks associated with treatment, and informed consent is to be obtained.

In subjects with **chronic hepatitis**, it is important to determine the possible existence of associated disorders (autoimmune processes, diabetes, etc.) to prevent their **direct complications** and **problems derived from specific medication use** (**corticosteroids and/or immune suppressors**).

Liver disease may often be associated with a **decrease in plasma coagulation factor concentrations**
In case any **invasive procedure** is to be performed in these patients, **prior coagulation and hemostasis tests are required, which include complete blood count**,
bleeding time, prothrombin time/international normalized ratio (INR), thrombin time, thromboplastin time, and liver biochemistry tests ,and the **hematologist and hepatologist must also be consulted**.

Usually in an **unfavorable state elective treatment is postponed**; however, **incase treatment is carried out**, the dentist must **stock up on local hemostatic agents such as oxidized and regenerated cellulose, as well as antifibrinolytic agents (tranexamic acid)**, **fresh plasma**, **platelets**, and **vitamin K.**

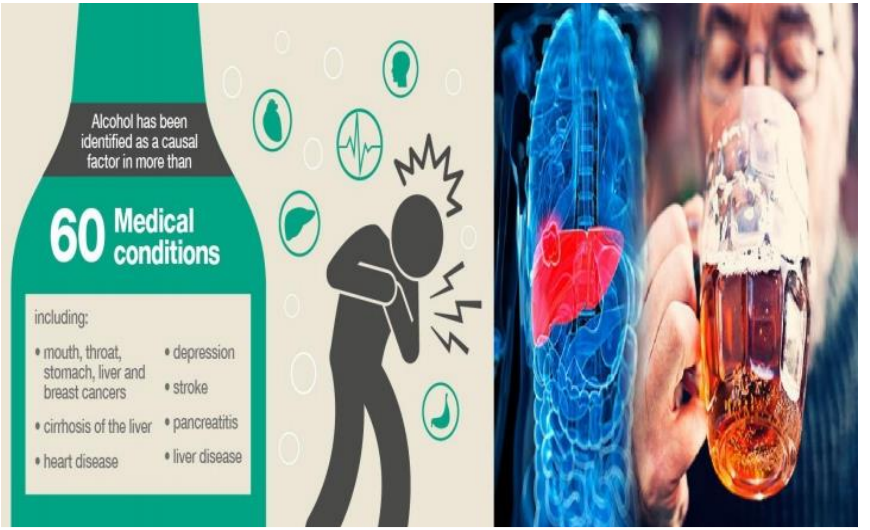
In some cases **antibiotic prophylaxis** is suggested, since liver dysfunction is associated with diminished immune competence.

Liver disease may result in alterations in the **metabolism of certain drugs**. The physician treating the patient therefore should be **consulted to establish which drugs are used**, their doses, and their possible interactions.

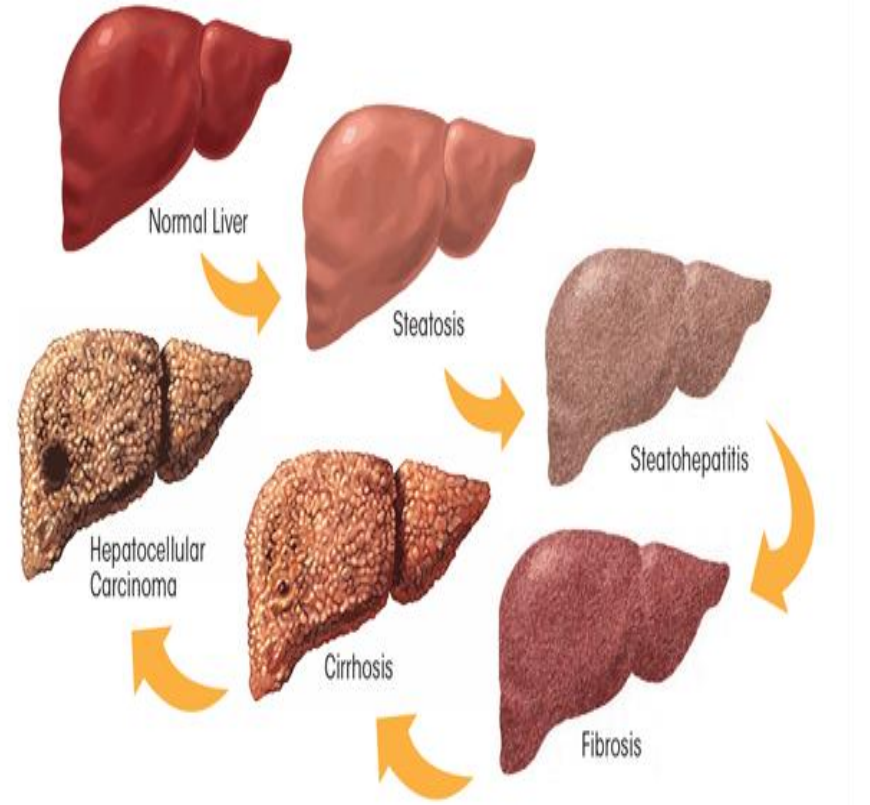
The administration of certain analgesics, antibiotics, and local anesthetics is generally well tolerated by patients with mild to moderate liver dysfunction, though modification might be necessary in individuals with advanced-stage liver disease.
In this context, drugs metabolized in the liver may have to be used with caution or their doses reduced and certain substances such as **erythromycin, metronidazole**, or **tetracyclines** must be **avoided entirely**.

Most of the antibiotics prescribed for oral and maxillofacial infection scan be used in patients with chronic liver disease, and in general the beta-lactams can be administered.
Aminoglycosides (The aminoglycosides include **gentamicin, amikacin, tobramycin, neomycin, and streptomycin** can increase the risk of liver toxicity in patients with liver disease, and **hence should be avoided.**
Non-steroidal anti-inflammatory drugs should be used with caution or **avoided**, due to the risk of **gastrointestinal bleeding** and **gastritis usually associated with liver disease.**
Prophylaxis can be provided in the form of **antacids** or **histamine receptor antag**onists.
Local anesthetics are **generally safe**, provided the total dosage **does not exceed 7 mg/kg**, combined with epinephrine.

Alcohol-related liver disease



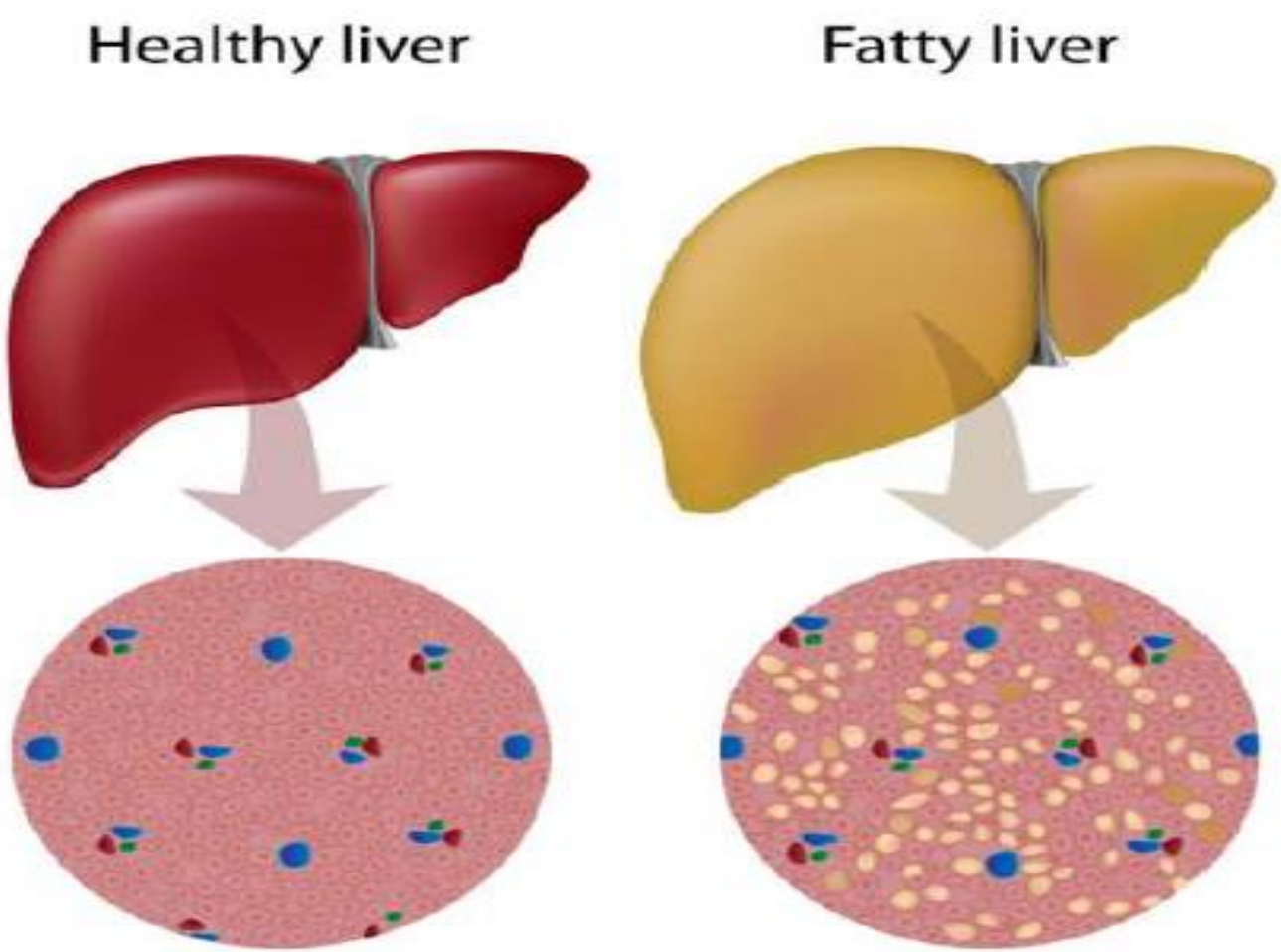
Drinking a large amount of alcohol, even for just a few days, can lead to a build-up of fats in the liver. This is called **alcoholic fatty liver disease**, and is the first stage of ARLD. Fatty liver disease rarely causes any symptoms, but it's an important warning sign that you're drinking at a harmful level
Fatty liver disease is reversible. If you stop drinking alcohol for 2 weeks, your liver should return to normal**Alcoholic hepatitis**
Alcoholic hepatitis, which is **unrelated to infectious hepatitis**, is a potentially **serious condition** that can be caused by **alcohol misuse over a longer period.**
When this develops, it may be the first time a person is aware they're damaging their liver through alcohol.
Less commonly, **alcoholic hepatitis can occur if** person drink a large amount of alcohol in a **short period of time (binge drinking).**



The **liver damage associated** with **mild alcoholic hepatitis** is usually **reversible** if person stop drinking permanently.
Severe alcoholic hepatitis, however, is a serious and life-threatening illness.

Many people die from the condition each year, and some people only find out they have liver damage when their **condition reaches this stage.**

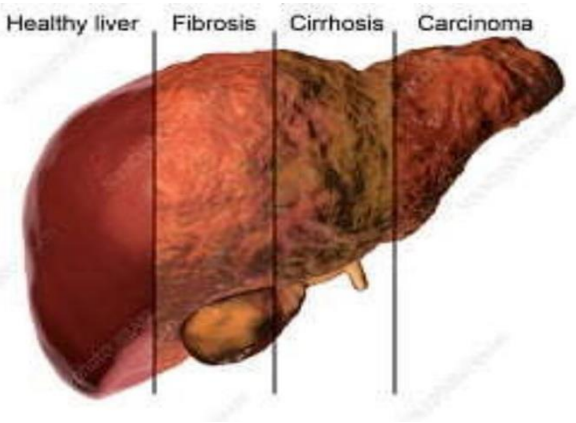
Alcoholic Liver Disease (ALD)



Alcoholic fatty liver disease

- Hepatic steatosis
- Micro-vesicular lipid droplets in hepatocytes, become macro-vesicular globules
- Large, soft, yellow, greasy liver
- Non-fibrous initially
- Severe liver dysfuncion unusual
- Reversible with abstinence

Liver Cirrhosis

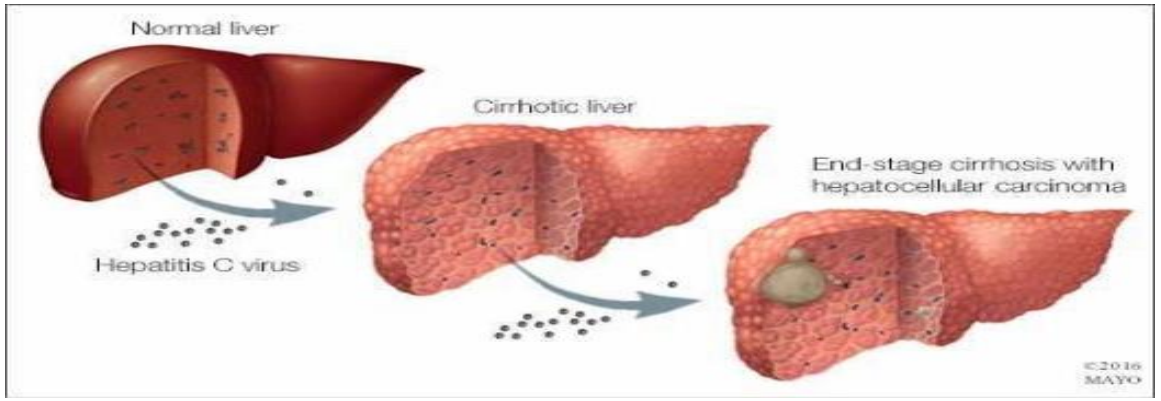


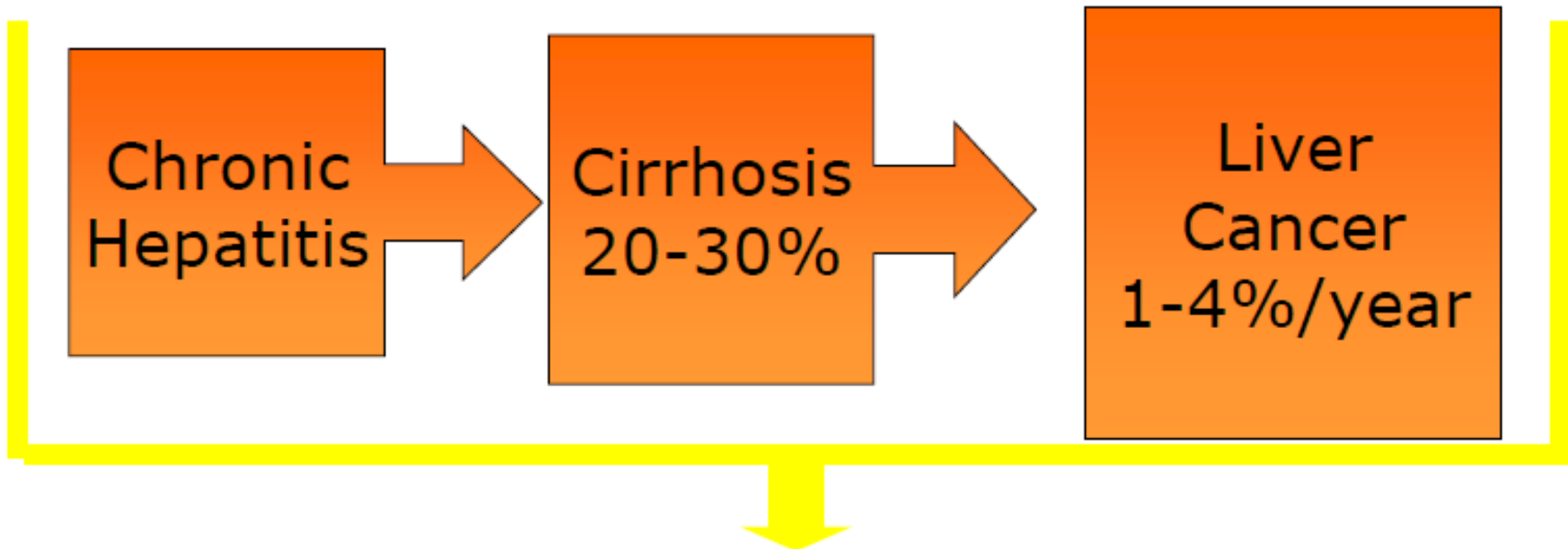
Liver Cirrhosis is a stage of ARLD where the liver has become significantly scarred. Even at this stage, there may not be any obvious symptoms.
It's generally not reversible, but stopping drinking alcohol immediately can prevent further damage and significantly increase your life expectancy.
A person who has alcohol-related cirrhosis and does not stop drinking has a less than 50% chance of living for at **least 5 more years.**
This counteract the damage from fatty liver disease, the scar tissue that develops has an altered structure that cannot hold on to lipids. Unfortunately, this makes it less capable of performing its job as a whole. Someone whose liver has extensive scarring will be diagnosed with cirrhosis. Cirrhosis refers to a liver that is stiff and swollen and barely functional.
This final stage of liver disease can cause the same symptoms as ASH, along with:
•Muscle atrophy ,Easy bruising ,Leg and/or abdominal swelling ,Bleeding in the mouth ,Vomiting blood
•Erythema of the palms ,Decrease in mental function (forgetfulness, trouble concentrating, etc.)
Lifestyle changes increase a client's chance of successful cirrhosis treatment.
Someone who has been drinking enough alcohol to cause this condition is likely dependent on or addicted to the substance and will need professional support to curb their habit.

Hepatocellular Carcinoma

Hepatocellular carcinoma accounts for the vast majority of liver cancers. Globally, **HCC is the 3 most frequent cause of cancer death**. • 78% of HCC cases caused by chronic HBV and HCV infections

- Three types of gross morphology
    1. Unifocal large mass
    2. Multifocal and widely distributed nodules
    3. Diffusely infiltrative, permeating widely
- Strong propensity for invasion of vascular structures
    - If venous invasion is identified during transplant, recurrence of HCC is likely
- Clinical manifestations often masked by underlying cirrhosis or chronic hepatitis
- Causes death by:
    - Wasting syndrome (cachexia)
    - Esophageal or gastric variceal bleeding
    - Liver failure with hepatic coma





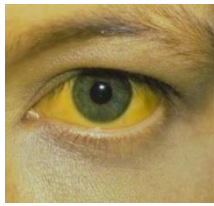
Most symptoms begin to show only when liver is more severely damaged

Manifestations of Liver Disease

• Jaundice ,• Portal hypertension • Ascites • Hepatic encephalopathy • Splenomegaly • Blood abnormalities • Light stools/Dark urine • Peripheral edema • Pruritus (itching) • Abdominal pain

Jaundice

• A yellowing of the skin and eyes from excessive bilirubin in the blood. Also causes itching. • The diseased liver either cannot processes bilirubin fast enough, or it is backing up from an obstruction to the flow of bile.



Portal Hypertension

• Increased resistance to portal blood flow.
• Leads to the formation of collateral veins that bypass the liver. Enlarged vessels are prone to rupturing causing massive bleeding and often death.

Ascites

• The accumulation of excess fluid in the peritoneal cavity.

Hepatic encephalopathy

• Disturbances in consciousness: subtle to marked confusion and stupor, to deep coma and death.
• Elevated levels of ammonia – brain edema, impaired neural function. Reversible if the underlying hepatic condition can be corrected.

Splenomegaly

• Spleen to enlarges due to increased pressure from the spleen into portal blood vessels. White blood cell count can decrease, platelet count can decrease.

Blood abnormalities

• Leukopenia and thrombocytopenia due to splenomegaly.

• Clotting abnormalities – decreased ability to synthesize clotting factors.

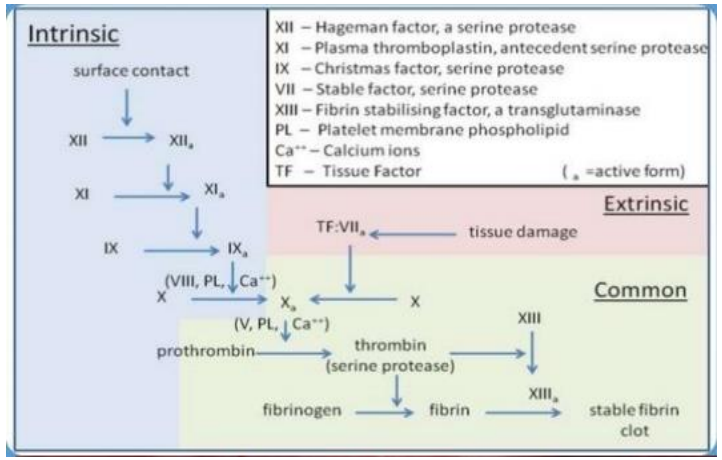
Light Stools/Dark Urine

• Bilirubin gives stool its characteristic color. In patients with hepatitis or cirrhosis, little bilirubin makes it into the gut, and stool is light in color.

• Dark brown but clear urine is a sign of **excess bilirubin in the urine**. Light stool and dark urine are generally concurrent with jaundice. Peripheral edema

Hypoalbuminemia causes reduced blood osmolarity. Fluid to escapes into the tissues. Abdominal • Abdominal pain, discomfort, or "feeling full" due to hepatomegaly or hepatocellular carcinoma.

Coagulopathy



• Hepatocellular destruction

• Reduced vitamin K absorption

• Decreased coagulation factors

• Splenomegaly • Thrombocytopenia

• Portal hypertension • Esophageal, gastric varices – massive hemorrhaging

Oral clinical manifestations

The oral cavity can **reflect liver dysfunction in the form of mucosal membrane jaundice**, **bleeding disorders**, **petechiae**, **increased vulnerability to bruising**, **gingivitis**, **gingival bleeding (even in response to minimum trauma) , foetor hepaticus** (a characteristic odor of advanced liver disease), **cheilitis**, **smooth and atrophic tongue**, **xerostomia**, **bruxism and crusted perioral rash** .
In these patients, **chronic periodontal disease is a common finding**. Patients with alcoholic hepatitis can present **glossitis**, **angle cheilitis** and **gingivitis**, **particularly in combination with nutritional deficiencies .**
Some patients who consume large amounts of alcohol for prolonged periods of time can develop **sialadenosis**.
This is believed to be the result of ethanolinduced peripheral autonomic neuropathy giving rise to alterations in salivary metabolism and secretion.

Patients with advanced **cirrhosis tend to present deficient oral hygiene**, particularly in those cases where the liver impairment is associated to **alcohol abuse**.

Extrahepatic manifestations have been reported in 74% of all HCV-infected individuals , and some of these conditions predominantly or exclusively affect the **oral region**
The main disorders associated with HCV infection are **xerostomia**, **Sjögren's syndrome (SS), sialadenitis** and **particularly lichen planus (LP)** .
Xerostomia increases patient vulnerability to caries and oral soft tissue disorders which, in combination with deficient hygiene, in turn facilitate the **development of candidiasis**.
likely first infected with HCV and posteriorly develop lichen planus ,though the way in which this-

It has not yet been demonstrated whether HCV infection causes disease similar to **primary Sjögren's syndrome** or whether it is directly responsible for development of **Sjögren's syndrome in certain types of patients**.

Some tine ,some subjects can present a triple **association of HCV infection**, Sjögren's syndrome and **sialadenitis** or **salivary gland .**Although **bacteria are the main cause of sialadenitis**, viruses such as HCV have been implicated as **causes of sialadenitis associated to xerostomia** .

The lichen planus may be significantly associated to **HCV infection**, This association appears to be dependent upon the **geographical setting**, being more common in **Mediterranean countries** and in **Japan** .

Dental management

Liver disease has important implications for patients receiving dental treatment .
The most frequent problems associated with liver disease in clinical practice refer to the **risk of viral contagion** on the part of the dental professionals and rest of patients (cross-infection), **the risk of bleeding in patients with serious liver disease**, and **alterations in the metabolism of certain drug substances ,which increases the risk of toxicity**.
It also must be taken into account that liver disease is often associated with a decrease in plasma coagulation factor concentrations
In a patient with liver disease, the surgical risk is related to the **severity of the disease**, the type of surgery planned, and the **presence of comorbidities**.
Surgery is contraindicated in patients with certain conditions such as **acute hepatitis**, **acute liver failure** or **alcoholic hepatitis** .

If invasive measures are required, **prior coagulation** and **hemostasis tests are required**: like complete blood count, bleeding time, prothrombin time / international normalized ratio (INR), thrombin time, thromboplastin time and **liver biochemistry (GOT, GPT and GGT) .**

In the event of surgery, trauma should be minimized in order to **optimize hemostasis**, with a careful surgical technique, **applying pressure to control bleeding** and **using hemostatic agents** . Based on the laboratory test findings and the treatment to be carried out, **local hemostatic agents may be advisable** (oxidized and regenerated cellulose), as well as **antifibrinolytic agents (tranexamic acid)**, **fresh plasma**, **platelets and vitamin** K

Antibiotic prophylaxis is suggested, since liver dysfunction is associated to diminished immune competence .
Liver disease may result in alterations in the metabolism of certain drugs. The physician treating the patient therefore should be consulted in order to establish which drugs are used, their doses and possible interactions .

Test	Normal values
Bleeding time	1-3 minutes
Prothrombin time	11-15 seconds
Thrombin time	15-20 seconds
Thromboplastin time	25-35 seconds
Platelet count	150.000-400.000/mm3 < 50.000/mm³: bleeding
INR	0,9-1,1

The normal coagulation test values

Drugs metabolized mainly in the liver	
Local anesthetics	Lidocaine
	Prilocaine
	Mepivacaine
	Bupivacaine
Analgesics	Aspirin
	Acetaminophen (Paracetamol)
	Ibuprofen
	Codeine
	Meperidine
Sedatives	Diazepam
	Barbiturates
Antibiotics	Erythromycin
	Clindamycin
	Tetracycline
Antifungals	Ketoconazole
	Fluconazole

. Drugs metabolized mainly in the liver ,

The administration of **certain analgesics**, **antibiotics** and **local anesthetics** is generally well tolerated by patients with **mild to moderate liver dysfunction**, though modifications may prove necessary in individuals with advanced stage liver disease .

In this context, drugs metabolized in the liver may have to be used with caution or reduce their doses reduced and certain substances such as **erythromycin**, **metronidazole or tetracyclines must be avoided entirely**

Most of the antibiotics prescribed for oral and maxillofacial infections can be used in patients with **chronic liver disease**, and in **general the beta-lactams** can be administered. **Aminoglycosides** can increase the risk of liver toxicity in patients with liver disease, and so should be avoided.

The metabolism of clindamycin in turn is prolonged in such patients, and different studies suggest that it contributes to liver degeneration .

Nonsteroidal anti inflammatory drugs (NSAIDs) should be used with caution or avoided, due to the risk of gastrointestinal bleeding and gastritis usually associated to liver disease. Prophylaxis can be provided in the form of antacids or histamine receptor antagonists

	CONTRAINDI-CATED	RECOM-MENDED
Anesthetics	Halothane Thiopentone	Isoflurane Nitrous Oxide Local anesthetics
Analgesics	Acetylsalicylic acid Codeine Indomethacin Mefenamic Acid Ibuprofen	Nitrous Oxide
Antibiotics	Tetracycline Erythromycin estolate Metronidazole	Local anesthetics
CNS depressants	Opioids	Benzodiazepi-nes
Corticoste-roids	Prednisone	Prednisolone

. Management of the different drugs in patients with liver

Acetaminophen (paracetamol) is to be avoided in patients with **serious liver disease** , and **aspirin** and **NSAID**s are not indicated in patients with **altered hemostasis**
In patients using benzodiazepines, the dose **should be lowered**, with prolongation of the interval between doses.
Local anesthetics are generally safe provided the total dosage does not exceed 7 mg/kg, combined with epinephrine.

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Academic Year 4
Chronic kidney disease, dialysis and Dental Considerations

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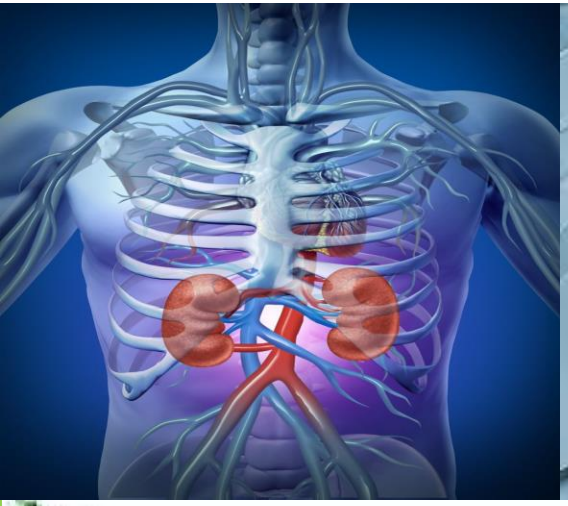
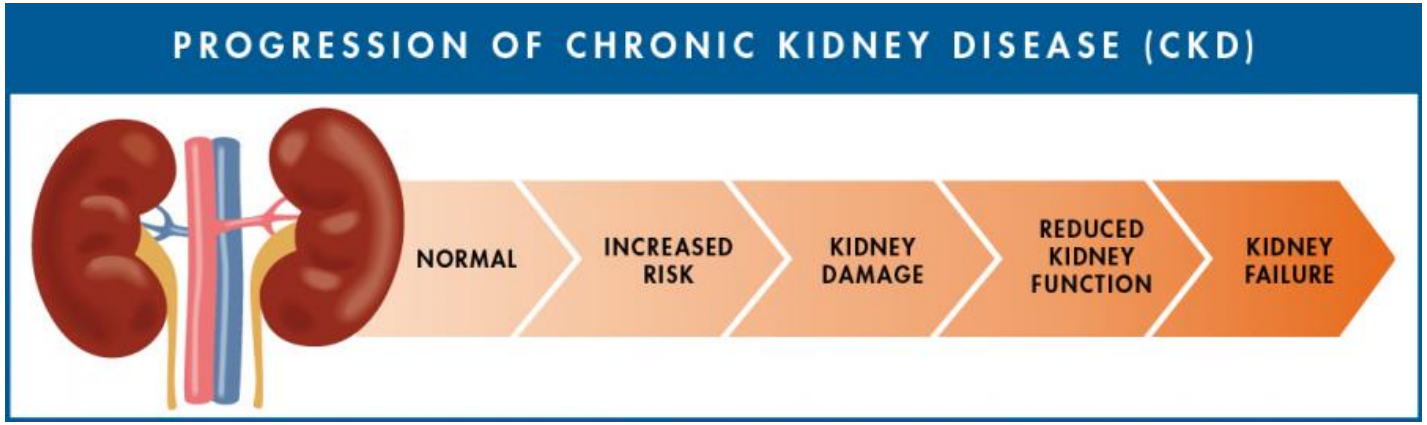
Ph.D in Oral & Maxillofacial Surgery



- **Chronic kidney disease and dialysis**
- ● Chronic kidney disease
- ● Dental management
- ✓ Patients receiving conservative care
- ✓ Dialysis
- ✓ Renal transplant
- ● Oral complications and manifestations

Causes of chronic kidney disease **include :diabetes**, **high blood pressure**, **glomerulonephritis**, and **polycystic kidney disease.**

Risk factors include a **family history of chronic kidney disease**.

Diagnosis is by **blood tests** to measure the estimated glomerular filtration rate (eGFR), and a **urine test** to measure **albumin**.
Ultrasound or **kidney biopsy** may be performed to determine the underlying cause.

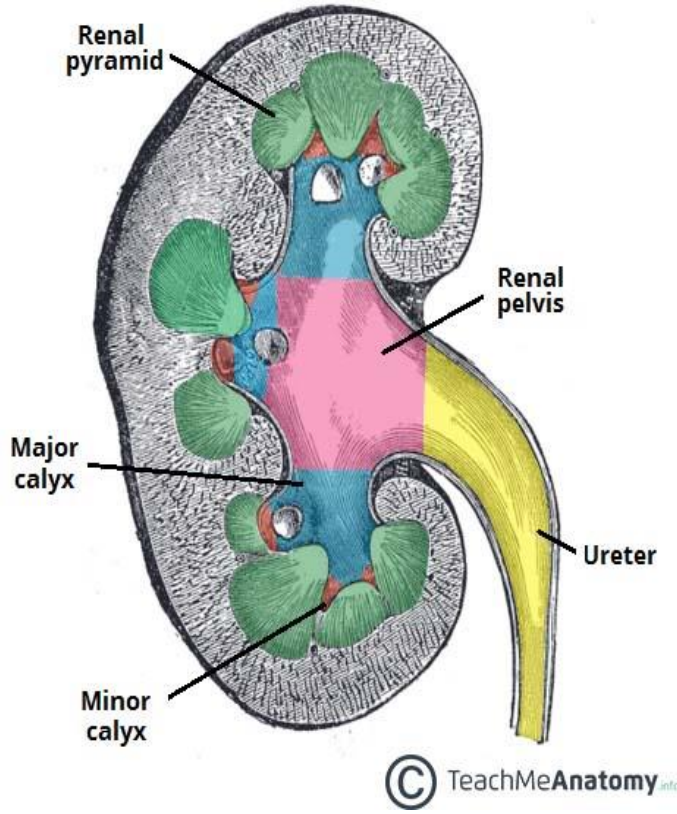
Several severity-based staging systems are in use. **Screening at-risk people is recommended**.
Initial treatments may **include medications** to **lower blood pressure**, **blood suga**r, and **cholesterol**.

Angiotensin converting enzyme inhibitors (ACEIs) or angiotensin II receptor antagonists (ARBs) are generally first-line agents for **blood pressure control**, as they slow progression of the **kidney disease** and the **risk of heart disease.**

Loop diuretics may be used to control edema and, if needed, to further lower blood pressure.

NSAIDs should be avoided. Other recommended measures include staying active, and **certain dietary changes** such as a low-salt diet and the right amount of protein.

Treatments for anemia and bone disease may also be required.
Severe disease requires hemodialysis, peritoneal dialysis, or a kidney transplant for survival



Chronic kidney disease

The **kidneys** are bilateral bean-shaped organs, reddish-brown in colour and located in the posterior abdomen. Their main function is to filter and excrete waste products from the blood. They are also responsible for water and electrolyte balance in the body.

Metabolic waste and excess electrolytes are excreted by the kidneys to form **urine**. Urine is transported from the kidneys to the bladder by the ureters. It leaves the body via the urethra, which opens out into the perineum in the female and passes through the penis in the male.

- **Anatomy of the kidneys** – their anatomical position, internal structure and vasculature

The kidneys lie **retroperitoneally** (behind the peritoneum) in the abdomen, either side of the vertebral column. They typically extend from **T12 to L3**, although the right kidney is often situated slightly lower due to the presence of the liver. Each kidney is approximately three vertebrae in length.

The adrenal glands sit immediately superior to the kidneys within a separate envelope of the **renal fascia**

'Chronic' means a condition that is **long term** and **does not get better**, but it does not always mean that it is **serious.** So chronic kidney disease (CKD) describes any **abnormality in kidney function**, even if the kidneys may only be slightly damaged.

Guidelines for doctors from NICE say that people who have relatives with **Autosomal dominant polycystic kidney disease** (ADPKD) should be offered testing for CKD. Patient with the ,Diabetes ,High blood pressure

•Heart disease ,Problems with the structure of kidneys or urinary tract (eg kidney stones, prostate problems in men)

•Other diseases that affect the kidneys (eg systemic lupus erythematosus), Blood or protein in your urine. **are liable to CKD .**

•CKD should never be diagnosed based on a single test. Instead, specialist doctor should only diagnose CKD after at least three tests done over at least three months.

Doctors divide CKD into five stages, according to the percentage of the remaining healthy kidney function.

The stage will be based on the estimated **glomerular filtration rate** (eGFR) and other problems may have.

Glomerular filtration rate (GFR) is a measure of how much fluid your kidneys can filter in a minute. There are a number of ways to measure GFR but in clinical practice, it is estimated based on the creatinine levels in your blood, your age, gender and ethnicity. This estimate or eGFR is roughly the same as % function. So an eGFR of 90 is roughly 90% kidney function.

Use the links below to learn about each stage of kidney disease:

- ***Stage 1 with normal or high GFR (GFR > 90 mL/min)***
- ***Stage 2 Mild CKD (GFR = 60-89 mL/min)***
- ***Stage 3A Moderate CKD (GFR = 45-59 mL/min)***
- ***Stage 3B Moderate CKD (GFR = 30-44 mL/min)***
- ***Stage 4 Severe CKD (GFR = 15-29 mL/min)***
- ***Stage 5 End Stage CKD (GFR <15 mL/min)***

kidney disease in which there is gradual loss of **kidney function** over a period of months to years.

Initially there are generally **no symptoms**; **later**, symptoms may include leg swelling, **feeling tired**, **vomiting**, **loss of appetite**, and **confusion**.

Complications can relate to **hormonal dysfunction of the kidneys** and include (in chronological order) high blood pressure (often related to activation of the Renin-Angiotensin-Aldosterone system), **bone disease**, and anemia.

Additionally CKD patients have markedly increased cardiovascular complications with increased **risks of death** and **hospitalization**.

Oral manifestation of CKD

The mouth is a powerful mirror AND diagnostic tool in the clinical assessment of systemic health . Peculiar oral findings have been reported in diseases such as **Human Immunodeficiency Virus (HIV)** infection where unusual oral lesions have aided the diagnosis of HIV infection among routine dental patients . Other diseases where oral manifestations may **play a vital role** in the diagnosis and management include **diabetes mellitus** , coronary heart disease , **graft versus host disease and chronic kidney disease** .

Generally, the reported oral lesions in systemic illness include periodontitis, white patches, red patches, mucositis, oral candidiasis, burning sensation, changes in salivary composition and flow rates, pale mucosa and **abnormal pigmentation** .The presence of these specific oral lesions is not only helpful in detecting underlying systemic diseases but may also indicate the severity of such systemic diseases.

Chronic kidney disease (CKD) like many other systemic diseases, have associated oral problems arising from the disease process or the effects of therapy or both. Consequently, untreated oral lesions may worsen the clinical presentation and prognosis . CKD is associated with clinical and radiographic changes in the mouth .

The radiographic changes include loss of lamina dura, **maxillary and mandibular radiolucent lesions** . The clinical findings in CKD patients are essentially as stated for oral lesions in systemic disease . Unfortunately, attention to the oral aspects has been lacking despite the many merits associated

High graft rejection rate (in kidney transplant patients) and increase in systemic inflammatory burden which worsen the underlying systemic disease are consequences of untreated oral lesions in CKD.

The cause effect relationship between oral infections and systemic diseases is yet to be fully established; **Poor dental awareness among the patients and some medical colleagues are contributory factors**

Oral lesions are usually due to restricted diets, malnutrition, mouth neglect, immunosuppression and the effects of medications and uremic toxins on the oral tissues . CKD patients on hemodialysis have also been found to be associated with **reduced dental vi**sits which further **worsen the oral care .**
A common oral symptom of CKD is the **sensation of a dry mouth**, which may be caused by restricted fluid intake which is necessary to accommodate the reduced excretory capacity of the kidney, adverse effects of drug therapy, and the low salivary flow rate

Abnormal lip pigmentation, Oral and cutaneous hyperpigmentation in renal patients is due to inability of the kidney to excrete excess beta melanocyte stimulating hormone (b-MSH), the accumulation of which results in the stimulation of melanocyte at the basal layer of oral epithelium .

Abnormal taste has been commonly reported . The mechanisms underlying alterations in taste perception in uremia patients are unknown, but are probably attributable to **influences of ureamic toxins** on the central nervous system (CNS) and the peripheral nervous system (the taste receptors) .

Bleeding gum has been attributed to poor oral hygiene, ginigival/periodontal inflammation and bleeding abnormalities

Burning mouth sensation which was significantly higher in CKD patients (16%) was a consistent finding in many other studies. It was attributed to effects of dry mouth, damage to peripheral nerves by the **ureamic toxins** and **effects of medication**

In CKD, there is usually fluid restriction, electrolyte imbalance, and use of medications, such as **frusemide** and **hydrochlorothiazide**. These may contribute to the complaint of a **dry mouth .**

The aetiological factors such as diabetes mellitus, hypertension, amyloidosis and autoimmune disease not only cause renal disease but also initiate salivary gland disease independently. In Africans, the commonest aetiology of renal disease is glomerulonephritis which usually results from infections. The complaint of halitosis was significantly higher in CKD patients (12%) and has been attributed to dry mouth, poor oral hygiene and ureamic smell.

Reduced salivary flow rate is a consistent finding in CKD patients and it has been reported that reduce flow is **due t**o effects of **drugs**, **emotional stress** and **neuropathy in CKD patients**

Oral candidiasis was more prevalent in CKD cases and may be due to **immune suppression from malnutrition**, **restricted diets, anaemia**, **stress**, and **immunosuppressive drugs.**

Gingival swelling, because of the poor oral hygiene and some medication are use such as **nifedipine**, **cyclosporine** and **tacrolimus**.

Systemic inflammation arising from oral infection could have an effect on microvasculature of heart and kidney .The possible establishment of bi-directional relationship between oral infection such as between periodontitis and heart disease has also been postulated between oral lesion and kidney disease .This probably explains the lower mean GFR in CKD subjects with oral lesions when compared with a relatively higher mean GFR in CKD subjects without oral lesions.

Dental treatment

Since kidney diseases may be more or less severe, there is no **uniform dental treatment**. Nevertheless, an invasive dental treatment requires **consultation with the nephrologist who administers prophylactic antibiotic therapy** Penicillin or cephalosporin are usually administered. Tetracycline and streptomycin should be avoided because they are nephrotoxic. **Patients should be asked if they suffer from allergies because allergy to penicillin is quite common**. Due to poor gastrointestinal resorption, antibiotics should be administered i.V. I.m. administration may show counter-indications because of kreatinine increase.

In patients with chronic kidney disease the **endodontic treatment** of the deciduous and multi-root teeth should be **avoided** at all costs because of **increased infection risk**. We should also avoid treatments of gangrenous teeth and those with apical parodontitis because they **can later develop into an inflammatory focus**.

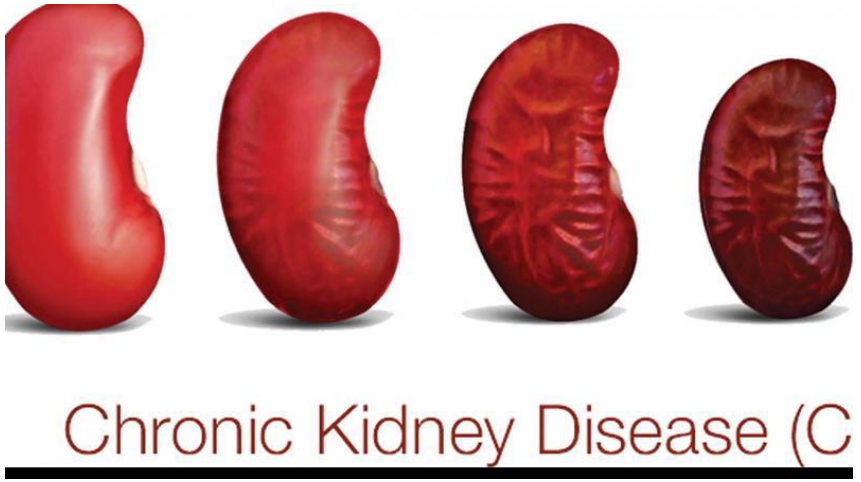
Extractions should be done with local anesthetic. As for anesthetics, anesthetics of **amidic type** should be applied such as **lidocain**, Xylocain because of their reabsorption **potential in the liver**. **Analgetics of almost any kind may be administered** and also **codeine-based medicaments that are also metabolized in the liver**. Since these patients often suffer from hepatitis B or C dentist must undertake all the precautionary measures (protective glasses, mask, cap, gloves, and inoculation against B hepatitis). If the dental intervention must be done with a total anesthetic consultations with the nephrologist or anesthetist prior to the intervention are obligatory

Patients who use dialysis

There are two possible therapies for patients with kidney dysfunction:

1.dialysis (hemodialysis, peritoneal dialysis)

2.kidney transplants



The level of kreatinine in serum should be 600-800 **micromoles per liter** (mcmol/l) if a patient is to use dialysis. Dialysis represents the perfusion of the patient's blood and the dialysis solution on **either side of the membrane**. At this, it is necessary to note that in the **course of dialysis the patient** is **given heparin in order to prevent blood coagulation outside the body**. The majority of patients undergo **dialysis three times a week** in the duration **of 4 hours**.

Heparin is an anti-coagulant agent for parenteral administration and its effect is prevention of activated coagulation factors Xa (coagulation cascade), and thus prevention of coagulation. It is retained in the circulatory system **4-6 hours** upon administration. **This fact is important because of proper timing of dental intervention**.

Accordingly, since heparin prolongs the **bleeding time** because of it's anticoagulant effect, the tooth extraction should be **done a day after dialysis** when the anti-coagulent agent's presence is reduced to the minimum while the dialysis effect is maximal. APTT and INR should be checked prior to the **surgical intervention**. **Heparin can also bring about mild thrombocytopenia .**

Approximately 90% of patients with **chronic renal failure present** with oral manifestations Treatment of CRF ranges from conservative management such as life-style changes to invasive procedures such as **dialysis or kidney transplantation** **Dental management requires prior consultation with patient's nephrologist to determine status of the disease**, **timing for dental care**, as well as procedural and pharmacologic modifications Modification include timing dental care on non-dialysis days, obtaining CBC prior to invasive treatment and considering antibiotic prophylaxis for patients with central lines. Drug modifications include avoidance of tetracycline and aminoglycosides,and dosing interval of **penicillin**, **clindamycin** and cephalosporin Multidisciplinary approach to patient's health care is critical to ensure patients **safety** and **prevent complications in the dental chair. The nephrologist** should undertake all the preparatory measures prior to sending the patient to his/her dentist. In addition to bleeding, the patients who undergo dialysis are also **very sensitive to infection**. Because of possible bacterial infection the prophylactic administration of antibiotics of broad specter is strongly recommended. We can administer cephalosporins. **Penicillin should be administered in the dosage of 2 mg after dialysis.**

Surgical interventions should be made with local anesthetic. The general anesthesia is to be avoided because of **concomitant hypertension, arteriosclerosis** and **anemia**

Patients with kidney transplants:

In general, kidney transplants involve the **risk of transplanted organ rejection**. In order to prevent this, patients who have undergone an **organ transplant operation**, are **given large doses of immunosuppressants** such as **corticosteroids, azatioprin, cyclosporine A** and **anti-lymhocite globulin** .

These patients are **extremely sensitive to infection**. After tooth extraction the wound healing is significantly impaired. The immunosuppressant therapy may involve many **side effects that, in turn**, may largely affect oral surgical intervention. The side effects are hypertension, increased bleeding, diabetes. Accordingly, in patients who underwent **kidney transplant operations prophylactic antibiotics should be administered in consultation with the patient's physician**. **Because of potential adrenalin crisis risk it is necessary to alter steroid therapy**. If the stress suffered during the **oral surgical intervention is minimal**, the therapy should not be altered. If the stress is insignificant, it is recommended to **increase the steroid dosage twice a day two days prior and following the oral surgical intervention**. If the stress is great, **100 mg of hydrocortisone should be administered i.m. prior to the operation**, gradually reducing dosage by **50 % on a daily basis for three days after the intervention until the dosage of 20mg which should be administered twice a day for the subsequent for** 7 days.

In any case, **steroid dosage is administered by the expert physician after consultations with the dentist and the expected stress assessment**. The patients who are getting prepared for kidney transplantation should be treated with regard to the following:

1.Comprehensive treatment of the **oral cavity should be done** ,including prophylactic measures, treating the teeth with caries, doing the necessary extractions, particularly of the gangrenous, pulpal and periorodontopathic teeth and the remaining roots.

2. Advise the patient on the importance of oral hygiene since oral infection may bring about the rejection of the organ transplant.

3. Mouth rinsing with chlorhexidine solution (0.2%) is recommended one day prior to the organ transplant operation in order to prevent candidiasis and bacterial infection.

4.The effect of immunosuppressant therapy (cyclosporin A) may induce **gingival hyperplasi**a similar to diIantine gingivitis in **epileptic patients**. Focus and remove any signs of infection ,rinsing with chlorhexidine solution prior to gingivectomy it is necessary to clean the teeth from calculus but also to motivate the patient to maintain a regular oral hygiene. **It is advisable to administer antibiotics with these patients.**

Please remember

1.Patients with kidney diseases are an extremely delicate group of patients.

2.They have tendency to infection and therefore, prophylactic antibiotics treatment is a must prior to surgical interventions.

3.They are also prone to bleeding and therefore surgical interventions should be undertaken in the days when the patient does not use dialysis.

4.We should always bear in mind that patients with kidney transplants are prescribed immunosuppressant therapy.

5. Dental treatment of such patients implies close cooperation between the dentist and the nephrologist.

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Academic Year 4

Rheumatologic and connective tissue disorders

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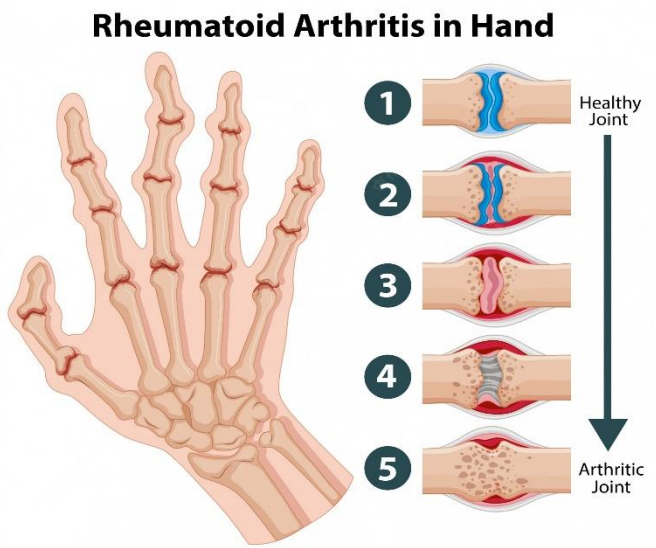
Ph.D in Oral & Maxillofacial Surgery



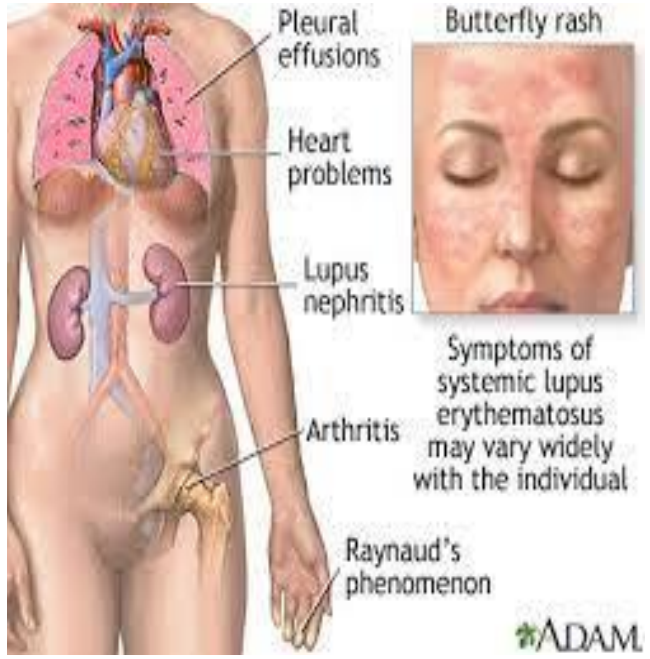
Rheumatologic and connective tissue disorders

- Rheumatoid arthritis
  - ✓ Dental management
  - ✓ Oral manifestations and complications
- Dental management of patients with prosthetic joint

A connective tissue disease or **disorder** is one that affects the **elastin and collag**en proteins within connective tissues.
Connective tissues are responsible for joining different body parts and structures together.
To date, more than 200 connective tissue diseases have been identified. A few of the most well-known and defined connective tissue diseases are scleroderma, rheumatoid arthritis, systemic lupus erythematosus, granulomatosis with polyangiitis, mixed connective tissue disease, and undifferentiated connective tissue disease.

Systemic Lupus Erythematosus

Systemic lupus erythematosus (SLE) is defined as a chronic disease that affects multiple tissues and organs such as skin, joints, heart, lungs, kidneys, blood cells, and brain. SLE has a wide range of symptoms, and their severity can range from mild to moderate and is patient dependent.
Many people with SLE experience bouts of flare-ups and periods of remission throughout their lives.
Some of the more common signs and symptoms patients experience is a butterfly-shaped rash across the cheeks and bridge of the nose, photosensitivity, fatigue, chest pain, Raynaud's syndrome, and joint pain or stiffness. Many times, lupus affects women in their reproductive years, but it can be seen in men and children as well



Scleroderma

Scleroderma is defined as a **group of connective tissue diseases that causes “hardening and tightening of connective tissue and skin.”**

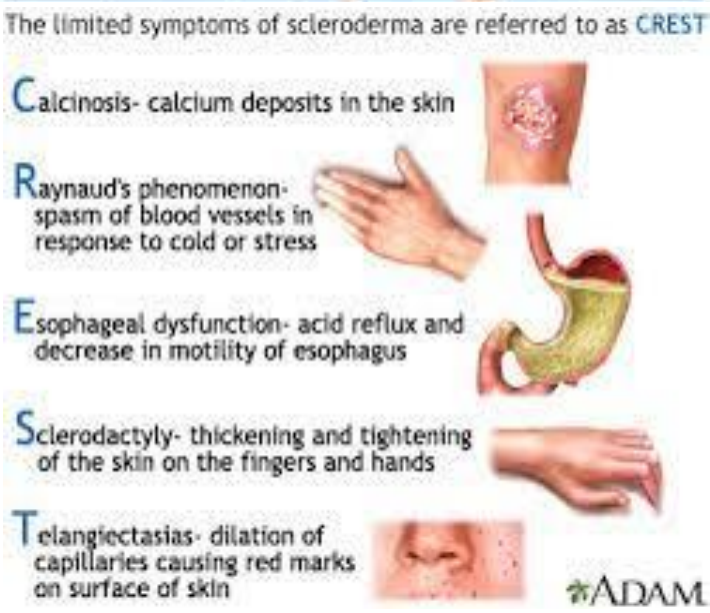
Women more frequently than men.

The two main types of scleroderma are categorized as **localized** and **systemic.**

Localized scleroderma is described as being confined to the **skin only** and can resolve on its **own without treatment.**

Systemic scleroderma can be characterized as **either diffuse** or **limited**.

Limited scleroderma is also known by the **acronym CREST Syndrome**.



It can lead to swelling of the fingers and toes, numbness and pain, and, in extreme cases, gangrene.
Tightening and swelling of the skin is also a common symptom of scleroderma.

Rheumatoid Arthritis

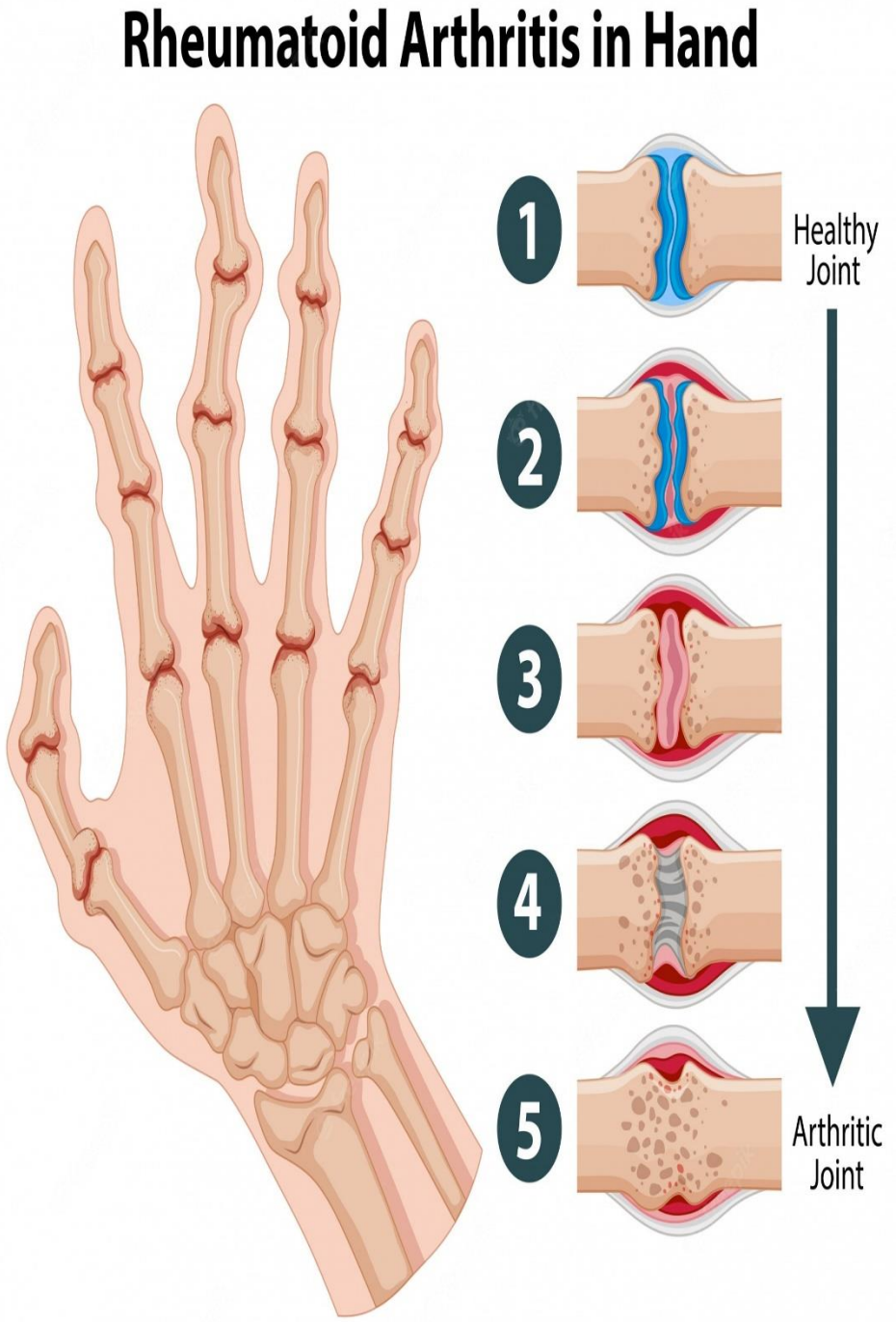
Rheumatoid arthritis (RA) is an **autoimmune disorder** that attacks the **synovium of the joints** as well as the skin, eyes, heart, lungs, and blood vessels,
arthritis.
Females are three times more likely to receive a diagnosis of RA than their male counterparts.
Rheumatoid arthritis is completely different to **osteoarthritis** which affects most of us as we **get older**.
Rheumatoid arthritis can affect **people of any age including very young children** and it is a condition where the immune system which usually protects us from infections, **starts to attack the joints causing pain**, **stiffness and swelling.**

It is very important to **diagnose rheumatoid arthritis** as soon as possible because there are very effective treatments and if the symptoms are ignored or not treated properly, joint damage can happen very quickly.
If rheumatoid arthritis is treated as soon as possible after the symptoms start, **joint damage** and **disability** can often be prevented.
Most hospital rheumatology departments now have rapid access early arthritis clinics to see people with suspected rheumatoid arthritis as soon as possible, so that treatment can start straight away and joint damage can be prevented

The most common symptoms of RA include **tenderness and pain of the joints** with or **without warmth and redness**, **stiffness** of the joints that arise first thing in the morning, as well as fever and fatigue.

Many times, the small joints of the hands and feet are affected first, and as the disease progresses, it can affect larger joints throughout the body. It is common for the same joints on both sides of the body to be involved

Diagnosing RA is based upon many factors, including a complete health history, physical examination, imaging, and blood tests that check for certain antibodies and inflammation markers that are linked to RA.



If left untreated, RA that affects the **synovium of the joints** can harm the bones as well as lead to impairment of the joints.

Because RA is considered a degenerative disease and can lead to life-alternating complications, quick and aggressive treatment is usually recommended.As with scleroderma, these patients are at high risk for developing Sjogren's syndrome. RA patients are at an increased risk for developing lymphoma, so close monitoring and follow-up with their physician is imperative

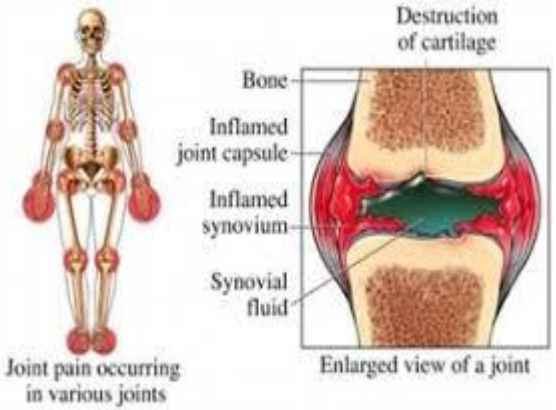
Causes rheumatoid arthritis?

Rheumatoid arthritis is an autoimmune condition, which means it's caused by the immune system attacking healthy body tissue. However, it's not yet known what triggers this.

The immune system normally makes antibodies that attack bacteria and viruses, helping to fight infection.

If the have rheumatoid arthritis, the immune system mistakenly sends **antibodies to the lining** of the joint.

This causes the thin layer of cells (synovium) covering your joints to become sore and inflamed, releasing chemicals that damage nearby: **bones, cartilage-** the stretchy connective tissue between bones, **tendons-**the tissue that connects bone to muscle, ligaments -the tissue that connects bone and cartilage



If rheumatoid arthritis is not treated, these chemicals gradually cause the joint to lose its shape and alignment. Eventually, it can destroy the joint completely.

Various theories of why the immune system attacks the joints have been suggested, such as an infection being a trigger, but none of these theories has been proven.

Possible risk factors:

There are several things that may increase the risk of developing rheumatoid arthritis, including:

•**The patient's genes** – there's some evidence that rheumatoid arthritis can run in families, although the risk of inheriting it is thought to be low as genes are only thought to play a small role in the condition

•**hormones** – rheumatoid arthritis is more common in women than men, which may be because of the effects of the hormone oestrogen, although this link has not been proven

•smoking – some evidence suggests that people who smoke have an increased risk of developing rheumatoid arthritis

a

b

Sign and symptoms of RA

The main symptoms of rheumatoid arthritis are joint pain, swelling and stiffness. It may also cause more general symptoms, and inflammation in other parts of the body.

The symptoms of rheumatoid arthritis often develop gradually over several weeks, but some cases can progress quickly over a number of days.

The symptoms vary from person to person. They may come and go, or change over time. You may experience flares when your condition deteriorates and your symptoms become worse.

Symptoms affecting the joints

Rheumatoid arthritis mainly affects the joints. It can cause problems in any joint in the body, although the small joints in the hands and feet are often the first to be affected.

Rheumatoid arthritis typically affects the joints symmetrically (both sides of the body at the same time and to the same extent), but this is not always the case.

Pain

The joint pain associated with rheumatoid arthritis is usually a throbbing and aching pain. It is often worse in the mornings and after a period of inactivity.

Stiffness

Joints affected by rheumatoid arthritis can feel stiff. For example, if your hands are affected, you may not be able to fully bend your fingers or form a fist.

Like joint pain, the stiffness is often worse in the morning or after a period of inactivity.

Morning stiffness that is a symptom of another type of arthritis, called osteoarthritis, usually wears off within 30 minutes of getting up, but morning stiffness in rheumatoid arthritis often lasts longer than this.

Swelling, warmth and redness

The lining of joints affected by rheumatoid arthritis become inflamed, which can cause the joints to swell, and become hot and tender to touch.

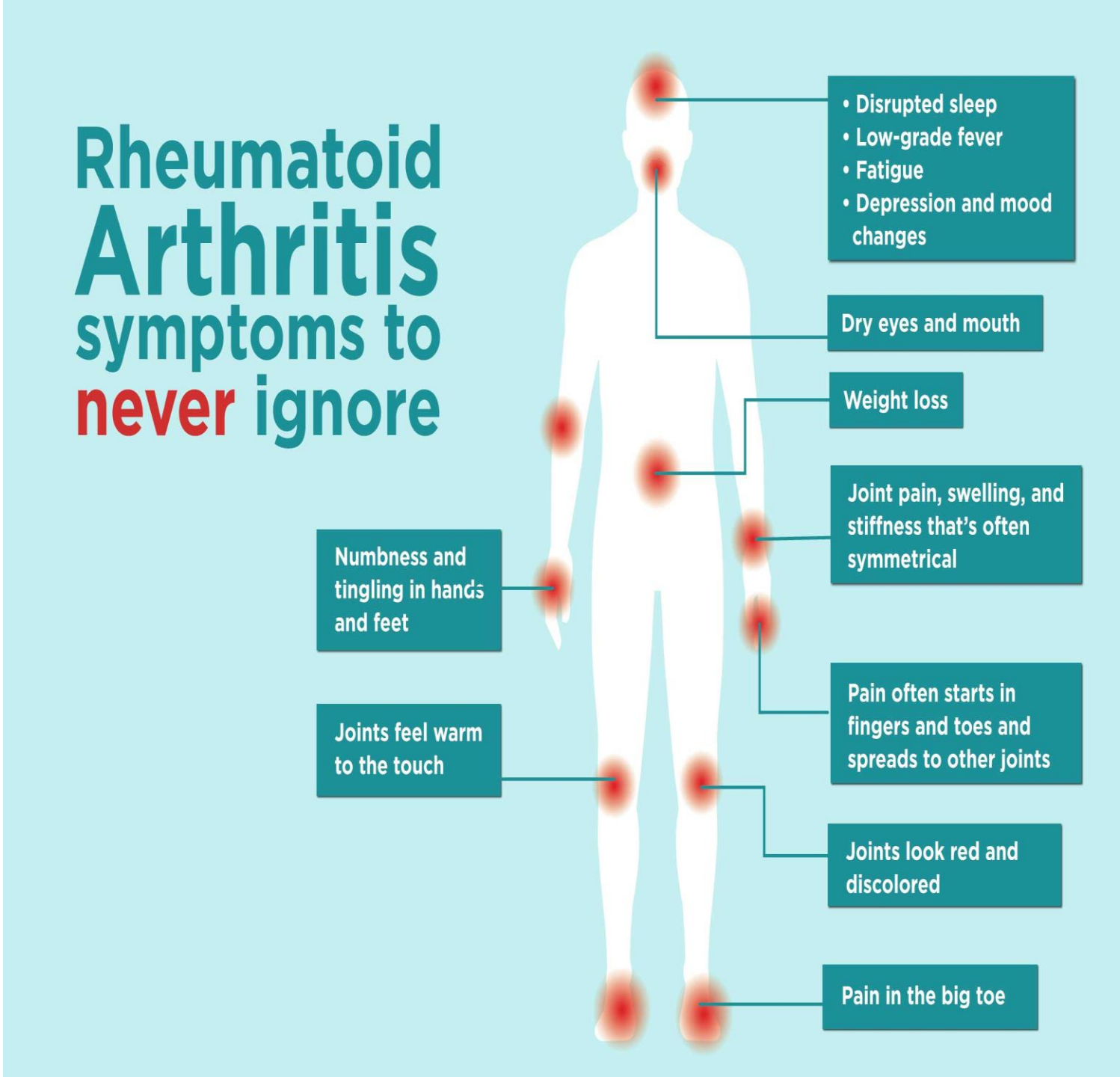
In some people, firm swellings called rheumatoid nodules can also develop under the skin around affected joints.

Additional symptoms

As well as problems affecting the joints, some people with rheumatoid arthritis have more general symptoms, such as:

- tiredness and a lack of energy
- a high temperature
- sweating
- a poor appetite
- weight loss

The inflammation that's part of rheumatoid arthritis can also sometimes cause problems in other areas of the body, such as**:** dry eyes – if the eyes are affected ,**chest pain** – if the heart or lungs are affected



Diagnosis

Rheumatoid arthritis can be difficult to diagnose because many conditions cause joint stiffness and inflammation and there's no definitive test for the condition.

Blood tests

No blood test can definitively prove or rule out **a diagnosis of rheumatoid arthritis**, but several tests can show indications of the condition. Some of the main blood tests used include:

•**erythrocyte sedimentation rate (ESR)** – which can help assess levels of inflammation in the body

C-reactive protein (CRP) – another test that can help measure inflammation levels **full blood count** – this test can be used to help rule out other possible causes of your symptoms as well as provide an indicator your general health

The full blood count test can also be used to check the anemia. **Anemia means the blood is unable to carry enough oxygen because of a lack of blood cells.** Anemia is common in people with rheumatoid arthritis, although having anemia does not prove you have rheumatoid arthritis.

Those who test positive for both **rheumatoid factor and anti-CCP** may be more likely to have severe rheumatoid arthritis requiring higher levels of treatment.

Joint scans

Scans may be done to check for **joint inflammation and damage.** These can help tell the difference **between types** of **arthritis** and can be used to **monitor how the condition is progressing over time.** Scans that may be done to diagnose and monitor rheumatoid arthritis include: **X-rays , MRI scans** (where strong magnetic fields and radio waves are used to produce detailed images of your joints).

Treatment:

Treatments for rheumatoid arthritis can help reduce inflammation in the joints, relieve pain, prevent or slow down joint damage, reduce disability and enable you to be as active as possible.

Although there's no cure for rheumatoid arthritis, early treatment and support (including medicine, lifestyle changes, supportive treatments and surgery) can reduce the risk of joint damage and limit the impact of the condition.

Your treatment will usually involve care from your GP and several different specialists.

There are medicines available to help stop rheumatoid arthritis from getting worse and reduce your risk of further problems.

These are often divided into main 2 types: disease-modifying anti-rheumatic drugs (DMARDs) and biological treatments.

Non-steroidal anti-inflammatory drugs (NSAIDs)

In addition to, or instead of, the painkillers mentioned above, your doctor may prescribe a non-steroidal anti-inflammatory drug (NSAID).
This may be a traditional NSAID, such as ibuprofen, naproxen or diclofenac. Or a COX-2 inhibitor, such as **celecoxib** or **etoricoxib.**
These medicines can help relieve pain while also **reducing inflammation** in the joints, although they will not stop rheumatoid arthritis getting worse over time.
NSAID patient should take, and the **benefits** and **risks associated with it**.
Although uncommon, taking NSAIDs can increase the risk of **serious stomach problems**, such as **internal bleeding.**
This is because the medicines can **break down the lining that protects the stomach against damage from stomach acids**.
such as a proton pump inhibitor (PPI).

Steroids

Steroids are powerful medicines that can help reduce pain, stiffness and inflammation. **They can be given as:**
•a tablet (for example, prednisolone)
•an injection directly into a painful joint
•an injection into a muscle (to help lots of joints)
They're usually used to provide **short-term pain relief** – for example, while you're waiting for DMARD medicines to take effect or during a flare-up. **Steroids are usually only taken** for a short time because long-term use can have serious side effects, such as: **weight gain, osteoporosis** (weakening of the bones) , easy bruising ,muscle weakness
•thinning of the skin

Oral manifestation:

Oral health complications due to RA and its treatments can cause additional problems for patients. A recent study found that approximately 30% of RA patients were taking additional analgesics specifically for oral pain.Due to their immunosuppressive effects, RA medications can promote periodontitis, candidiasis and oral ulceration aided by a lack of saliva.

The three main oral conditions associated with RA

Periodontal disease

Periodontal disease (PD) is a chronic inflammatory condition which leads to destruction of the periodontal ligament and alveolar bone, and can result in tooth loss.

PD is caused by the presence of pathogenic gram-negative anaerobic bacteria within the biofilm attached to the sub-gingival tooth surface.

Porphyromonas gingivalis (Pg) is the main pathogen in PD.Its virulence combined with an intense host immune response is thought to contribute to the severity of the disease.

People with RA are almost twice as **likely to have PD than** those without.

RA patients with severe PD have significantly higher DAS-28 scores than those with moderate or no periodontitis, and PD is associated with increased radiographic joint damage.

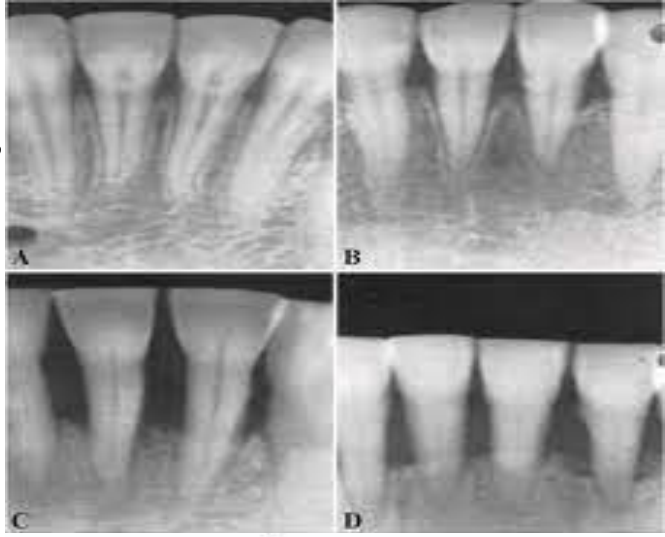
These data strongly suggest an association between RA and PD/tooth loss.

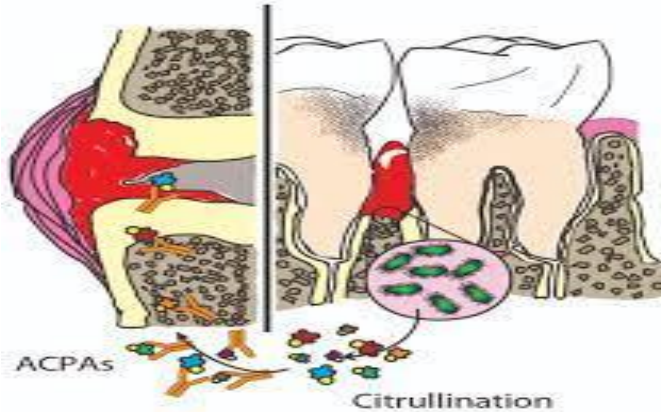
This association is independent of common risk factors such as smoking, alcohol intake, socioeconomic background and poor oral hygiene.

RA and PD are both chronic inflammatory diseases. Both conditions feature excessive destruction of collagen-rich tissues: in RA these are bone, cartilage and other periarticular tissues; in PD these are alveolar bone, periodontal ligament and gingiva.

Alveolar bone loss in PD results from the activation of osteoclasts and is very similar to bone erosion in RA, which is caused by cytokine-driven osteoclast activation.

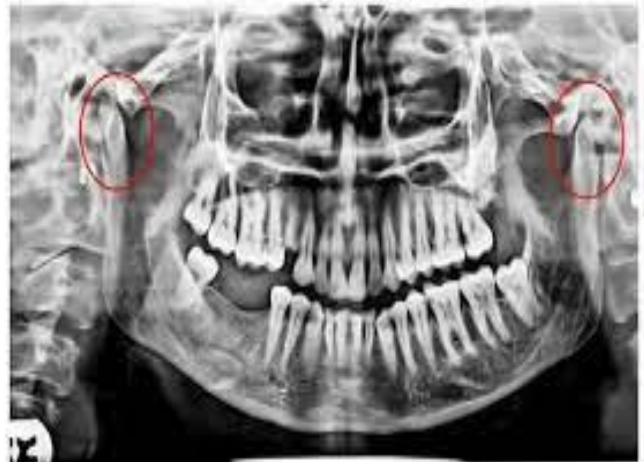
PD may be involved in the initiation and/or maintenance of systemic inflammation in RA. The level of Pg antibodies has been found to positively **correlate with levels of ACPA in circulation in RA**. Pg is the only bacterium known to express a PAD enzyme, which can cause the citrullination of bacterial and host proteins.





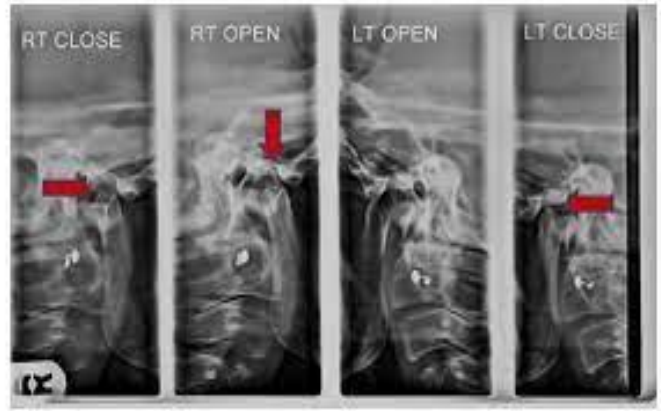
Effective control of PD for RA patients is important to reduce both local and systemic inflammation, and the likelihood of bacteraemia.

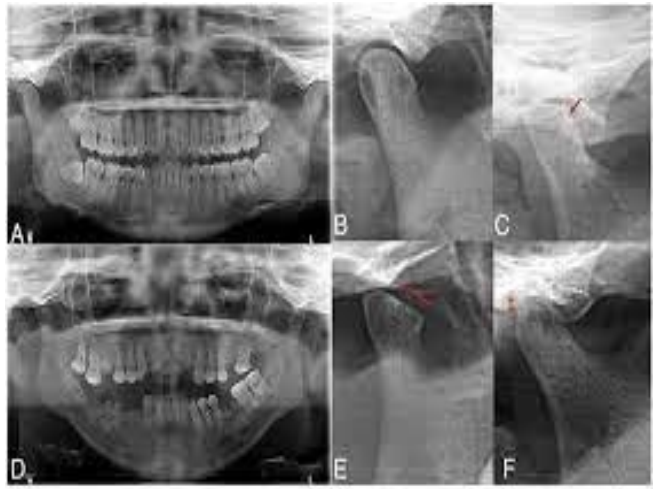
Reduction in disease activity may be due to less inflammatory products, bacteria and endotoxins in the bloodstream after periodontal treatment, thereby reducing the exposure of joints to these products.
Longer-term clinical trials are currently in progress to find out whether non-surgical periodontal treatment can lead to an improvement in clinical outcomes and quality of life for patients with active RA. A recent systematic review also highlighted the importance of smoking cessation, which results in improved outcomes for non-surgical periodontal therapy.



Temporomandibular dysfunction:

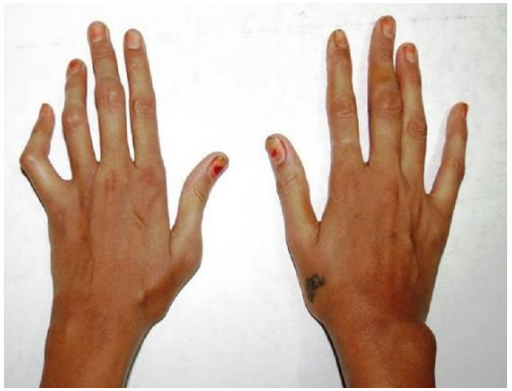
The temporomandibular joint (TMJ) is used up to 2,000 times a day for chewing and speaking, making it one of the most frequently used synovial joints in the body.
People with RA have a higher frequency and greater severity of temporomandibular dysfunction (TMD) than the normal population.
The estimated prevalence of TMJ symptoms in adults with RA is between 5–86% (depending on diagnostic criteria, assessment methods and the population studied) with clinical involvement of the TMJ seen in about 50% of cases.





RA patients with TMD may present with pain, difficulty with opening the mouth, ‘locking’ of the jaw, tenderness of the TMJ/masticatory muscles, and joint sounds.
The most frequent joint sound is clicking, followed by crepitus (which indicates TMJ degeneration but may be seen less often due to improved RA medication).
It is thought that pain in TMD is associated with RA disease activity, and impairment in the range of motion and function of the TMJ are more likely due to degeneration of the joint.
Patients may also report associated symptoms such as ear pain/stuffiness, tinnitus, dizziness, headache and neck pain.

It is important to note that the TMJ may already be affected by RA in patients who do not yet report TMD symptoms.



Clinical signs of TMJ involvement include **swelling**, **reduced range of motio**n and/or **deviation of the mandible to the affected side**.
Imaging shows condylar resorption with a resultant shortening of the mandibular ramus-condyle unit and possibly a reduced joint space.
Cone-beam computed tomography (CBCT) imaging is best for showing the extent of condylar damage from RA, particularly in the early stages, and involves a lower radiation dose than conventional CT scans.
There is a positive correlation between the duration and severity of RA, and the degree of TMJ involvement.Ankylosis of the TMJ is uncommon and occurs late in the disease course.If ankylosis or collapse of the TMJ occurs, joint replacement may become necessary.

Patients with JIA should have regular imaging of the TMJ and evaluation by an orthodontist, even in the absence of TMD signs and symptoms.

Lastly, it is important to note that some patients with RA/JIA will have TMD that is unrelated to their inflammatory arthritis.

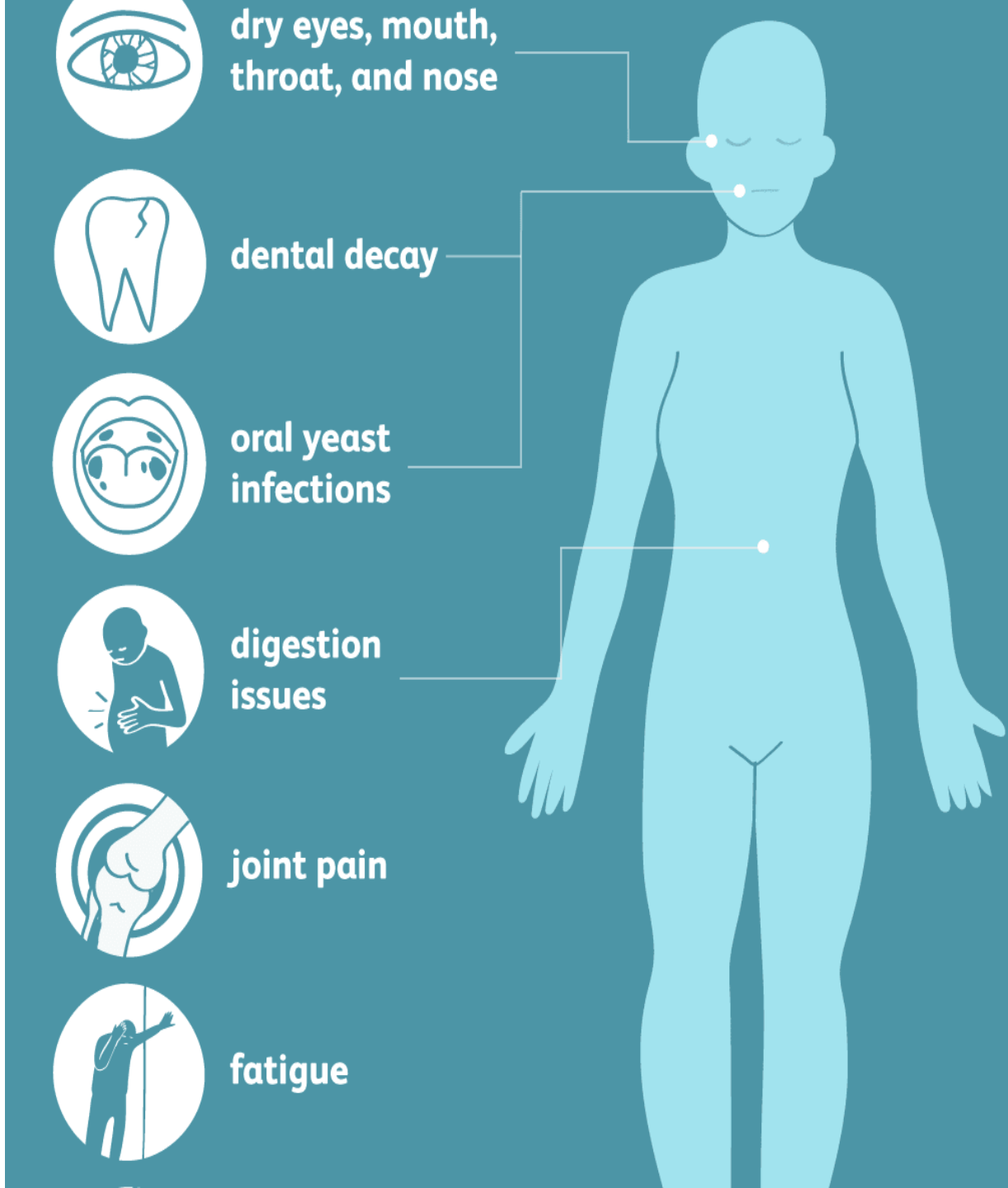
Salivary gland dysfunction

Sjögren's syndrome (SS)

Sjögren's syndrome (SS) is a chronic autoimmune condition that is characterised by the sicca symptoms xerophthalmia and xerostomia, caused by inflammation leading to dysfunction of the lacrimal and salivary glands. It can occur alone (primary form) or secondary to other systemic autoimmune diseases such as RA.

The estimated prevalence of sicca symptoms in RA patients ranges between 30–50%.

RA patients with SS have reduced salivary flow and altered saliva composition (due to destruction and dysfunction of the salivary glands).



Dental management

Most RA patients can be successfully managed at the dental practice with some minor adjustments for suggestions.

Chronic inflammation of the cervical spine in RA can result in neck instability, which can cause neurological symptoms and in rare cases be fatal.

It is therefore important that a patient's head and neck are well supported during dental treatment. Suspected cervical instability should also be discussed with the patient's rheumatologist.

Due to pain, impaired hand function and fatigue, RA patients may find it difficult and lack the motivation to follow a good oral hygiene regime (leading to further unfavourable outcomes).

Good oral hygiene is the cornerstone for dental management of these patients, and aids should be recommended to making brushing and interdental cleaning easier for this population with poor grip and dexterity. Resources on suitable aids and adaptations are available.for a summary of management of common RA-associated dental problems. *If a patient is having recurrent problems due to their RA or medication, please discuss this with their rheumatologist*

Table 4 Summary of suggested management for RA-associated dental problems[74,75,77,88,90,91,93–95,97–100]

Dental problem	Management
Periodontal disease	More frequent dental/hygiene visits
	Regular scaling and root planing (no adjuncts necessary)
	Oral hygiene instruction – recommend electric toothbrushes and interdental cleaning aids with wider handles
	Smoking cessation advice and support
	Refer to a periodontist if necessary
Temporomandibular dysfunction	Jaw rest
	Warm compress application
	Physiotherapy
	Soft food diet
	Short-term NSAID use (topical or systemic)
	Occlusal splint (soft or hard) wear at night time
	Biobehavioural therapy
	Elimination of unhelpful habits for example, nail biting, wide yawning
	Discuss with patient's rheumatologist/GP if TMJ arthritis suspected
	Refer to oral & maxillofacial surgery and orthodontics (for children) if necessary
Salivary gland dysfunction	More frequent dental visits
	Medication review
	Advise to keep hydrated with regular sipping of water
	Smoking cessation advice
	Chew sugar-free gum or lozenges regularly (if no TMJ problems)
	Oral hygiene instruction
	Pit and fissure seal teeth
	Fluoride varnish, prescription-strength toothpaste or mouthwash
	Use of non-fluoride remineralising agents for example, calcium phosphate rinse
	Chlorhexidine varnish, gel or mouth rinse
	Advise to reduce sugar/acid intake and frequency
	Salivary replacement (gels, mouth rinses, toothpastes, lozenges)
	Advise patient to use a humidifier, particularly when sleeping
	Discuss with patient's rheumatologist/GP
	Prescribe salivary stimulants for example, pilocarpine
	Refer to oral medicine if necessary
	Refer to GP/rheumatologist if an undiagnosed underlying rheumatic disease is suspected
Oral candidosis/ angular cheilitis	Prescribe topical or systemic antifungals
	Discourage denture wear at night
	Encourage good denture hygiene
Oral ulceration	Check patient is taking medication (especially methotrexate) at the prescribed dose and interval
	Prescribe benzydamine mouthwash/oromucosal spray
	Urgent referral to oral medicine if ulcers are longstanding (>3 weeks) or suspicious

NSAID = Non-steroidal anti-inflammatory drug; GP = General medical practitioner; TMJ = Temporomandibular joint.

Dental management of patients with prosthetic joint

Replacing arthritic joints with prosthetic joints is one of the great advances of modern medicine, with 2.9 million joints replaced annually worldwide.

Periprosthetic joint infection (PJI) is a leading cause of **arthroplasty failure**.

Early infections, **within 3 months of joint replacement**, are considered the result of wound contamination at the time **of the surgical procedure**.

Early infection rates in the 1950s were approximately 12%, but antibiotic prophylaxis before joint replacement and lamina airflow operating rooms have reduced this to 1% to 2%, and refocused attention on late PJIs (LPJIs), which occur 3 months or longer after joint replacement operations.

Prosthetic joint infection (PJI) is **a tremendous burden for individual patients as well as the global health care industry**.

While a small minority of joint arthroplasties will become infected,

appropriate recognition and management are critical to preserve or restore adequate **function** and **prevent excess morbidity**.

The ADA Clinical Recommendation:

In general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection.

For patients with a history of complications associated with their joint replacement surgery who are undergoing dental procedures that include gingival manipulation or mucosal incision, prophylactic antibiotics should only be considered **after consultation with the patient and orthopedic surgeon.**

To assess a patient's medical status, a complete health history is always recommended when making final decisions regarding the need for antibiotic prophylaxis.

Clinical Reasoning for the Recommendation:

- There is evidence that dental procedures are not associated with prosthetic joint implant infections.
- There is evidence that antibiotics provided before oral care do not prevent prosthetic joint implant infections.
- There are potential harms of antibiotics including risk for anaphylaxis, antibiotic resistance, and opportunistic infections like Clostridium difficult.
- The benefits of antibiotic prophylaxis may not exceed the harms for most patients.
- The individual patient's circumstances and preferences should be considered when deciding whether to prescribe prophylactic antibiotics prior to dental procedures.

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Academic Year 4

Patients on Radiotherapy and Chemotherapy

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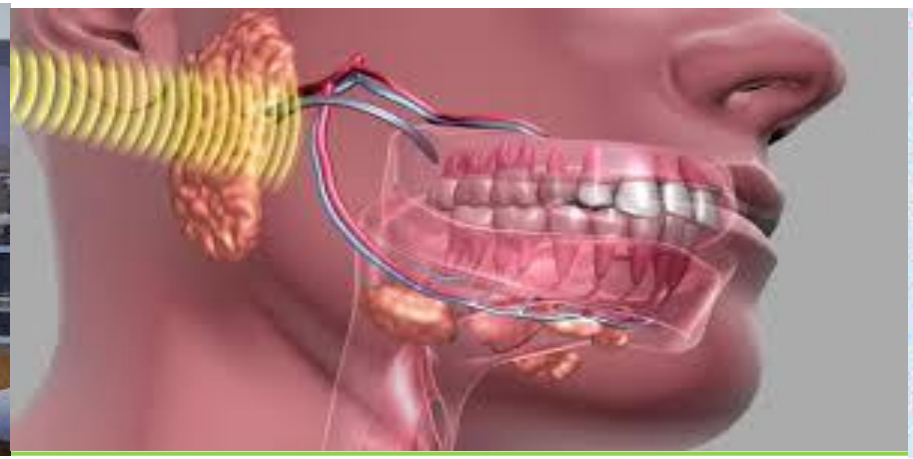
Ph.D in Oral & Maxillofacial Surgery



Patients on radiotherapy and chemotherapy

- Patients on radiotherapy
- Radiation effects on normal tissues in the path of the external beam
- Dental Management
- Patients on chemotherapy
- The effect of chemotherapy on normal tissues
- Dental management

What is radiotherapy?

Radiotherapy uses high-energy rays to destroy the cancer cells, while doing as little harm as possible to normal cells. It is an important treatment for **head and neck cancers**.

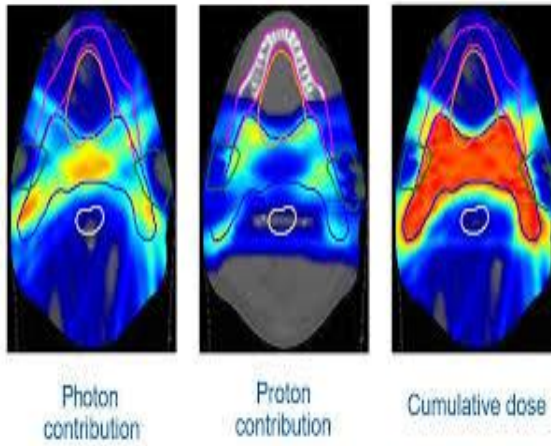
External radiation (or external beam radiation) is the most common type of radiation therapy used for cancer treatment.

A machine is used to aim high-energy rays or particles from outside the body into the tumor.

External beam radiation is given most often as photon (x-ray) beams and less often as particle (proton, neutron) or electron beams

Radiation technology allows the very careful delivery of external beam radiation therapy. The machines focus the radiation beam on the exact location in such a way to maximize the radiation reaching the cancer, but also to limit the effect on normal tissues as little as possible.

External radiation is usually done during outpatient visits to a hospital or treatment center. Most people get external radiation therapy over many weeks



Photon beam radiation therapy

Types of beams used in external radiation therapy:

Photon beam radiation therapy: Photon beams are the same type of radiation that is used during an x-ray, like a chest x-ray, but at a much higher amount. The radiation is released from the machine as a wave of energy. Photon beams can travel deep into the body to the tumor but can also damage healthy tissue in front of and behind the tumor. Photons are given by a machine called a **linear accelerator.** The photon beams are invisible and cannot be felt when they are passing through the skin to the cancer

Particle beam radiation therapy: Particle beams are separate units of energy like a proton or neutron.
The radiation is released from the machine as a stream of high-energy particles. Particle beam radiation can also travel deep into the body like photon beams but their energy is released at a certain distance. This means that this type of radiation is often able to deliver more radiation to the tumor while reducing its effects on normal tissues in front of and behind the tumor. Particle beams are given by special types of machines called **particle accelerators**, like a cyclotron or synchrotron. The particle beams are invisible and cannot be felt when they are passing through the skin to the cancer

proton beam therapy

Electron beam radiation therapy: Electron beams are also separate units of energy and can act like particle beams or can be converted into photon beam radiation. Electrons do not travel very far so they are most often used to treat **cancers on the skin** or near the surface of the body. Electron beams can be given from a linear accelerator or a particle accelerator.
The electron beams are invisible and cannot be felt when they are passing through the skin to the cancer.

Electron
beam radiation therapy

The total dose of external radiation therapy is usually divided into smaller doses called fractions.
Most patients get radiation treatments daily, 5 days a week (Monday through Friday) for 5 to 8 weeks. Weekend rest breaks allow time **for normal cells to recover.**

The total dose of radiation and the **number of treatments is based on:**

•The size and location of the cancer
•The type of cancer
•The reason for the treatment
•Patient‘s general health
•Any other treatments patient getting

Other radiation schedules might be used in certain cases. For instance, radiation therapy might last only a few weeks (or less) when it’s used to relieve symptoms, because the overall dose of radiation needed is lower. In some cases, radiation might be given as 2 or more treatments each day. Or you might have several weeks off in the middle of treatments so your body can recover while the cancer shrinks. Your doctor will talk to you

Radiotherapy can be used on its own, but is often given in combination with **chemotherapy**. This is called chemoradiation.

Chemoradiation

Chemoradiation is a very effective treatment for head and neck cancers. It is often the main treatment for locally advanced head and neck cancers. But it can cause severe side effects so it is not be suitable for everyone.

Chemoradiation may be used to treat head and neck cancers:

•that cannot be removed with surgery
•that are in harder-to-reach areas, such as **nasopharyngeal cancer** or **oropharyngeal cancer**
•when surgery could cause severe changes to speech or swallowing
•to reduce the risk of the **cancer coming back (adjuvant treatment) after surgery**

Radiotherapy for locally advanced cancers:

If a cancer is bigger, or is affecting other tissues nearby (locally advanced cancer), radiotherapy is usually combined with other treatments. It may be given:

•after **surgery** (with or without chemotherapy) to destroy any remaining cancer cells and reduce the risk of cancer coming back

•in combination with **chemotherapy** (chemoradiation), without surgery

•in combination with the **targeted therapy** drug **cetuximab**

•to reduce symptoms **(palliative radiotherapy).**

Radiotherapy after surgery (adjuvant radiotherapy)

If patient have surgery for some early and locally advanced cancers, you are usually given radiotherapy afterwards. This is to reduce the risk of the **cancer coming back**. It is called **adjuvant radiotherapy**. Sometimes **chemotherapy and radiotherapy** are given together after surgery. This called **adjuvant chemoradiation.**

If patient need adjuvant treatment, the specialist team will decide whether **radiotherapy** or **chemoradiation i**s best for patient's situation.

Radiotherapy and cetuximab

Some people may be given **radiotherapy i**n combination with a **targeted therapy (**targeted therapy is **a type of cancer treatment**. It uses drugs to target specific genes and proteins that help cancer cells survive and grow. Targeted therapy can affect the tissue environment that cancer cells grow in or it can target cells related to cancer growth) like blood vessel cells drug called **cetuximab.**

This is usually when they are not well enough to cope with the side effects of **chemoradiation**. Or they may have other health problems that could be made worse by **chemotherapy.**

Palliative radiotherapy

Sometimes it is not possible to **cure a cancer**, and the main aim of **treatment is to relieve symptoms**. This is called **palliative treatment**. **Palliative radiotherapy may be used to:**

- stop bleeding from a tumour
- shrink a tumour that is causing **swallowing** or **breathing difficulties**
- relieve symptoms if the cancer has spread to other parts of the body, such as **the lungs** or **bones**.

Oral Mucositis lesion on the buccal mucosa of a patient receiving radiation therapy to the head and neck region

Head and neck radiotherapy side effects:

Patients undergoing radiation therapy for the head and neck are susceptible to a significant and often abrupt deterioration in their oral health. RT results in a deterioration in dental and periodontal health as well as a risk of osteoradionecrosis.

The acute effects of RT include mucositis, thickened secretions, mucosal infections, pain, and sensory disruptions.

The long-term chronic effects of head and neck RT comprise tissue fibrosis, salivary gland dysfunction, increased susceptibility to mucosal infections, neuropathic pain, sensory disorders and an increased susceptibility to dental caries and periodontal disease

Mucositis : Oral mucositis (OM) is an acute response to treatment that affects the majority of the patients receiving RT for head and neck cancer (HNC) .In patients receiving a typical **6–7 week course of RT**, OM presents as erythema of the oral mucosa in the first 2–3 weeks of RT and progresses to ulceration and **pseudomembranes**

Oral Mucositis lesion on the buccal mucosa of a patient receiving radiation therapy to the head and neck region

The treatment of OM is symptomatic, and it mainly consists of pain management and infection control. For the pain management, mouthwash containing topical anesthetic agent such as lidocaine is usually prescribed. Tetracaine, amethocaine, dyclonine, and benzocaine are also used for pain relief. The use of topical anesthetics allows patients to do regular daily activities such as eating and tooth brushing. **Most of the studies, aimed at pain relief Neurosensory disorders:** mucosal pain and taste dysfunction Mucosal pain that affects diet and quality of life occurs during active cancer therapy and is a common chronic complaint in survivors .

Xerostomia.

Mucosal pain may be related to inflammation, ulceration, mucosal atrophy or mucosal neuropathy and may be compounded by dry mouth and potentially secondary infection. Radiation-induced neuropathies may be caused by neurotoxicity, ischemia, oxidative stress, and inflammation .Pain prevention and management will improve with further understanding of the molecular and neurophysiologic mechanisms underlying the painful condition

Oropharyngeal candidiasis

mechanisms of Mucosal pain in oncology

Processes		
Radiation therapy	Acute	Mucositis, infection, molecular sensitization and stimulation
	Chronic	Neuropathy, atrophy, hyposalivation, ischemia, fibrosis; molecular sensitization and stimulation
Chemotherapy/targeted therapy, immunotherapy	Acute	Mucositis; infection, molecular sensitization and stimulation
	Chronic	Neuropathy, fibrosis; molecular sensitization and stimulation

Oropharyngeal candidiasis (OPC) :is common in HNC patients OPC is associated with **mucosal pain**, **taste change** and **can extend to the esophagus** and **result in dysphagia**; **Regional extension or systemic dissemination may occur in myelo/immunosuppressed patients. Clinical presentation includes** pseudo-membranous (thrush) and erythematous candidiasis, and angular cheilitis. **Hyperplastic** (nodular) and invasive candidiasis are less common and may require biopsy for diagnosis.**Treatment:Topical oral treatments** are recommended as first-line therapy in milder forms of candidiasis . Topical azole or polyene antibiotics in the form of a **lozenge**, **suspension** or **cream** may be applied intra-orally. Instructions include applying nystatin and amphotericin B.

Systemic treatments should be used in case of failure of local treatment or immediately with severe clinical OPC in high risk (myelosuppressed, immunocompromised) patients. In general, systemic therapy with fluconazole (Triflucan®, Diflucan®) is superior to topical antifungals in cancer patients.

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Xerostomia

Xerostomia is one of the most frequent and debilitating side effects of head and neck RT. It develops acutely (early in the course of irradiation), but frequently remains chronic (permanent) complication

Xerostomia.

Taste disorder

During the RT, majority of patients experience complete or partial taste loss. According to a recent literature review, taste **disorder affects 66.5%** of patients undergoing RT alone and 76% of patients undergoing combined chemoradiotherapy.

Neurosensory disorders: mucosal pain and taste dysfunction

Mucosal pain that affects diet and quality of life occurs during active cancer therapy and is a common chronic complaint in survivors

Mucosal pain may be related to inflammation, ulceration, mucosal atrophy or mucosal neuropathy and may be compounded by dry mouth and potentially secondary infection.

Hair loss

Radiotherapy to the head can cause hair loss in the treatment area. How much hair loss depends on the size of the area being treated and the dose of radiotherapy.

Swelling in THE neck or face (lymphoedema)

After radiotherapy to treat a head and neck cancer, you are at risk of getting swelling called lymphoedema in the neck or face.

Typical submental edema after radiation

Chronic side effects of head and neck irradiation

Radiation-induced dental caries

The primary cause of radiation-induced dental caries is change in quality and quantity of saliva, due to radiation-induced salivary gland damage.

After RT, salivary viscosity is increased and its buffering capacity and pH are reduced. Salivary pH becomes cariogenic, decreasing from 7.0 to 5.0 and making minerals of enamel and dentin dissolve easily

A defensive role of saliva is impaired, which leads to changes in oral flora of these patients.

Within 3 months of completing RT, oral flora becomes more acidogenic and cariogenic because of increased concentration of *Streptococcus mutans*, *Lactobacillus*, and *Candida* species.

If the teeth are located in the irradiation field, irradiation also has a direct destructive effect on dental hard tissue, **causing decreased circulation through pulp**, **secondary fibrosis**, and **degeneration of the odontoblast processes**.

Doses lower **than 30 Gy (gray unit)** cause minimal tooth damage, **doses 30–60 Gy increase risk** of tooth breakdown two to three times while doses greater than 60 Gy increase risk of tooth damage 10 times .

Radiation-induced caries characteristically has a quick progress and affects smooth tooth surfaces where caries in nonradiated patients seldom occurs. The affected teeth become discolored and demineralized, with erosions in the cervical region, which makes them fracture easily

Despite advanced clinical presentation, the lesions are painless

The risk of occurrence of radiation caries is lifelong so patients should be instructed to

maintain adequate oral hygiene and to come to regular dental checkups every 1–3 months.

Osteoradionecrosis:

Osteoradionecrosis (ORN) is the most serious complication of head and neck RT, which affects the bone in irradiated area. RT alters collagen synthesis and induces inflammation and obliteration of the blood vessels that provide blood supply to the bone. Irradiated bone becomes hypovascularized and hypoxic, with impaired healing capacity .

The process is irreversible and progressive, and the risk of osteonecrosis is lifelong.

The most commonly used definition of ORN implies exposed bone without healing for 3 months, without recurrence of the tumor .

The literature shows that two-thirds of ORN in the orofacial region appear after a traumatic event, such as tooth extractions, ill-fitting dentures, biopsies, or periodontal dental procedures, while one-third can appear spontaneously.

The most frequently affected bone in the head and neck region is the .Risk factors for the development of ORN include therapeutic dose and mode of irradiation or combined chemotherapy and radiotherapy. **Doses greater than 60 Gy,** use of **brachytherapy**, or **combined chemo- and radiotherapy** increases the risk of **development of ORN**, **while hyperfractioned** RT or moderately accelerated fractioned RT, even in greater doses, decrease the **risk of its occurrence** . **Other risk factors include poor oral hygiene**, **malnutrition**, **chronic trauma from ill-fitting dentures**, or **acute trauma from surgical procedures in the jaw**, **especially in posterior mandible**

ORN manifests as an area of exposed bone in the oral cavity . When oral hygiene is poor and other local factors are present, such as ill-fitting dentures or post-RT dentoalveolar surgery, the incidence can exceed 25%. ORN may cause significant loss of quality of life particularly in advanced stages .

Risk factors associated with ORN include tumor-related factors, treatment-related factors, and patient-related factors .

Some of these factors include the presence of **dental disease** (inflammation and infection), the need for pre-irradiation HNC surgery and dental surgery, oral health and hygiene . Others factors predicting ORN include increased RT fraction size, increased total RT dose to the mandible, and other factors **such as the extent of the tumor**, proximity with bone, bone invasion and **the need for pre-radiation bone resection .**

Osteoradionecrosis of the jaws

Osteonecrosis of the mandible

Osteoradionecrosis of the skull base

The goal is to minimize the need of **invasive interventions (e.g., extraction)** and dental inflammatory disease/infection during and after RT for the life of the patient. Evaluation by an experienced dental provider and integration of care with the oncology team will determine ideal oral care prior to starting radiation therapy.

Management protocols **proposed to treat ORN include conservative therapy with medication, ultrasound**, **HBO**, and **surgical resection and reconstruction for nonresponding, advanced stage ORN** The characterization of **fibrosis as part of the pathogenesis of ORN** has led to the use of **anti-radiation fibrosis drugs such as pentoxifylline**, **tocopherol**, and **clodronate** Antioxidant therapy has also been proposed New experimental studies have assessed bone **marrow-derived stem cells** and **bone morphogenetic protein-2 to facilitate osseous healing in cases of ORN** Other approaches include **promotion of bone** and **soft tissue repair using low-level laser therapy** **Resection and vascular graft reconstruction are considered in cases with pathologic fracture or threatening fracture with progression despite nonsurgical therapy**. The best approach to treating ORN is prevention. Additional prospective studies are needed to determine long-term success of ORN management.

Symptoms of ORN include **pain**, **dysgeusia**, **dysesthesia**, **halitosis**, or **food impaction in the area of exposed bone**, although in early stages it can be **asymptomatic**.

Untreated, it can lead to **fistulas and pathological fractures of the bone**
Still, there is no universally accepted classification system for ORN, which makes comparison of different studies difficult

Trismus

Trismus can occur if temporomandibular joint and masticatory muscles are located in irradiated area during head and neck cancer therapy.
Irradiation causes **spasm and fibrosis of masticatory muscles**, which limits mouth opening
Trismus is often defined as **reduced mouth opening with interincisal space less than 35 mm**, but there is no universally accepted definition in the literature which is the reason for a wide range of reported prevalence of trismus after head and neck RT, ranging from 5 to 38% of patients
Trismus is often underreported as RT side effect, although it seriously impairs quality of life, resulting with difficulties in patient's social life, affecting speech, food intake, and oral hygiene maintaining and even leading to depression
Risk factors for the occurrence of the trismus are similar as for other late oral side effects of RT and include the total dose of radiation, fractionation regimen (mode of irradiation), treatment modality (conventional RT vs. intensity-modulated radiotherapy (IMRT)), overall duration of RT, tumor location, and poor physical condition
Some results show that a total dose of RT greater than 55 Gy increases the incidence of trismus up to 47%, while treatment modality as conventional RT compared to IMRT decreases the mean incidence of trismus from 25.4 to 5%

Patients receiving RT to head and neck area should be instructed in rehabilitative exercises during and after RT to prevent the trismus development

Dentist's role in head and neck cancer team:

Patients with head and neck tumors (PwHNTs) must take all measures to increase their quality of life .
Over decades, modern treatment modalities have increased the survival rate of these patients, owing to the great efforts invested. However, it is obvious that the quality of life to which PwHNTs are destined is far below the level of being comfortable and functional .
The function of the **upper aerodigestive tract** is impaired following the treatment in **PwHNT,** especially of structures related to the oral tissues.
The function of the mouth is a very important aspect of the quality of life of cancer patients in general . While significant developments occur in the field of treatment, especially in terms of procurement of modern equipment for RT, as well as in education of radiation oncologists and medical physicists, which improves the survival rate of patients, we have to ask ourselves: what about the quality of life of our PwHNT following RT?
Good protocols for an interdisciplinary approach to PwHNT clearly emphasize that the dentist is a part of the oncology team
Dentists' activities are directed to adherence to guidelines for oral care, which improve the quality of life in PwHNT, especially those who are treated with RT.
Those include the reduction of the inevitable side effects of treatment, as well as the prevention of long-term complications of treatment.
Patients should be referred to dental evaluation before the treatment of any head and neck cancer site: lip cancer, oral cavity, oropharynx, hypopharynx, nasopharynx, glottic, and supraglottic larynx, paranasal sinuses
With the obligatory oral and dental evaluation and treatment before cancer treatment..

Timing of RT as the part of multimodal treatment is important. It is well established that time elapsed between surgery and RT inversely affects the prognosis .. Head and neck surgeons who assume a role of “oral health advocates” can help dentists to significantly increase patients’ compliance. We have observed that if surgeons also motivate patients for good oral care, a significant increase in compliance with the recommendations will be achieved [45]. The ideal would be that the oral assessment is introduced as a legal requirement before the radiation of the head and neck. Listed experiences should be of practical help to readers who plan to start this service

Dental management prior radiation therapy for head and neck cancers

Prior to the head and neck RT, all patients without exception should be referred for oral/dental care. There are no generally accepted evidence-based clinical guidelines for dentists how to prepare patients for RT; however, it is rational to follow effective strategies from the relevant

The main purposes of pretreatment dental evaluation are as follows:

•to prevent or minimize acute and chronic oral side effects associated with RT

•to facilitate submission of RT and radiation-induced sequelae

The task of the dentist, as a member of the oncology team preparing the patients for head and neck RT, is to perform the following procedures:

1.treatment of oral and dental diseases

2.implementation of preventive procedures

3.education of the patients

Osteoradionecrosis may be prevented by extracting these teeth at least 2 weeks before radiotherapy, periodontally involved teeth, unerupted teeth.
Prevention of dental caries and periodontal disease and their sequelae can prevent ORN in most cases. If teeth are extracted after radiotherapy care should be given to use atraumatic technique, smooth sharp edges of bone, and avoid reflection of the periosteum if possible

Initial treatment should always be conservative. The lesion should be carefully cleaned, and any small sequestered bony fragments are carefully removed. Oral hygiene procedures are reviewed, and the patient is asked to rinse frequently with dilute hydrogen peroxide or a salt and soda solution in an effort to keep the area moist and clean.

Dentures are relieved over the affected area, and soft plastic mouth guards have also been used as protective devices. Topical packing of the area with zinc oxide and various antibiotics has been recommended

Partial mandibulectomy may be necessary in severe cases of ORN, mandible can be reconstructed for esthetics and function. Initial treatment should always be conservative. The lesion should be carefully cleaned, and any small sequestered bony fragments are carefully removed. Oral hygiene procedures are reviewed, and the patient is asked to rinse frequently with dilute hydrogen peroxide or a salt and soda solution in an effort to keep the area moist and clean. Dentures are relieved over the affected area, and soft plastic mouth guards have also been used as protective devices. Topical packing of the area with zinc oxide and various antibiotics has been recommended.

Treatment of oral and dental diseases:

Oral status is evaluated and recorded: present teeth, clinical and radiographic findings (carious lesions, oral mucosa status, periodontal status, salivary gland functional assessment, interincisal opening), presence of orthodontic devices, and denture use.

Prophylactic dental clearance includes restorative treatments, periodontal scaling, fluoride therapy, and dental extractions.

The following teeth need to be extracted :

•Teeth with advanced caries lesions with questionable pulpal status or pulpal involvement

•Teeth with extensive periapical lesions

•Teeth with signs of severe periodontal disease (advanced bone loss and mobility or furcation involvement)

•Residual root tips not fully covered with bone or showing radiolucency

Impacted or incompletely erupted teeth, particularly third molars that are not fully covered by alveolar bone or that are in contact with the oral environmentPatient with HN cancer should have all necessary dental treatment before radiation or chemotherapy .

In the case there is less than 10 days to the beginning of the RT, teeth extractions are delayed for the "window" period after radiation (within 5–6 months after completion of RT)

Implementation of preventive procedures

The elimination of all potential causes of local trauma is mandatory. It is known that ORN can develop also in edentulous patients and therefore the adjustment of ill-fitting dentures is necessary. It is important to remove sharp edges and protruding teeth fillings. **Orthodontic braces should be removed before the beginning of the RT.**

Dental Extraction: A conservative approach is advised in regard to extraction of teeth after radiation Extraction should only be considered after careful evaluation. extremely mobile periodontally compromised teeth can be safely removed with minimal risk of developing **ORN**

Edema: Early in the post radiation period, scarring fibrosis and edema begin to appear lymphatic channels are thought to be relatively radio-resistant. radiation-induced fibrosis impairs the lymphatic and venous channels. edema is most prominent in the submental region following irradiation for anterior tongue and floor of the mouth and occasionally severe enough compromise tongue mobility and salivary control further impending denture wearing and speech articulation. the severely of edema varies by time of the day (worse on waking and early morning and day to day).

Education of the patients

Besides teeth preservation and elimination of potential trauma, it is necessary that dentist educates the patient prior to RT. The dentist should explain the expected and possible RT-induced complications. Patients must be aware that the salivary glands may be affected by irradiation, which can result in severe decrease of salivary function .
Radiation-induced xerostomia is an important chronic side effect of RT that can lead to many oral diseases and patients should be warned on the rapid occurrence of dental caries Untreated on time, it results in the extraction of teeth and the possible development of ORN.
During preirradiation, **dental management** ,dentist should strongly emphasize to the patients that postirradiation caries and following oral diseases are avoidable through the regular and meticulous dental hygiene, daily fluoridation, and regular dental checkups.

TREATMENT:

Zinc appears to favor wound healing and preservation of epithelial tissue integrity. It seems to increase re-epithelialization and acts against inflammation and bacterial development.

Polaprezinc lozenges or suspension was orally administered at a dose of 5 mL. It was rinsed for 2 min and then swallowed **4 times a day for a month**. **Polaprezinc suspension** proved to be effective in preventing OM after high dose **chemotherapy course**. **Polaprezinc is currently used as an anti-ulcer agent**, with a protective action on mucosal cells against noxious stimuli and it presents anti-oxidant characteristics.

Osteonecrosis of the jaws

Osteonecrosis impairs the function of osteoclasts and osteoblasts which are the main types of cells that are closely related to bone health and repair. It appears after temporary or permanent impairment of the bone blood supply.

Osteonecrosis can be caused by trauma (tooth extraction, periodontal procedures, biopsy), osteoporosis, malignancy, or certain types of medication. In the first stages, the lesions may remain asymptomatic for weeks, months, or even years. When inflammation invades the lesions, pain reveals itself. Tooth mobility, mucosal swelling, erythema, ulceration, paresthesia, or even damage to the associated part of the trigeminal nerve may be observed

Osteonecrosis of the maxilla due to bisphosphonates

Bisphosphonates are mainly responsible for the development of osteonecrosis of the jaws (ONJ)

They are used as chemotherapy agents against bone metastases, malignant hypercalcemia, or malignant melanoma, and for the treatment of osteoporosis.

It is important to mention that sunitinib (a tyrosine kinase inhibitor) may increase the risk of bisphosphonate-related osteonecrosis of the jaws. The presence of ONJ can be intense in patients receiving **sunitinib** and **bisphosphonates**. **Sunitinib was shown to be strongly related to mucositis,**

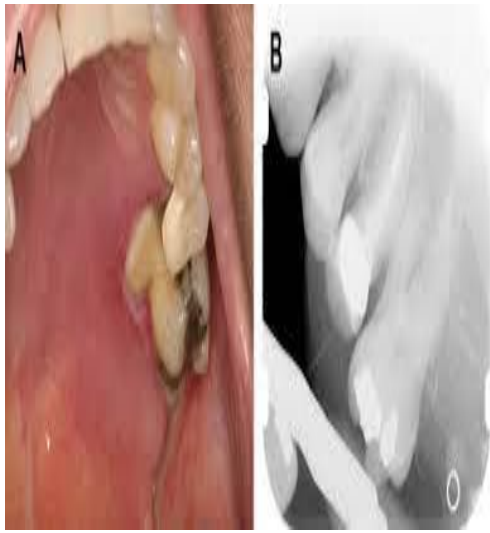
How these variables influence the course of ONJ, and its treatment response are largely unknown.

Infections

Neutrophils represent 55-70% of the circulating white blood cells. They are able to identify and destroy invaders. Chemotherapy reduces their number causing neutropenia which in turn favors the development of infections. The oral cavity is a common sight of infections, often caused by bacteria, fungi, and viruses.

Bacterial

Bacteria may be responsible for odontogenic infections. The usual symptoms are erythema, edema, and purulence. During neutropenia, it is common to observe a previously asymptomatic tooth (which has received successful endodontic treatment and has been radiographically checked), giving rise to symptoms of infection.
Periapical infections affect maxillary posterior teeth and if severe perforate the Schneiderian membrane and lead to sinusitis



Fungal

The persistence of neutropenia, due to chemotherapy, favors the development of fungal infections. The most common fungi are *Candida* and *Aspergillus* species. Zygomyces and endemic fungi, such as *Histoplasma capsulatum*, should also be considered as well as *Fusarium* species.
***Candida albicans* is widely detected in such infections.**
Pseudomembranous, erythematous, and hyperplastic candidiasis, as well as the angular cheilitis, are usually present can cause dysgeusia and xerostomia, a burning sensation and a general oral discomfort.

Viral infections: In most cases, infections due to herpes simplex virus (HSV), varicella-zoster virus (VZV) and Epstein-Barr virus (EBV) are the result of the reactivation of a latent virus, while infections due to cytomegalovirus (CMV) can result from the reactivation of a latent virus or from a recently acquired virus .

The oral lesions generally appear simultaneously with **chemotherapy** or **chemo-radiotherapy** during the period of most intense immune suppression. The treatment of HSV infection consists of the administration of 400-800 mg of acyclovir via the **oral** route 5 times **a day or of 5-10 mg/kg via the intravenous route every 8-12 hours**, for as long as the lesions persist. Infection due to VZV: Immune compromised patients may present involvement of several dermatomes, or alternatively the lesions may show a more generalized.

Lichenoid reactions:

A lichenoid reaction (LR) is a pathologic entity involving **cutaneous or mucosal areas**, or **both of them simultaneously**. The clinical appearance of oral lichen planus (OLP) with characteristic lesions of **whitish reticular papules** and **erythematous** erosions, and plaques in a reticular form accompanied by radiating striae may be present.

Although LRs clinical presentation resembles that of OLP, LR has a close relationship with the causative agent. LR can disappear, either immediately after the agent's action is completed, or can persist.[55] In addition, histologic examination reveals eosinophilic infiltration, prominent parakeratosis with acanthosis, and a vascular inflammation around the deep plexuses. These histologic features are absent in OLP.

LRs usually are caused by several chemicals (e.g. amalgam) or by certain types of medications including **chemotherapeutic** agents **Imatinib mesylate** is a **tyrosine kinase inhibitor** that is a **first choice agent against chronic myeloid leukemia**. It impairs CD117, c-kit, or platelet derived tyrosine kinases.**Imatinib** administration can be accompanied by several side effects, such as periorbital edema, Steven-Johnson syndrome, pityriasis rosea, erythroderma, myalgia, diarrhea, exfoliative dermatitis, or edema of the legs.[57] It is responsible for lichenoid lesions in the oral mucosa, skin, or nails.

Treatment before chemotherapy

The role of the dentist in the care of a patient before, during, and after the chemotherapy course is crucial. Before any procedure takes place, the oncologist should inform the dentist of the patients current health status, the characteristics of the pathologic entity, and the antineoplastic therapy to be prescribed.

A thorough examination which consists of a dental history, a radiographic baseline (including periapical, bitewing and panoramic radiographs), a periodontal and endodontic evaluation, and a prognosis of the existing restorations is completed.

Recognition of potentially malignant findings providing signs and symptoms is critical.

Investigations, such as quantitative **sialometry,** are very useful and can help evaluate, predict, and manage the **potential xerostomia** and **hyposalivation.**

In addition, the dentist should take into consideration a number of aspects that will help him/her organize a suitable and successful treatment plan. In particular, he/she must realize that odontogenic infections are rare, but may give rise to bacteremia in immunosuppressed patients. All possible sources of dental inflammation should be addressed.

Moreover, the periodontal index (PI), gingival index (GI) in combination with the decayed, missing and filled teeth/surfaces (DMFT/S) can provide a clear indication of patient's oral hygiene, and be a reliable predictive indicator of future disease. Finally, the dentist organizes his/her treatment plan, according to the time available before the initiation of the chemotherapy, keeping in mind the patient's immune status.

Chlorhexidine provides bactericidal activity against gram-positive and gram-negative bacteria by damaging the cell membrane and cellular enzymes.

Chlorhexidine 0.12% has been found to reduce bleeding and plaque accumulation, as well as a reduction in Streptococcus mutans concentrations in saliva.

In children, fissure sealing and crack restoration in recently erupted teeth, especially molars and premolars, are mandatory.[

Endodontic care is performed under specific guidelines, for reversible pulpitis, only caries control is advised. In cases of irreversible pulpitis, initial biomechanical preparation of the canal is suggested. However, in chronic periapical situations, endodontic procedures are performed when there is a time interval of 7 days between completion of endodontic therapy and the initiation of chemotherapy.

Extractions should be performed 2-3 weeks before the onset of chemotherapy.

The removal of a tooth should be followed by primary wound closure and suturing. Intra-alveolar hemostatic agents should be avoided. Platelet transfusion is required if the platelet count is under 40,000/mm^3. Antibiotic prophylaxis is also necessary if granulocytes are under 2,000/mm^3. Moreover, limited invasive procedures should take place at least 2 weeks before chemotherapy, while major surgery should be completed 4-6 weeks before the onset of the chemotherapy.

Dental treatment during chemotherapy

Dental treatment during chemotherapy should be avoided unless it is urgently necessary. Extractions and other invasive procedures should be postponed. Throughout chemotherapy, the dentist must be aware of the degree of immunosuppression of the patient. Dental hygiene must be preserved at a satisfying level, and cariogenic food must be avoided.

Dental health can be achieved by fluoridation and the use of chlorhexidine.

Tooth brushing can take place when the oral pain resolves, whereas, some patients can only tolerate swabbing with a special finger brush. Toothpaste containing 1,450 ppm sodium fluoride is recommended.

Dental treatment after chemotherapy

After chemotherapy, dental treatment is **planned by consulting the oncologist**.

The treatment is designed to remove the **remaining foci of infection** and to **restore esthetic and any functional impairment**.

As side effects after the completion of the chemotherapy reside, the patient can eat and drink small frequent meals. These meals must be composed of a high-calorie diet or even sweets in order to preserve the patients' weight at a desirable level. However, this must take place under the close supervision of the dentist to monitor the oral hygiene to preserve dental and oral health.

High concentration fluoride toothpaste is recommended, as well as chlorhexidine rinses every night for at least 3 weeks. The latter must be repeated every 3 months.

Complications arising from chemotherapy must be managed in the most effective fashion. The patient should be regularly checked by their dentist, especially in the first few months.

Extractions and other invasive procedures should be avoided for at least 1 year. However, if procedures cannot be postponed, precautions must be taken. **The most important precaution is antibiotic coverage**. The antibiotic coverage should be initiated 48 h before the procedure and continue for 7-15 days. Hyperbaric oxygen before and after extractions is recommended.

Denture use should be avoided for 1 year. If this is not possible, the construction of the dentures should be **postponed for 4-6 months following the chemotherapy**.

Moreover, in patients who have **received intravenous bisphosphonates**, special considerations must be addressed. When placing implants, **the risk of bisphosphonate-related osteonecrosis of the jaw is significant**.

This condition is different in the patients who have had implants placed prior to the initiation of the bisphosphonates. Finally, reexaminations every month for the first 3 months is recommended, and then every 3 months for the first year.

Mandatory examinations can then be extended to every 6 months for 3 years

Chemotherapy can be associated with multiple side effects which affect the patient's quality of life. As it becomes well understood, most of these side effects cannot be avoided. Several preventive measures are taken in order to limit their expression.

Nevertheless, most cancer patients experience difficult situations.

The oral cavity is a usual site of discomfort and pain caused by chemotherapy, making dentist's contribution to patient's relief extremely important

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Fourth Stage

Dental management of Bleeding Disorders-1

Bleeding disorders are conditions that alter the ability of blood vessels, platelets, and coagulation factors to maintain hemostasis, in other words; **Bleeding disorders** are a group of **disorders** that share the inability to form a proper blood clot.
In a dental practice of 2000 adults, about 100 to 150 patients may have a possible bleeding problem.
A number of procedures that are performed in dentistry may cause bleeding. Under normal circumstances, these procedures can be performed with little clinical risk. In most cases, after identification the patient with a bleeding problem due to drugs or disease, appropriate dental management will greatly reduce the associated risks.

There are two types of these disorders; *Inherited bleeding disorders* are genetically transmitted. *Acquired bleeding disorders* occur as the result of diseases that affect vascular wall integrity, platelet, coagulation factors, drugs, radiation, or chemotherapy for cancer.

Potential Bleeding Problem

Every patient who receives anticoagulant medication like coumarin to prevent recurrent thrombosis has a potential bleeding problem. Most of these patients suffer from different diseases like:

- cardiovascular disorders or
- chronic illnesses such as rheumatoid arthritis,
- atrial fibrillation;
- who have had open heart surgery to correct a congenital defect,
- replace diseased arteries, or
- repair or replace damaged heart valves;
- or who have had recent total hip or knee replacement,
- recent myocardial infarction,
- a cerebrovascular accident, or
- thrombophlebitis

CLASSIFICATION OF BLEEDING DISORDERS

I. Non-thrombocytopenic purpuras

a. ***Vascular wall alterations***

(1) Scurvy

(2) Infection
(3) Chemicals
(4) Allergy

b. *Disorders of platelet function*
(1) Genetic defects (Bernard-Soulier disease)
(2) Drugs;
- Aspirin
- NSAIDs
- Alcohol
- Beta-lactam antibiotics
- Penicillin
- Cephalothins

(3) Allergy
(4) Autoimmune disease
(5) Von Willebrand's disease (secondary factor VIII deficiency)
(6) Uremia

II. Thrombocytopenic purpuras

A. Primary—idiopathic
B. Secondary
- ✓ Chemicals
- ✓ Physical agents (radiation)
- ✓ Systemic disease (leukemia)
- ✓ Metastatic cancer to bone
- ✓ Splenomegaly
- ✓ Drugs
- ✓ Vasculitis
- ✓ Mechanical prosthetic heart valves
- ✓ Viral or bacterial infections

III. Disorders of coagulation

A. Inherited
1. Hemophilia A (deficiency of factor VIII)
2. Hemophilia B (deficiency of factor IX)
3. Others

B. Acquired
1. Liver disease
2. Vitamin deficiency
- ➢ Biliary tract obstruction
- ➢ Malabsorption
- ➢ Excessive use of broad-spectrum antibiotics

3. Anticoagulation drugs
- Heparin
- Coumarin

- Aspirin and NSAIDs

4. Disseminated intravascular coagulation (DIC)
5. Primary fibrinogenolysis

Pathophysiology

The three phases of hemostasis for controlling bleeding are **vascular**, **platelet**, and **coagulation**. The vascular and platelet phases are referred to as *primary*, and the coagulation phase is *secondary*. The coagulation phase is followed by the ***fibrinolytic phase***, during which the clot is dissolved.

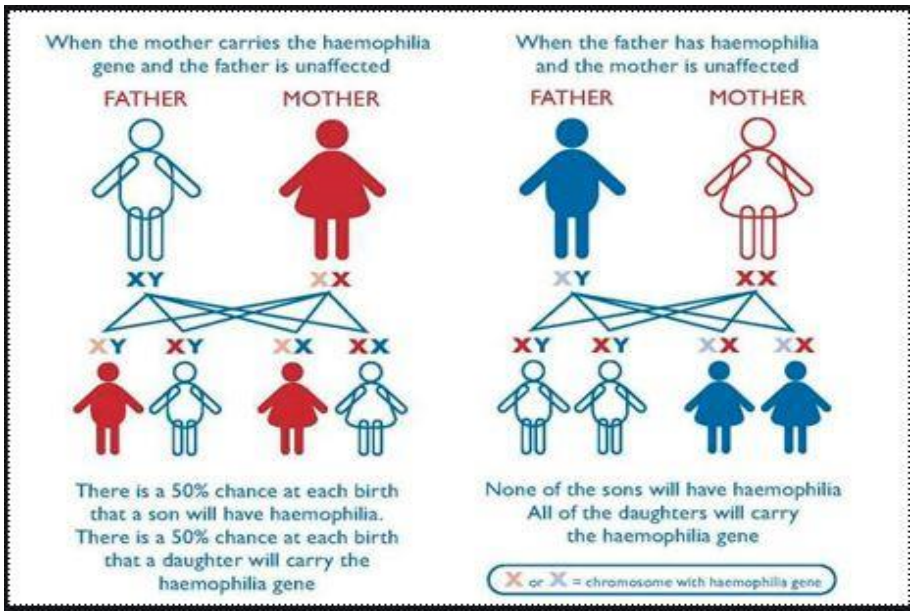
HAEMOPHILIA A AND B

Haemophilia is an inherited bleeding disorder where the blood doesn't clot properly. It is caused when blood does not have enough clotting factor. A clotting factor is a protein in blood that controls bleeding. This results in people bleeding for a longer time after an injury, easy bruising, and an increased risk of bleeding inside joints or the brain.

There are two main types of haemophilia:

1) **Haemophilia A;** is the commonest, accounting for approximately 85% of all cases of haemophilia (incidence 1:5,000 live male births), and characterised by a deficiency of factor VIII **(FVIII-8)**.
2) **Haemophilia B;** also known as Christmas disease characterised by a deficiency of factor IX **(FIX-9)** (incidence 1:30,000 live male births).

Both types of haemophilia are inherited as X-linked recessive conditions which is not contagious, and share identical clinical manifestations (same symptoms). Female carriers of haemophilia may have low factor levels and may be at risk of bleeding.



There is a spectrum of severity of haemophilia, defined as;

- Mild
- Moderate
- Severe

according to the plasma levels of FVIII or FIX activity (Table 1). The medical treatment includes replacement of Factor VIII, Cryoprecipitate, desmopressin or anti-fibrinolytic Agents.

Table 1: classification of haemophilia

Degree of haemophilia	Factor percentage (Normal range 50-100%)	Clinical features
Severe	<1%	Frequent spontaneous bleeds
Moderate	2-5%	May have spontaneous bleeds
Mild	6-40%	Bleed after trauma or surgery

Since one unit of F VIII concentrate per kilogram of body weight raises the F VIII level by 2%, a 70 kg patient would require infusion of 3,500 units to raise his factor level from < 1% to 100%. Additional outpatient doses may be needed at 12-hour intervals.

The dose to be infused (Units)= {Weight (Kg) x increment needed (Unit/dl)} /2

Von Willebrand disease (VWD)

Is a genetic **disorder** caused by missing or defective **von Willebrand** factor (VWF), a clotting protein. VWF binds factor VIII, a key clotting

protein, and platelets in blood vessel walls, which help form a platelet plug during the clotting process.

Its affects both males and females. The VWF protein stabilises FVIII and enables platelet interaction with the blood vessel wall. Bleeding after dental extractions may be a presenting feature of this condition.
Clinical manifestations include muco-cutaneous haemorrhage & gingival bleeding, features that are secondary to platelet dysfunction.

In the majority of patients with type 1 VWD, treatment with desmopressin is used while type II and type III VWD usually require the administration of coagulation factor replacement therapy with a FVIII concentrate rich in VWF.

Signs and Symptoms
Signs associated with bleeding disorders may appear in the skin or mucous membranes or after trauma or invasive procedures. Jaundice Fig. 1, spider angiomas Fig. 2, and ecchymoses Fig. 3, may be seen in the person with liver disease. In about 50% of persons with liver disease, a reduction in platelets occurs because of hypersplenism that results from the effects of portal hypertension; these patients may show petechiae on the skin and mucosa.
The signs seen most commonly in patients with abnormal platelets or thrombocytopenia are petechiae and ecchymoses.
Patients with acute or chronic leukemia may reveal one or more of the following signs:

- ulceration of the oral mucosa,
- hyperplasia of the gingivae ,
- petechiae of the skin or mucous membranes,
- ecchymoses of skin or mucous membranes and
- lymphadenopathy

A number of patients with bleeding disorders may show no objective signs that suggest the underlying problem. Severe or chronic bleeding can lead to anemia with features of pallor and fatigue

Fig. 1: Jaundice of the skin in a patient with chronic liver disease.

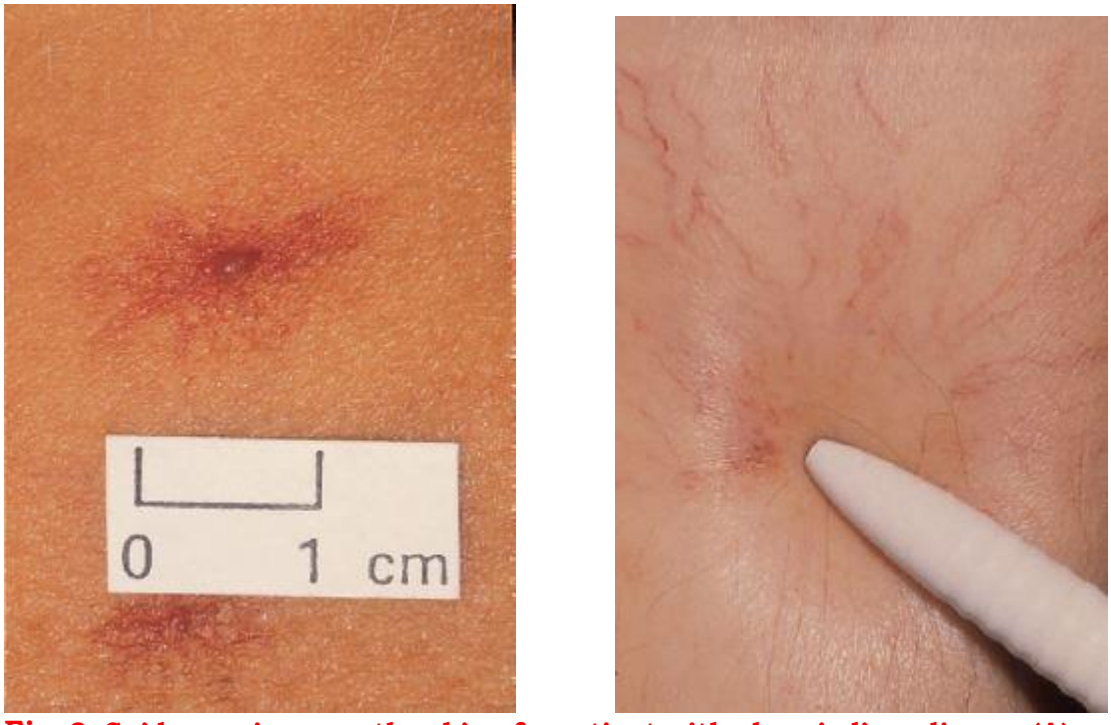


Fig. 2: Spider angioma on the skin of a patient with chronic liver disease (A). Note, on the right (B), how the spider legs of the angioma blanch with pressure on the central arteriole.

Fig. 3: Ecchymoses on the mucosa of the hard and soft palate in a patient with chronic liver disease.

Fig. 4: Palatal petechiae in a patient with leukemia

Laboratory Tests

Several tests are available to screen patients for bleeding disorders and to help pinpoint the specific deficiency. Three tests are recommended for use in initial screening for possible bleeding disorders: activated partial thromboplastin time (aPTT), prothrombin time (PT), and platelet count.
If no clues are evident two additional tests can be added to the initial screen: platelet function analyzer (PFA-100) and thrombin time (TT).
A hematologist orders these tests, establishes a diagnosis that is based on the additional testing, and makes recommendations for treatment of the patient who is found to have a significant bleeding problem.

Partial thromboplastin time (PTT); is used to check the intrinsic system (factors VIII, IX, XI, and XII) and the common pathways (factors V and X, prothrombin, and fibrinogen). It also is the best single screening test for coagulation disorders.
When a contact activator is added, the test is referred to as *activated PTT (aPTT).* In general, aPTT ranges from 25 to 35 seconds, and results in excess of 35 seconds are considered abnormal or prolonged in cases of mild to severe deficiency of factor VIII or IX.

Table 2: Clinical presentation of bleeding disorders

Clinical signs	Disorders of coagulation	Disorders of platelets or vessels
Petechiae	Rare	Characteristic
Superficial ecchymoses	Common: large and solitary	Characteristic: small and multiple
Bleeding from superficial cuts and bruises	Minimal	Persistent: often profuse
Delayed bleeding	Common	Rare
Deep dissecting haematomas	Characteristic	Rare
Haemarthrosis	Characteristic	Rare

Also spontaneous gingival bleeding consider as a characteristic feature in vascular or platelets disorders, while it's rare in disorders of coagulation.

Prothrombin Time. The prothrombin time (PT) is used to check the extrinsic pathway (factor VII) and the common pathway (factors V and X, prothrombin, and fibrinogen). When the test is used to evaluate the level of anticoagulation with coumarin-like drugs the INR format is recommended.

Platelet Count. Platelet count is used to screen for possible bleeding problems due to thrombocytopenia. Normal platelet count is 140,000 to 400,000/μL of blood. Patients with a platelet count of between 50,000 and 100,000/μL manifest excessive bleeding only with severe trauma.
Patients with counts below 50,000/μL demonstrate skin and mucosal purpura and bleed excessively with minor trauma. Patients with platelet counts below 20,000/μL may experience spontaneous bleeding.

Thrombin Time. In this test, thrombin is added to the patient's blood sample as the activating agent. It converts fibrinogen in the blood to insoluble fibrin which makes up the essential portion of a blood clot. This test bypasses the intrinsic, extrinsic, and most of the common pathway. For example, patients with hemophilia A or factor V deficiency have a normal TT. Generally, the normal range for the TT test is 9 to 13 seconds, and results in excess of 16 to 18 seconds are considered abnormal or prolonged. Abnormal test results usually are caused by excessive plasmin or fibrin split products.

PREOPERATIVE EVALUATION OF HEMOSTASIS

Most experts do not recommend routine preoperative screening for potential bleeding disorders in patients with a negative history and clinical findings who are scheduled for minor surgery such as dental extractions and biopsy procedures. It is recommended that patients with a negative history for excessive bleeding who are scheduled for major surgery be screened with use of platelet count and aPTT. Patients with an equivocal bleeding history who are scheduled for major surgery involving hemostatic impairment (heart bypass machine) should be screened with use of PT, aPTT, platelet count, factor XIII assay, and euglobulin clot lysis time. All patients with a positive bleeding history who are scheduled for minor or major surgery should be screened with use of PT, aPTT, platelet count, factor XIII assay, and euglobulin clot lysis time.

The suggestions for dentistry are based on these recommendations. Patients with a significant history of a bleeding disorder should be referred to a hematologist for all screening and diagnostic testing.

Patients with a history suggestive of a possible bleeding disorder may be screened by the dentist at a commercial laboratory or may be referred to a hematologist for screening. If the dentist orders screening tests, aPTT, PT, TT, and platelet count should be used.

PATIENT IDENTIFICATION

The four methods by which the dentist can identify the patient who may have a bleeding problem are listed here. Skills acquired through application of these methods determine how well dentists can protect certain patients from the dangers of excessive bleeding after dental surgical treatment. ***These four methods consist of the following***:

- A thorough history
- Physical examination
- Screening clinical laboratory tests
- Observation of excessive bleeding after a surgical procedure

Prolonged bleeding after a surgical procedure may be the first indication of a bleeding problem in a patient with a negative history and clinical

findings. The dentist should use the appropriate local procedures in an attempt to control the bleeding. If these measures should fail, consultation with the patient's physician or hematologist is indicated. Screening laboratory tests may be ordered to better identify the source of the problem before the consultation.

MEDICAL CONSIDERATIONS

No surgical procedures should be performed on a patient who is suspected of having a bleeding problem on the basis of history and physical examination findings. Such a patient should be screened by the dentist through appropriate clinical laboratory tests or should be referred to a hematologist for screening. Patients screened by the dentist with abnormal test results should be referred to a hematologist for diagnosis, treatment, and management recommendations. Patients under medical care who may have a bleeding problem should not receive dental treatment until consultation with the patient's physician has taken place, and appropriate preparations have been made to avoid excessive bleeding after dental procedures.

DENTAL MANAGEMENT ACCORDING TO CLINICAL SITUATIONS:

1- Haemophilia

LOCAL ANAESTHESIA

In adults, local anaesthetic infiltration using a slow injection technique and modern fine gauge single-use needles can usually be used without the need for factor replacement therapy. In children there are differing views and advice should be sought from the paediatric haemophilia center; for children on regular prophylaxis a dose of factor replacement therapy may be administered before infiltration.

Augmentation of factor levels with or without tranexamic acid is required in all age groups when inferior alveolar and posterior superior alveolar dental nerve-blocks are given; there is a risk of muscle haematoma, in addition to potential airway compromise due to haematoma formation in the retromolar or ptyerygoid space. Factor replacement therapy is also necessary for lingual infiltration and floor-of-mouth injections in all age groups as there may be a significant risk of haematoma.

Specifically in adults the consensus view is that intraligamentous or intrapapillary injections do not require haemostatic cover; however, it would be advised to give buccal infiltration at the time of the injection to avoid pain.

Table 3 Dental anaesthetic procedures and factor replacement therapy[44]	
Procedures that do not require factor cover (specifically applies to adult patients only; paediatric patients may receive factor replacement therapy before local anaesthetic infiltration as directed by the haemophilia unit)	Procedures that require factor cover (applies to both adult and paediatric patients)
Buccal infiltration	Inferior dental block
Intra-papillary injection	Lingual infiltration
Intra-ligamentary injections	

There are no restrictions regarding the type of local anaesthetic used, and 2% lidocaine with 1 in 80,000 epinephrine is routinely used in restorative dentistry; the use of a vasoconstrictor improves local haemostasis. Recently there have been reports that the use of articaine with 1:100,000 epinephrine may achieve more optimal bone penetration. This local anaesthetic has been described for infiltration as an alternative to inferior dental block in the restoration of mandibular molars, removing the need for pre-operative factor cover.

Scaling and periodontal disease
Routine periodontal probing, supragingival scaling, and polish (including ultrasonic scaling) is unlikely to cause prolonged bleeding for patients, especially those with mild conditions.
The use of tranexamic acid (oral or mouthwash) and/or factor replacement therapy may be required to control bleeding and the haemophilia centre should be consulted. The use of antibacterial mouthwashes and antibiotics may be necessary.

Prosthodontic
The provision of any removable prosthesis and the use of full or partial dentures should not pose any additional problems in this group of patients

Restorative treatment
Restorative dentistry, including the provision of crowns and bridges, is associated with low bleeding risk and can be carried out safely in general dental practice. If an inferior dental block or lingual infiltration is required, coagulation factor concentrate will be necessary

Endodontic (root canal) treatment
Endodontic treatment should not cause problems. However, if vital pulp tissue is present at the apical foramen this may bleed for some time and

cause pain. The use of 4% sodium hypochlorite for irrigation and calcium hydroxide paste appears to minimise this problem.

Dental extractions and oral surgical procedures
Dental extraction and minor surgical procedures under local anaesthesia should be planned after discussion with the local haemophilia center

EMERGENCY TREATMENT
1. Acute pulpitis
The pain in adults can usually be controlled by removing pulp from the tooth. In paediatric patients local anaesthesia is used as for any other patient who presents with acute pulpitis. If patients cannot tolerate this treatment an urgent referral to a specialist paediatric unit is required as use of sedation or general anaesthesia may be indicated. A temporary dressing should be used if the tooth is not restorable & the haemophilia center contacted for planning of the extraction.
2. Dental abscess with facial swelling
Antibiotics should only be prescribed if there is local spread or signs of systemic infection. Advice should be sought from the haemophilia center for factor concentrate cover.

OTHER ISSUES
1. Analgesia
Analgesia may be necessary for the management of dental pain or abscess, or for alleviation of pain post procedure. Aspirin, and aspirin-containing medications, should be avoided in patients with bleeding disorders as the haemorrhagic tendency may worsen as a result of the inhibitory effect on platelet function. Using of non-steroidal anti-inflammatory drugs may be beneficial to control dental pain but their prescription should be discussed with the haemophilia center as they may increase the risk of bleeding if taken pre-procedure. Paracetamol and codeine-based preparations are safe alternatives.

2. Antibiotics
There are no contra-indications to any antibiotics from the dental section of the British National Formulary for patients with congenital bleeding disorders.

3. Patients on Anticoagulants:
Management of the dental patient on anticoagulant therapy involves consideration of the degree of anticoagulation achieved as gauged by the PT/INR, the dental procedure planned, and the level of thromboembolic risk for the patient.

* **Minor oral surgery are planned and the patient's INR is between 2.0 and 3.5 : no adjustment in the warfarin dosage is indicated.**

* **If the INR is greater than 3.5 or major oral surgery is planned : Patients stop warfarin therapy + while the Low molecular weight heparin (LMWH) is administered to maintain anticoagulation therapy. After 3-5 days the surgery can be performed and scheduled for early in the day. LMWH is withheld the day of surgery and resumed in the evening. Warfarin can be resumed the following day, and the LMWH is continued until the INR returns to the desired therapeutic range.**

Oral Surgery **Dr.Anas Hammad**
Fourth Stage

Adrenal Insufficiency

Introduction

Disorders that affect the adrenal glands result in overproduction of adrenal products **Hyperadrenalism,** or underproduction of adrenal products **Hypoadrenalism**. Excess production of the adrenal glands results in the overproduction of cortisol, mineralocorticoids, androgens, or estrogen, in isolation or combination.
The adrenal glands are small (6 to 8 g) endocrine glands that are located bilaterally at the superior pole of each kidney. Each gland contains an outer cortex (*about 90% of the gland and consists of three zones*) and an inner medulla. The adrenal medulla functions as a sympathetic ganglion and secretes catecholamines, primarily epinephrine, whereas the adrenal cortex secretes several steroid hormones with multiple actions. The cortex manufactures three classes of adrenal steroids:

1. Mineralocorticoids (Aldosterone)
2. Glucocorticoids (Cortisol), and
3. Androgens

All are derived from cholesterol; the predominant hormone of the zona glomerulosa is ***aldosterone, a mineralocorticoid***. Aldosterone regulates physiologic levels of sodium and potassium and is relatively independent of pituitary gland feedback.
The zona fasciculata secretes ***glucocorticoids,*** and the zona reticularis secretes ***androgens, or sex hormones***.

Cushing disease is a condition in which the pituitary gland releases too much adrenocorticotropic hormone (ACTH), thus over stimulating the adrenal glands' cortisol production (glucocorticoid excess) (**Hyperadrenalism)**.
Not everyone with **Cushing syndrome** has **Cushing's disease.** Long term excessive use of glucocorticoids can result in clinical features mimicking Cushing's disease. This collection of clinical features of glucocorticoid excess is known as *Cushing's syndrome.*

The symptoms of Cushing's syndrome **:**

1) Weight gain
2) thin arms and legs
3) round face
4) increased fat around the base of the neck

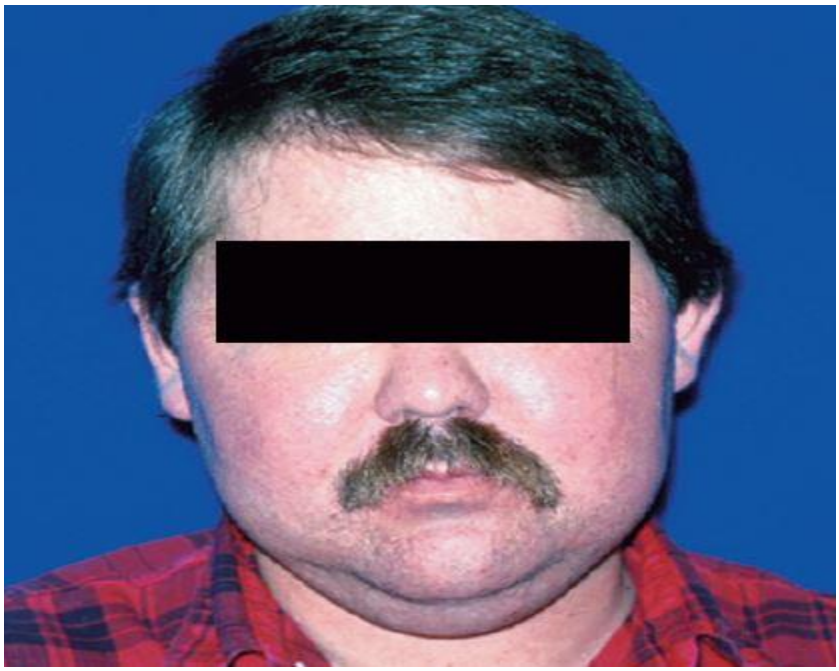


Fig. 1 : Moon-shaped face; a clinical manifestation of cushing disease

5) easy bruising
6) wide purple stretch marks, mainly on the abdomen, breasts, hips, and under the arms
7) Muscle weakness & aches
8) Changes in skin
9) Declining bone health; osteoporosis and ↓ osteoblast action. Unfortunately, many people consider these symptoms as normal side effects of aging, and doctors may overlook them as such, as well
10) Male-Pattern Hair Growth; This usually causes fast-growing and thick body hair usually on the face, neck, and back and excess and darker facial hair.
11) Cushing's syndrome can also lead to menstruation fluctuations.
12) Change in Sexual Habits

Fig. 2: Buffalo hump pure posture

Adrenocortical insufficiency can be divided in to:

1) Primary adrenocortical insufficiency (Addison's disease)
2) Secondary adrenocortical insufficiency, caused by structural lesions of the pituitary gland (e.g., tumor), removal of the pituitary gland, cranial irradiation of the pituitary gland, head trauma, and lack of responsiveness of the adrenal glands to ACTH (corticotrophin) or due to critical illness (e.g., sepsis , liver cirrhosis).
3) Tertiary adrenal insufficiency results from processes that impair function of the hypothalamus; which is most commonly caused by chronic use of corticosteroids.

Because abnormal adrenal function can be life threatening, these conditions are of significant concern in clinical practice.

Secondary and tertiary adrenal insufficiencies are associated with low levels of cortisol. Unlike primary adrenal insufficiency, aldosterone is not impaired with secondary or tertiary adrenal insufficiency. This is because aldosterone secretion is ACTH independent.

Physiology

The **hypothalamic pituitary adrenal** (**HPA**) **axis** is our central stress response system. Regulation of cortisol secretion occurs via the

hypothalamic-pituitary-adrenal (HPA) axis … ACTH binds to receptors on the **adrenal** cortex and stimulates **adrenal** release of cortisol. In response to stressors, cortisol will be released for several hours after encountering the stressor.

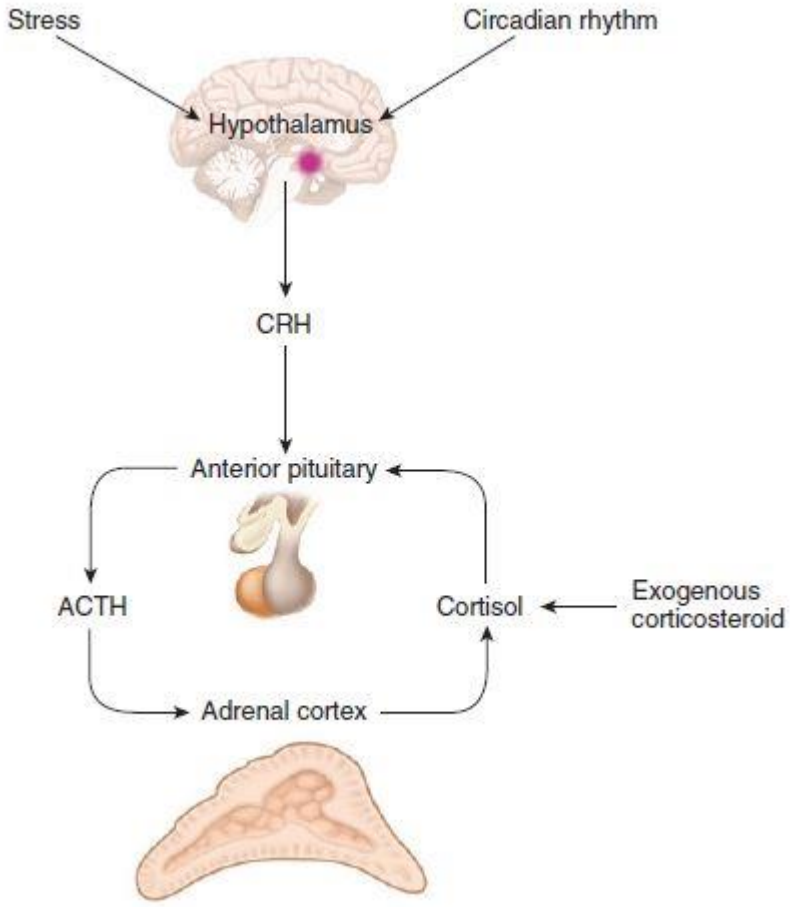


Fig. 3 ; Hypothalamic–pituitary–adrenal axis and the regulation of cortisol secretion. *ACTH*, Adrenocorticotropic hormone; *CRH*, corticotropin-releasing hormone.

Mineralocorticoids (Aldosterone)

Aldosterone is the primary mineralocorticoid secreted by the adrenal cortex. It is essential to sodium and potassium balance and to the maintenance of extracellular fluid (i.e., intravascular volume).

Aldosterone secretion is regulated by the;

- **A.** Renin-angiotensin system,
- **B.** ACTH, and
- **C.** Plasma sodium and potassium levels.

It is stimulated by a fall in renal blood pressure, which results from decreased intravascular volume or a sodium imbalance, and causes release of renin, which activates angiotensin. Angiotensin causes aldosterone to be secreted. When blood pressure rises, renin-angiotensin release diminishes, serving as a negative feedback loop that inhibits additional production of aldosterone

Renal BP ↓ —> renin ↑ + angiotensin ↑ —> ↑ Aldosterone

While….

Renal BP ↑ —> renin ↓ + angiotensin ↓ —> ↓ Aldosterone

Cortisol

The primary glucocorticoid, is responsible for a wide variety of functions and effects. Some of the more important ones include regulation of carbohydrate, fat, and protein metabolism, maintenance of vascular reactivity, inhibition of inflammation, and maintenance of homeostasis during periods of physical or emotional stress.
Cortisol acts as an insulin antagonist (**Figure 4**), increasing blood levels and peripheral use of glucose; increasing liver glucose output; and initiating lipolysis, proteolysis, and gluconeogenic mechanisms.

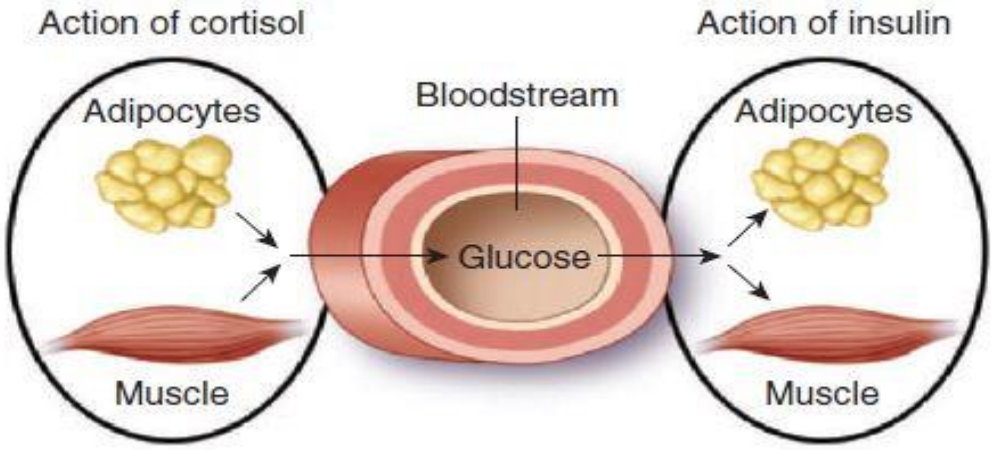


Fig. 4 : Effects of cortisol & insulin on glucose in the bloodstream

The anti-inflammatory action of cortisol is modulated by its ***inhibitory action*** on;

1) lysosome release,
2) prostaglandin production,
3) eicosanoid and cytokine release,
4) endothelial cell expression of intracellular and extracellular adhesion molecules that attract neutrophils,

5) the function of leukocytes.

The normal secretion rate of cortisol over a 24-hour period is approximately 20 mg, which increased during stress ((surgery is the one of the biggest stressors)).
Various stressors such as

- ✓ surgery,
- ✓ athletic event,
- ✓ trauma,
- ✓ illness,
- ✓ burns,
- ✓ fever,
- ✓ hypoglycemia,
- ✓ and emotional upset

All these stressors can trigger this effect ((cortisol increasing secretion through HPA axis activation)). The greatest response is noted in the immediate postoperative period. However, this can be reduced by morphine-like analgesics, benzodiazepines, or local anesthesia, suggesting that the pain response mechanism increases the requirement for cortisol. .Cortisol secretion normally follows a diurnal pattern (day time). Peak levels of plasma cortisol occur about the time of awakening in the morning and are lowest in the afternoon and evening (Figure 16-4). This pattern is reversed in an individual who habitually works nights and sleeps during the day.

Adrenal Androgens

Dehydroepiandrosterone is the principal androgen secreted by the adrenal cortex. The effects of adrenal androgens are the same as those of testicular androgens (i.e., masculinization and the promotion of protein anabolism and growth).
Estrogen precursors are secreted from the zona reticularis of the adrenal cortex.

Signs and Symptoms of Addison Disease:

Primary adrenal insufficiency (Addison disease) produces signs and symptoms associated with a deficiency of all adrenocortical hormones (aldosterone, cortisol, androgens). The most common complaints are

1) weakness,
2) fatigue,
3) abdominal pain, and
4) hyperpigmentation of the skin (i.e., skin areas subjected to pressure: elbows, knuckles, palmar creases) and mucous membranes.

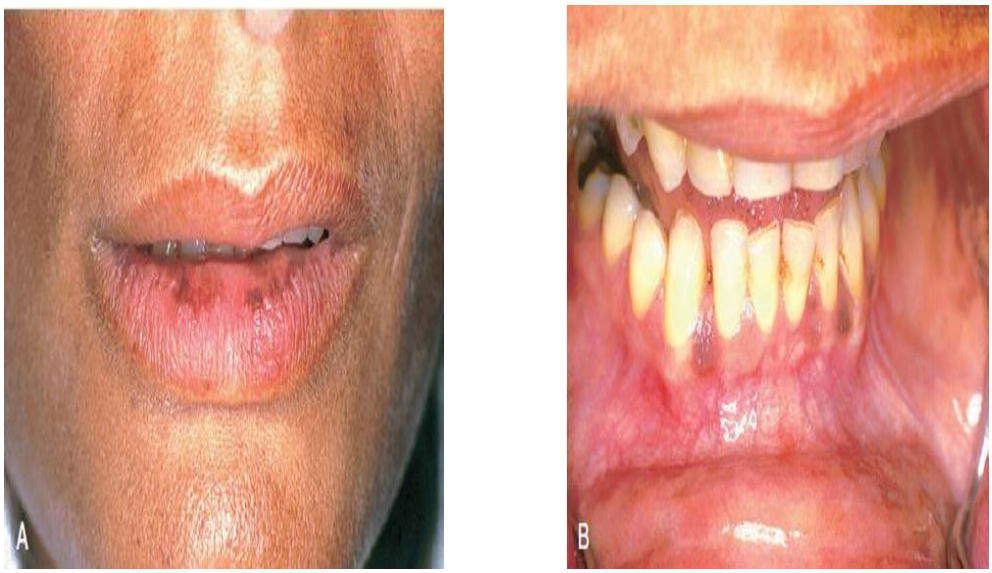


Fig. 5 : Patient with Addison disease. Note bronzing of the skin with pigmentation of the lip, **A,** and the oral mucosa, **B.**

5) Hypotension,
6) anorexia,
7) salt craving,
8) myalgia,
9) hypoglycemia, and
10) weight loss are additional commonly associated features.

If a patient with Addison disease is challenged by emotional or physical stress (e.g., illness, infection, surgery), an *adrenal crisis* may be precipitated.

Adrenal Crisis

Adrenal crisis is a potentially life-threatening complication resulting from adrenal insufficiency triggered by emotional and physical stress (e.g., infection, fever, sepsis, surgery).
This medical emergency evolves over a few hours and manifests as severe exacerbation of the patient's condition, including sunken eyes, profuse sweating, hypotension, weak pulse, cyanosis, abdominal pain, nausea, vomiting, weakness, headache, dehydration, fever, dyspnea, myalgias, arthralgia, hyponatremia, and eosinophilia.
If not treated rapidly, the patient may develop hypothermia, severe hypotension, hypoglycemia, confusion, and circulatory collapse that can result in death

The condition occurs at a rate of 5 to 6 events per 100 patient-years among those with primary adrenal insufficiency, with older affected adults at higher risk

Treatment: This condition requires timely diagnosis and immediate treatment, including IV injection of a glucocorticoid—usually a 100-mg hydrocortisone bolus—and fluid and electrolyte replacement to reverse the hypotension, cortisol deficiency, and electrolyte abnormalities. IM injection results in slow absorption and is not preferred for emergency treatment. After the initial bolus, 50 mg of hydrocortisone is administered by IV slowly every 6 to 8 hours for 24 hours for a typical total dose of 100 to 200 mg per 24 hours along with fluid replacement, vasopressors, continuous infusion of saline, and correction of hypoglycemia, if needed. Resolution of the precipitating event or condition also is required.

Hospitalization is required for adequate treatment and monitoring.

	Target Dose	
Procedure	Primary Adrenal Insufficiency†	Secondary Adrenal Insufficiency‡
Routine dentistry	None	None
Minor surgery	25 mg of hydrocortisone equivalent, preoperatively on the day of surgery	Daily therapeutic dose
Moderate surgical stress	50–75 mg on day of surgery and up to 1 day after Return to preoperative glucocorticoid dose on postoperative day 2	Daily therapeutic dose
Major surgical stress	100–150 mg per day of hydrocortisone equivalent given for 2–3 days After preoperative dose, 50 mg of hydrocortisone IV every 8 hours after the initial dose for the first 48–72 hours after surgery	Daily therapeutic dose

Table 1: Recommendations for Steroid Supplementation During Surgery

Dental Management

Corticosteroids are used during perioperative periods for reduction of pain, edema, and trismus after oral surgical and endodontic procedures. The dentist must consider the type and degree of adrenal dysfunction and the dental procedure planned. Patients with hyperadrenalism have an increased likelihood of hypertension and osteoporosis and increased risk for peptic ulcer disease.

Significant cortisol increases are not generally seen before or during the operation but are increased in the postoperative period approximately 1 to 5 hours after the procedure is begun.

Supplementation is not required for patients who take corticosteroids when uncomplicated minor surgical procedures of the orofacial complex are performed with local anesthesia with or without conscious sedation.

Four clinical factors appear to contribute to the risk of adrenal crisis during the perioperative period of oral surgery. These include

1) Severity of surgery,
2) Drugs administered,
3) Overall health of the patient,
4) Extent of pain control.

Additional factors (e.g., amount of blood loss, fasting state) may contribute to hypotension and hypoglycemia that can be confused with adrenal crisis but do not require glucocorticoids for resolution.

At present, for minor oral and periodontal surgery, adrenal insufficiency is prevented when circulating levels of glucocorticoids are about 25 mg of hydrocortisone equivalent per day. This is equivalent to a dose of about 6 mg of prednisone. If the patient is to gain the benefit of the corticosteroid, the drug should be taken within 2 hours of the surgical procedure. Preferably, surgery is scheduled in the morning and stress reduction measures are implemented.

For major oral surgical stress involving the use of general anesthesia, procedures of longer than 1 hour duration, or significant blood loss, the glucocorticoid target is about 50 to 100 mg per day of hydrocortisone equivalent on the day of surgery and for at least 1 postoperative day. Patients should take their normal dose and should be given supplemental hydrocortisone intraoperatively to achieve 100 mg. Hospitalization should be considered for these patients because blood pressure can be more closely monitored postoperatively in this setting. Hydrocortisone 25 mg is usually prescribed every 8 hours subsequent to surgery for 24 to 48 hours, depending on the procedure and the anticipated level of postoperative pain.

*Steroid supplementation protocol for major surgical procedure:

• Discontinue drugs that decrease cortisol levels (e.g., ketoconazole) at least 24 hours before surgery with the consent of the patient's physician.

• Have patient take usual morning dose (or the parenteral equivalent as a preoperative dose), and provide supplemental hydrocortisone preoperatively and intraoperatively to achieve 100 mg within first hour of surgery. Give hydrocortisone 25 mg every 8 hours subsequent to surgery for 24 to 48 hours. Perform in hospital environment.

• Provide adequate operative and postoperative analgesia.

• Use barbiturates with caution and knowledge of the potential for adverse effects on plasma cortisol levels.

• Monitor blood pressure (BP) and blood loss throughout the procedure. If BP drops to below 100/60 mm Hg and the patient is unresponsive to fluid replacement and vasopressive measures, administer supplemental steroids.

• Communicate with the patient at the end of the appointment and within 4 hours postoperatively to determine whether features of weak pulse, hypotension, dyspnea, myalgias, arthralgia, ileus, and fever are present. Signs and symptoms of adrenal crisis dictate transport to a hospital for emergency care.

Emergency Action; Immediate treatment during an adrenal crisis requires proper patient positioning (i.e., head lower than feet), fluid replacement, administration of vasopressors, administration of 100 mg of hydrocortisone or 4 mg of dexamethasone IV, and immediate transportation to a medical facility.

When oral maxillofacial surgical procedures are planned; **Box 1 shows recommendations for supplementation**

Dental Management of the Patient With Possible Adrenal Insufficiency

1. Patient past history of systemic corticosteroid use
   a. Evaluate the patient.
   b. Determine whether systemic corticosteroid was taken within the past 2 weeks and the reason for discontinuing usage.
   c. Determine type, dose, and duration of systemic corticosteroid used.
   d. Identify signs and symptoms of possible adrenal insufficiency.
   e. If major invasive oral procedure is planned and corticosteroid was taken within the past 2 weeks, consult with the physician regarding status and stability (adrenocorticotropic hormone [ACTH] or perform corticotropin-releasing hormone [CRH] test performed). If adrenal insufficient, implement steroid supplementation protocol.* Note that risk of medical complications increases when major surgical procedures are performed on persons who have low adrenal reserve.
2. Patient currently taking systemic corticosteroids
   a. Evaluate the patient.
   b. Determine dose and duration of systemic corticosteroid used.
   c. Identify signs and symptoms of possible adrenal insufficiency.
   d. For diagnostic and minimally invasive procedures, have patient take the usual daily dose, and perform oral procedure in the morning, shortly after the corticosteroid is taken. Stress reduction measures should be implemented, blood pressure recorded during the procedure.
   e. For major invasive oral procedures, consult with the physician regarding status and stability (ACTH or CRH test performed). Implement the steroid supplementation protocol.*
3. Patient not taking systemic corticosteroids, but may have adrenal insufficiency
   a. Evaluate the patient for historical findings associated with risk for adrenal insufficiency.
   b. Identify signs and symptoms of adrenal insufficiency.
   c. Refer to the physician for ACTH testing.
   d. If the patient is found to be adrenally insufficient, defer dental treatment until stabilized with corticosteroid treatment. Then, follow the steroid supplementation protocol* as defined in 2d and 2e.

Oral Complications and Manifestations

In primary adrenal insufficiency, diffuse or focal brown macular pigmentation of the oral mucous membranes is a common finding **(see Figure 5)**. Pigmentation of sun-exposed skin often follows the appearance of oral pigmentation. Patients with secondary adrenal insufficiency may be prone to delayed healing and may have increased susceptibility to infection.

Reference;

LITTLE & FALACE'S DENTAL MANAGEMENT OF THE MEDICALLY COMPROMISED PATIENT

THANKS

Pregnancy and Breast Feeding

Apregnant patient, although not considered medically compromised, poses a unique set of management considerations for the dentist. Dental care must be rendered to the mother without adversely affecting the developing fetus, and although routine dental care of pregnant patients is generally safe to perform, the delivery of dental care involves some potentially harmful elements, including ionizing radiation and drug administration. In contrast, the provision of select dental care can be beneficial to the developing infant.
Thus, the prudent practitioner must balance the beneficial aspects of dentistry while minimizing or avoiding exposure of the patient to potentially harmful procedures.
Additional considerations arise during the postpartum period if the mother elects to breast-feed her infant.
Although most drugs are only minimally transmitted from maternal serum to breast milk, and the infant's exposure is not significant, the dentist should avoid using any drug that is known to be harmful to the infant.

Physiology and Complications

To define rational management guidelines, a review of the normal processes of pregnancy and fetal development is provided. Endocrine changes are the most significant basic alterations that occur with pregnancy. They result from the increased production of maternal and placental hormones and from modified activity of target end organs.
Fatigue is a common physiologic finding during the first trimester that may have a psychological impact. A tendency toward syncope and postural hypotension has also been noted. During the second trimester, patients typically have a sense of well-being and relatively few symptoms. During the third trimester, increasing fatigue and discomfort and mild depression may be reported. Several cardiovascular changes occur as well. Blood volume increases by 40%, cardiac output by 30% to 40%, and red blood cell volume by only about 15% to 20%. In spite of the increase in cardiac output, blood pressure falls (usually to 100/70 mm Hg or lower) during the second trimester. This increase in blood volume is associated with high-flow/low-resistance circulation, tachycardia, and heart murmurs, and it may unmask glomerulopathies, peripartum cardiomyopathy, arterial aneurysms, or arteriovenous malformations. A benign systolic murmur is one of the more common complications; it develops in 90% of pregnant women but disappears shortly after delivery. A murmur of this type is considered physiologic or functional. However, a murmur that preceded pregnancy or persisted after delivery would require further evaluation for determination of its significance.
During late pregnancy, a phenomenon known as supine hypotensive syndrome may occur that manifests as an abrupt fall in blood pressure, bradycardia, sweating, nausea, weakness, and air hunger when the patient is in a supine position. [Symptoms are caused by impaired venous return to the heart that results from compression of the inferior vena cava by the gravid uterus. This leads to decreased blood pressure, reduced cardiac output, and impairment or loss of consciousness. The remedy for the problem is to roll the patient over onto her left side, which lifts the uterus off the vena cava. Blood pressure should rapidly return to normal.
Blood changes in pregnancy include anemia and a decreased hematocrit value. Anemia occurs because blood volume increases more rapidly than red blood cell mass. As a result, a fall in hemoglobin and a marked need for additional folate and iron occur. Approximately 20% of pregnant women have iron deficiency—a problem that is exaggerated by significant blood loss. Although changes in platelets are usually insignificant, several blood clotting factors (especially fibrinogen; von Willebrand factor; factors VII, VIII, IX, and X; and fibrin-split products) are increased. This hypercoagulation state increases the risk of thrombosis 7- to 10-fold.
The general pattern of fetal development should be understood when dental management plans are being formulated. Normal pregnancy lasts approximately 40 weeks. During the first trimester, organs and systems are formed. Thus, the fetus is most susceptible to malformation during this period. After the first trimester, the majority of formation is complete, and the remainder of fetal

development is devoted primarily to growth and maturation. Thus, the chances of malformation are markedly diminished after the first trimester. A notable exception to this is the fetal dentition, which is susceptible to malformation from toxins or radiation, and to tooth discoloration caused by administration of tetracycline.

Complications of pregnancy are infrequent when prenatal care is provided and the mother is healthy. Common complications include infection, inflammatory response, glucose abnormalities, and hypertension. Each increases the risks for preterm delivery, perinatal mortality, and congenital anomalies. Insulin resistance is a contributing factor to the development of gestational diabetes mellitus (GDM), which occurs in 2% to 6% of pregnant women. GDM increases the risks for infection and large birth weight babies. Hypertension is of particular interest because it can lead to end organ damage or preeclampsia, a clinical condition of pregnancy that manifests as hypertension, proteinuria, edema, and blurred vision. Preeclampsia progresses to eclampsia if seizures or coma develop. The cause of eclampsia is unknown but appears to involve sympathetic overactivity associated with insulin resistance, the renin-angiotensin system, lipid peroxidation, and inflammatory mediators. Complications of pregnancy that are unresponsive to diet modification and palliative care ultimately require drugs or hospitalization for adequate control.

Another consideration related to fetal growth is spontaneous abortion (miscarriage). Spontaneous abortion, the natural termination of pregnancy before the 20th week of gestation, occurs in more than 15% of all pregnancies; most cases are caused by intrinsic fetal abnormalities. Therefore, it is most unlikely that any dental procedure would be implicated in spontaneous abortion, provided fetal hypoxia and exposure of the fetus to teratogens are avoided. Febrile illness and sepsis also can precipitate a miscarriage; therefore, prompt treatment of odontogenic infection and periodontitis is advised. Because of immature liver and enzyme systems, the fetus has a limited ability to metabolize drugs. Pharmacologic challenge of the fetus is to be avoided when possible.

During the postpartum period, the mother may suffer from lack of sleep and postpartum depression. Also during the postpartum period, risks for autoimmune disease, particularly rheumatoid arthritis, multiple sclerosis, and thyroiditis, are increased

DENTAL MANAGEMENT

Medical Considerations

Management recommendations during pregnancy should be viewed as general guidelines—not as immutable rules. The dentist should assess the general health of the patient through a medical history. Inquiries should be made regarding current physician, medications taken, use of tobacco, alcohol, or illicit drugs, history of gestational diabetes, miscarriage, hypertension, and morning sickness. If possible, contacting the patient's obstetrician or physician to discuss her medical status, dental needs, and proposed dental treatment is helpful. This is beneficial from the standpoint of planning treatment and also demonstrates to the patient a caring concern about her and her baby.

Dental Management Considerations for Patients Who Are Pregnant

1. Evaluate patient; determine trimester and health status.
2. Confirm that medical prenatal care was provided, or facilitate entry into medical care.
3. Provide periodontal therapy and oral hygiene instructions.
4. Educate the patient: Discuss the importance and benefits of good plaque control and fluoride.
5. Minimize radiographic exposure.
6. Minimize drug use. Drug selection should be based on safety profile, risk to mother and fetus, and potential for interactions and adverse effects.
7. Avoid prolonged appointment time in the dental chair (i.e., risk of supine hypothesion).
8. The safest time for provision of dental treatment is the second trimester.

At a minimum, blood pressure, pulse, and respirations should be measured. Systolic pressure values at or above 140 mm Hg and diastolic pressure at or above 90 mm Hg are signs of hypertension . Also diagnostic of hypertension is an increase of 30 mm or more in systolic blood pressure or an increase of 15 mm Hg in diastolic blood pressure compared with prepregnancy values. Confirmed hypertensive values dictate that the patient should be referred to a physician to ensure that preeclampsia and other cardiovascular disorders are properly diagnosed and managed

Preventive Program.

This essentially consists of a plaque control program that minimizes the exaggerated inflammatory response of gingival tissues to local irritants that commonly accompany the hormonal changes of pregnancy. This is important because maternal periodontal disease increases the infant's risk for preterm birth and low birth weight. This is speculated to be caused by bacteria or bacterial products transported through the systemic circulation that elicit inflammatory responses within the placental membranes.In addition, maternal plaque control has implications for caries risk for the infant. Studies conducted over the past 25 years have shown that reduced oral streptococcal levels in the pregnant mother reduce the risk that the infant will become infected and develop caries. The benefits of prenatal fluoride are also apparent. The conclusion was that fluoride tablet supplementation from the third through ninth months of pregnancy was safe and effective.

-

Treatment Timing During Pregnancy

First Trimester	Second Trimester	Third Trimester
Plaque control	Plaque control	Plaque control
Oral hygiene instruction	Oral hygiene instruction	Oral hygiene instruction
Scaling, polishing, curettage	Scaling, polishing, curettage	Scaling, polishing, curettage
Avoid elective treatment; urgent care only	Routine dental care	Routine dental care

Dental Radiographs

The safety of dental radiography has been well established, provided features such as fast exposure

techniques (e.g., high-speed film, digital imaging), filtration, collimation, and lead aprons are used. Of all
aids, the most important for the pregnant patient is the protective lead apron.

Drug Administration during pregnancy

Anesthetics.

Although both the local anesthetic and the vasoconstrictor cross the placenta, subtoxic threshold doses have not been shown to cause fetal abnormalities. Because of adverse effects associated with high levels of these drugs, it is advisable to limit the dose to the amount required. Concerns include risk for methemoglobinemia with high-dose prilocaine and articaine, as well as embryocidal effects associated with toxic doses of bupivacaine.

Analgesics.

The analgesic of choice during pregnancy is acetaminophen. Aspirin and nonsteroidal anti-inflammatory drugs convey risks for constriction of the ductus arteriosus, as well as for postpartum hemorrhage and delayed labor .The risk of these adverse events increases when agents are administered during the third trimester. Risk also is more closely associated with prolonged administration, high dosage, and selectively potent anti-inflammatory drugs, such as indomethacin.
Prolonged or high doses of opioids are associated with congenital abnormalities and respiratory depression. For this reason, opioid-containing drugs should generally be avoided.

Antibiotics.

Penicillins, erythromycin and cephalosporins (first and second generation) are considered safe for the expectant mother and the developing child.
The use of tetracycline is contraindicated during pregnancy. Tetracyclines bind to hydroxyapatite, causing brown discoloration of teeth, hypoplastic enamel, inhibition of bone growth, and other skeletal abnormalities.

Anxiolytics.

the following guidelines are recommended for the use of anxiolytics
• Use of N_2O—O_2 inhalation should be minimized to 30 minutes.
• At least 50% oxygen should be delivered to ensure adequate oxygenation at all times.
• Appropriate oxygenation should be provided to avoid diffusion hypoxia at the termination of administration.
• Repeated and prolonged exposures to nitrous oxide are to be prevented.
• The second and third trimester are safer periods for treatment because organogenesis occurs during the first trimester.

During Breast Feeding.

Data on which to draw definitive conclusions about drug dosages and effects via breast milk are limited.. A significant fact is that the amount of drug excreted in
the breast milk usually is not more than 1% to 2% of the maternal dose. Therefore, most drugs are of little pharmacologic significance to the infant .Agreement exists that a few drugs, or categories of drugs, are definitely contraindicated for nursing mothers. These include lithium, anticancer drugs, radioactive pharmaceuticals, and phenindione.
As a general guidelines for treatment, authorities suggest that nursing mothers take the drug just after breast feeding and avoid nursing for 4 hours or longer if possible. This should result in reduced drug concentrations in the breast milk.

Neurologic disorders

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Oral Surgery
Fourth Stage

Neurologic disorders:

Neurological disorder meant to any condition in which a person experiences dysfunction in the brain or the nervous system, which results in psychological and even physical symptoms.

The neurological disorders happen in the brain, spinal column or especially in nerves.

The symptoms depend on the severity and location of the disorder. Furthermore, there is a wide range of neurological disorders, these can **affect body coordination**, **senses**, **vision**, **hearing**, and **taste.**

Generally, the symptoms could be **behavioral**, **emotional**, **physical** and **with the combination of each**

Types of Neurological Disorders:

There is a wide range of neurological disorders. However, common ones **including:**

1.Alzheimer's disease

2.Parkinson's disease

3.Migraines

4.Multiple Sclerosis

5.Epilepsy

Definition of Terms

•Seizure

•Paroxysmal event due to abnormal, excessive, hypersynchronous discharges from an aggregate of CNS neurons

•Epileptic Seizure

• Transient occurrence of signs and/or symptoms due to abnormal excessive or synchronnous neuronal activity in the brain

•Epilepsy

•History of at least one seizure

•Enduring alteration in the brain that increases the likelihood of future seizures

•Associated neurobiologic, cognitive, psychological and social disturbances

•Stroke

• rapidly developing loss of brain function(s) due to disturbance in the blood supply to the brain

•neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours

•Post stroke seizure

•single or multiple convulsive episode/s (fit/s) after stroke and thought to be related to reversible or irreversible cerebral damage due to stroke regardless of time of onset following the stroke

•Post-stroke Spilepsy

•recurrent seizures following stroke with confirmed diagnosis of epilepsy

Epilepsy:

Epilepsy is a neurological disorder. **Its primary identifying factor is recurrent**, **unprovoked seizures.**
Abnormal electrical activity in the brain causes seizures. This brain activity affects how a person feels, acts, and behaves. **Fit** or **convulsion that occurs when a sudden burst of electrical activity in the brain temporarily interferes with the normal messaging processes** Depending on the seizure **type** and **severity**, a person may or may **not lose consciousness.**

There are **four main types** of epilepsy: **focal**, **generalized**, **combination focal and generalized**, and **unknown**.
A person's seizure type determines what **kind of epilepsy they have ?**.

The word **"epilepsy"** is derived from the Greek • word "**epilambanein**" meaning to take or to **seize**.

Classification of seizures[a]

- Generalized seizures
  - Tonic–clonic (in any combination)
  - Absence
    - Typical
    - Atypical
    - Absence with special features
      - Myoclonic absence
      - Eyelid myoclonia
  - Myoclonic
    - Myoclonic
    - Myoclonic atonic
    - Myoclonic tonic
  - Clonic
  - Tonic
  - Atonic
- Focal seizures
- Unknown
  - Epileptic spasms

[a]Seizure that cannot be clearly diagnosed into one of the preceding categories should be considered unclassified until further information allows their accurate diagnosis. This is not considered a classification category, however.

Types of epilepsy

Different types of seizures affect the **brain in different ways**. For example, **focal seizures affect only one part of the brain**, whereas **generalized seizures** affect the **entire brain**.

To be categorized as **having epilepsy**, a person must **experience two or more unprovoked seizures**. Some people can receive an **epilepsy diagnosis** if they have had **one seizure** and a doctor thinks they have a high likelihood of having another.

The four different types of epilepsy are defined by the type of seizure a person experiences. **They are:**

•generalized epilepsy , focal epilepsy ,combined generalized and focal epilepsy ,unknown epilepsy

Each type of epilepsy affects the **brain differently**. This means they have **different identifying factors** and **treatments.**

Generalized epilepsy:

People with this type of epilepsy have **generalized seizures**. These affect **both the left and right sides of the brain.** Additionally, these seizures may be **either motor**, which involve **physical movement**, or **non-motor**, which do not.

If someone has a motor seizure, they may experience:

jerking movements ,weakness or limp limbs ,tense, rigid muscles ,muscle twitching ,full-body epileptic spasmsNon-motor seizures are also **called absence seizures**. Symptoms **may include:** staring into space , a sudden stop in movement ,brief twitches fluttering eyelids .Generalized epilepsy usually starts during childhood. However, it can also affect adults.

DRUGS AND OTHER SUBSTANCES THAT CAN CAUSE SEIZURES

- Alkylating agents (e.g., busulfan, chlorambucil)
- Antimalarials (chloroquine, mefloquine)
- Antimicrobials/antivirals
  - β-lactam and related compounds
  - Quinolones
  - Acyclovir
  - Isoniazid
  - Ganciclovir
- Anesthetics and analgesics
  - Meperidine
  - Tramadol
  - Local anesthetics
- Dietary supplements
  - Ephedra (ma huang)
  - Gingko
- Immunomodulatory drugs
  - Cyclosporine
  - OKT3 (monoclonal antibodies to T cells)
  - Tacrolimus
  - Interferons
- Psychotropics
  - Antidepressants
  - Antipsychotics
  - Lithium
- Radiographic contrast agents
- Theophylline
- Sedative-hypnotic drug withdrawal
  - Alcohol
  - Barbiturates (short-acting)
  - Benzodiazepines (short-acting)
- Drugs of abuse
  - Amphetamine
  - Cocaine
  - Phencyclidine
  - Methylphenidate
- Flumazenil[a]

Generalized

Tonic Clonic Seizures

- The seizure usually begins abruptly without warning
- Tonic Phase
  - tonic contraction of muscles throughout the body
  - Tonic contraction of the muscles of expiration and the larynx at the onset will produce a loud moan or “ictal cry.”
  - Respirations are impaired, secretions pool in the oropharynx, and cyanosis develops.
  - Contraction of the jaw muscles may cause biting of the tongue.
  - marked enhancement of sympathetic tone
    - increases in heart rate, blood pressure, and pupillary size.
- Clonic Phase (After 10–20 s
  - superimposition of periods of muscle relaxation on the tonic muscle contraction.
  - Progressively increase until the end of the ictal phase, which usually lasts no more than 1 min. T
- Postictal Phase
  - unresponsiveness, muscular flaccidity, and excessive salivation
  - Patients gradually regain consciousness over minutes to hours
  - Patients subsequently complain of headache, fatigue, and muscle ache that can last for many hours
- The EEG during the tonic phase of the seizure shows a progressive increase in generalized low-voltage fast activity, followed by generalized high-amplitude, polyspike discharges.
- In the clonic phase, the high-amplitude activity is typically interrupted by slow waves to create a spike-and-wave pattern.

Absence

Typical

- Characterized by sudden, brief lapses of consciousness without loss of postural control.
- Lasts for only seconds
- usually accompanied by subtle, bilateral motor signs
- usually begin in childhood (ages 4–8) or early adolescence
- Provoked by hyperventilation
- The electrophysiologic hallmark: Generalized,symmetric, 3-Hz spike-and-wave discharge that begins and ends suddenly, superimposed on a normal EEG background.

Atypical Absence

- Lapse of consciousness is usually of longer duration
- Less abrupt in onset and cessation
- Seizure is accompanied by more obvious motor signs that may include focal or lateralizing features.
- Atypical absence seizures are usually associated with diffuse or multifocal structural abnormalities of the brain.
- Less responsive to anticonvulsants
- The EEG shows a generalized, slow spike-and-wave pattern with a frequency of ≤2.5/s, as well as other abnormal activity.

Atypical Absence with Special Features

- Myoclonic Absence
  - The manifestations are abrupt onset of absences accompanied by bilateral rhythmic myoclonic jerks of severe intensity
  - The seizure mainly involves muscles of the shoulders, arms, and legs; facial muscles are less involved.
  - May last from 10 to 60 seconds
  - Hyperventilation, awakening, and stimulation by intermittent light can precipitate the attack.

Atypical Absence with Special Features

- Eyelid Myoclonia
  - The eyelid myoclonia consists of rapid 4 to 6 Hz jerking of the eyelids, which, if brief, may occur in isolation or proceed to an absence also associated with rapid jerking of the eyelids
  - Seizures are brief, 3 to 6 seconds, occurring mainly after eye closure, photic stimulation, or both
  - Onset is usually in early childhood, 5 to 8 years of age
  - Consist of eyelid myoclonia that persists through the attack with or without absences Photosensitivity

Myoclonic

- Myoclonus is a sudden and brief muscle contraction that may involve one part of the body or the entire body
- Myoclonic seizures or twitches are brief contractions, or relaxations, of a muscle or muscle group, resulting in a sudden, jumpy movement.
  - Positive myoclonus - muscular contraction
  - Negative myoclonus - muscular relaxation.
- Consciousness does not usually seem to be impaired
- duration of <1 second
- The EEG may show bilaterally synchronous spike-and-wave discharges synchronized with the myoclonus, although these can be obscured by movement artifact.
- Myoclonic seizures usually coexist with other forms of generalized seizure disorders

Clonic

- Consists of rhythmic jerking movements of the arms and legs, sometimes on both sides of the body.
- Rapidly alternating contraction and relaxation of a muscle
- Movements cannot be stopped by restraining or repositioning the arms or legs
- EEG: high-amplitude activity is typically interrupted by slow waves to create a spike-and-wave pattern.

Tonic

- Often occur during sleep
- Flexion at the waist and neck, abduction and flexion or extension of the upper extremities, and flexion or extension of the lower extremities
- Typical duration is 5–20 seconds.
- Tonic seizures are generalized, involving bilateral musculature in a symmetric or nearly symmetric manner
- EEG usually shows generalized, low-voltage, fast polyspikes.

Atonic

- Atonic seizures are characterized by sudden loss of postural muscle tone lasting 1–2 s
- Usually no postictal confusion
- The EEG shows brief, generalized spike-and-wave discharges followed immediately by diffuse slow waves that correlate with the loss of muscle tone.

Focal epilepsy

People with focal epilepsy have **focal seizures**. Unlike generalized seizures, focal seizures only affect **one part of the brain**. **They can start in one area and move to others.**

These seizures can begin with an aura, which are **minor symptoms signifying the seizure's onset**. This can feel like an **uneasy feeling** in the **stomach**, similar to the feeling of **riding a rollercoaster.**

As the seizure progresses, a person can **experience motor** and **non-motor symptoms**.

Some motor symptoms of focal seizures include:

•muscle twitching , jerking ,spasms ,repeated movements, like clapping or chewing

Non-motor symptoms do not affect how someone moves. However, they may cause confusion or changes in emotions.

Some non-motor symptoms of focal seizures include:

•waves of hot or cold ,goosebumps ,lack of movement , changes in emotions or thoughts

Combined generalized and focal epilepsy:

Someone with combination epilepsy has both **generalized seizures** and **focal seizures**. Therefore, they can experience a mixture of the symptoms discussed above.

Combined epilepsy is **linked to Dravet syndrome(**Dravet syndrome (DS) is a severe form of epilepsy characterized by frequent, prolonged seizures often triggered by high body temperature (hyperthermia), **developmental delay**, **speech impairment**, **ataxia**, **hypotonia**, **sleep disturbances**, and **other health problems which is a rare**, **lifelong form of epilepsy.** It is usually **caused by a mutation in the SCN1A gene**. Because it is often misdiagnosed, people who think they or a family member may have these seizures should contact a doctor.

Causes of epilypsy:

Many things **cause seizures**,these include A-**Head injuries, toxins, tumors, and infections.,hypertension**, and **diabetes as well as electrolyte imbalances**, **dehydration**, and **lack of oxygen.**

B-High doses and withdrawal from chronic use of drugs such as **heroin**, **cocaine**, **barbiturates**, **amphetamines**, and **alcohol** can also lead to seizures.

C-Genetic predisposition to epilepsy associated with **chromosome 12 anomalies**. These anomalies increase the risk of epilepsy in **children of epileptic women**

CAUSES OF SEIZURES	
Neonates (<1 month)	Perinatal hypoxia and ischemia Intracranial hemorrhage and trauma Acute CNS infection Metabolic disturbances (hypoglycemia, hypocalcemia, hypomagnesemia, pyridoxine deficiency) Drug withdrawal Developmental disorders Genetic disorders
Infants and children (>1 mo and <12 years)	Febrile seizures Genetic disorders (metabolic, degenerative, primary epilepsy syndromes) CNS infection Developmental disorders Trauma Idiopathic
Adolescents (12–18 years)	Trauma Genetic disorders Infection Brain tumor Illicit drug use Idiopathic
Young adults (18–35 years)	Trauma Alcohol withdrawal Illicit drug use Brain tumor Idiopathic
Older adults (>35 years)	Cerebrovascular disease Brain tumor Alcohol withdrawal Metabolic disorders (uremia, hepatic failure, electrolyte abnormalities, hypoglycemia) Alzheimer's disease and other degenerative CNS diseases Idiopathic

Types of treatment

Treatment is usually only considered after a diagnosis of epilepsy has been made which usually happens after someone has had repeated seizures. A diagnosis should be made by a specialist, preferably with expertise in epilepsy. This is recommended by NICE (the National Institute for Health and Care Excellence).

In some rare situations treatment might be considered after just a single seizure. This is usually only when a doctor thinks that it is very likely that you will have further seizures. If this is the case they may suggest starting treatment straightaway.

A-Anti-seizure medication (ASM)

Generic names with brand names

- Acetazolamide
- Brivaracetam available as Briviact
- Cannabidiol available as Epidyolex
- Carbamazepine also available as Tegretol, Tegretol Prolonged Release
- Cenobamate available as Ontozry
- Clobazam also available as Frisium, Perizam, Tapclob, Zacco
- Clonazepam
- Eslicarbazepine acetate available as Zebinix
- Ethosuximide
- Everolimus also available as Votubia
- Fenfluramine available as Fintepla
- Gabapentin also available as Neurontin
- Lacosamide available as Vimpat
- Lamotrigine also available as Lamictal
- Levetiracetam also available as Desitrend, Keppra
- Oxcarbazepine also available asTrileptal
- Perampanel available as Fycompa
- Phenobarbital
- Phenytoin also available as Epanutin, Phenytoin Sodium Flynn
- Piracetam available as Nootropil
- Pregabalin also available as Alzain, Axalid, Lecaent, Lyrica
- Primidone also available as Liskantin Saft
- Rufinamide available as Inovelon
- Sodium valproate (**important information for women here**) also available as Epilim, Epilim Chrono, Epilim Chronosphere, Episenta, Epival, Dyzantil
- Stiripentol also available as Diacomit
- Tiagabine available as Gabitril
- Topiramate also available as Topamax
- Valproic acid available as Convulex, Epilim Chrono, Epilim Chronosphere, Dyzantil
- Vigabatrin available as Sabril, Kigabeq
- Zonisamide also available as Zonegran, Desizon

B-Ketogenic diet

The ketogenic diet is one treatment option for children or adults with epilepsy whose seizures are not controlled with AEDs. The diet may help to reduce the number or severity of seizures and may have other positive effects

C-Vagus Nerve Stimulation

Vagus nerve stimulation therapy is a treatment for epilepsy that involves a stimulator (or 'pulse generator') which is connected, inside the body, to the left vagus nerve in the neck. The stimulator sends regular, mild electrical stimulations through this nerve to help calm down the irregular electrical brain activity that leads to seizures

D-Cannabis oil for epilepsy

With talk in the media about the use of cannabis products to treat epilepsy, generating interest and confusion, we outline the different forms of cannabis, their legality and their safety.

E-Epilepsy surgery

Brain surgery or neurosurgery is one way of treating epilepsy. Certain criteria have to be met and tests have to be done to assess suitability.

Living with epilepsy

People with epilepsy must be consistent with their medication and/or treatment regimen. **They should also try to avoid seizure triggers**. Because **triggers vary from person to person**, a person can keep a diary of seizures to record possible triggers.

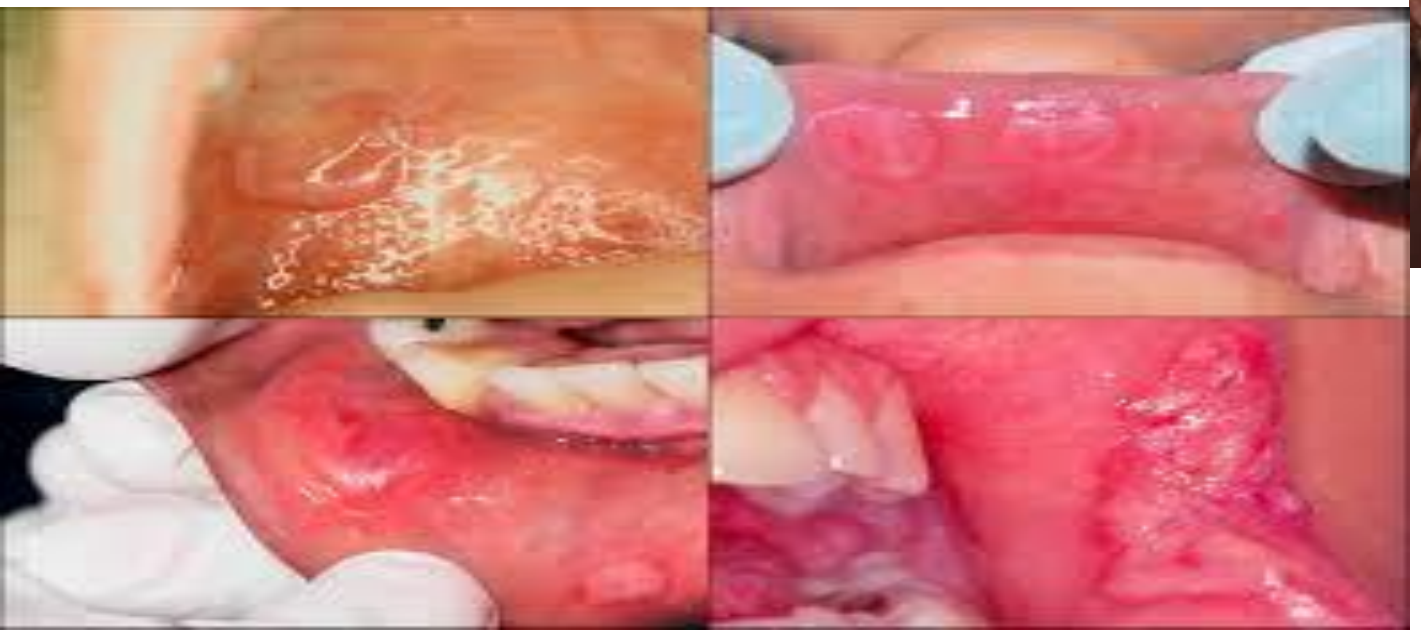
Children with an epilepsy diagnosis often outgrow itTrusted Source with age. For those whose epilepsy continues into adulthood, or people diagnosed later in life, it is very possible **to live a normal life with epilepsy**. Two-thirds of adults with epilepsy no **longer experience seiz**

Oral manifestation of epilepsy:

However, epilepsy has been occur more frequently **in men than in women**.

Oral manifestations are: soft tissue lacerations of tongue or **buccal mucosa**, avulsion, luxation and **fractures of teeth** and **jaws are more common** and **also subluxation of the temporo mandibular joint**.

Due to drug therapy **gingival hyperplasia**, **recurrent apthous** like **ulceration** and **anomalous dental development** like **small teeth** and **delayed eruption**.



Some of Oral manifestation of epilepsy

Management of Epileptic Patients in Dentistry

Epileptic patients have a variety of unique medical and dental needs. These patients can be safely managed in a general dental office by an informed practitioner. A good health history to fully understand the patient's disease, and the medications they are taking is essential.

A proper oral examination to uncover any dental problems and possible oral effects of anti-epileptic drugs is necessary.

Some simple and straightforward treatment planning considerations will ensure the patient's oral health is properly maintained

When treating epileptic patients, the major difficulty a dentist faces is the high risk of seizures occurring. In order to prevent such seizures, three fundamental principles should guide the dentist during his or her interaction with the patient in a clinical environment:

1-knowledge of the patient’s previous seizure episodes and medication,

2-knowledge of the conditions that provoke epileptic seizures, in order to avoid such conditions, and

3-dentist should be able to recognize the early signs of a seizure, take precautions before it occurs, and provide the patient with supportive care if it does occur

Anti-epileptic drugs (AEDs) can also **have side effects which have a direct bearing on dental treatment**. **Phenytoin**, for example, has the most widely known side effect, as it causes gingival hyperplasia. It has been reported that this side effect is observed in 50% of patients taking this medicine for three months .**Carbamazepine,** another AED, causes xerostomia, ulcer, glossitis and stomatitis .**Sodium valproate** may reduce the effectiveness of the blood-clotting mechanism.

It has been recommended that, if a major operation is **planned, the patient should consult his/her doctor** and precautions should be taken; however, this is not essential in the case of minor operations such as tooth removal [5,24]. In addition, Phenobarbital-induced multiform erythema causes bullous and eruption formation and primidone has been reported to cause megaloblastic anemia

It has been reported that most of the medicines prescribed by dentists react with AEDs and reduce the effects of those AEDs. It is stated that non-steroidal antiinflammatory drugs and some of antifungals such are metronidazole, fluconazole and miconazole affects the metabolism of carbamazepine sodium valproate and phenytoin negatively. Therefore, it has been stressed that these drug combinations need to be avoided

Factors to Be Taken into Consideration While Administering Treatment

Before starting treatment, a detailed patient anamnesis should be obtained This should cover the following:

- The frequency of seizures;
- The date of the patient's last seizure;
- The consciousness and respiratory state of the patient during seizures;
- The physical condition of the patient after a seizure;
- Whether there is any aura before seizures;
- Whether experiencing an aura always leads to a seizure;
- The factors provoking seizures;
- The existence of status epilepticus.

As stress is one of the most important factors that provoke seizures, stress-causing factors should be eliminated before starting the treatment. The patient's appointment should be in the early hours of the day, treatment sessions should be kept short, and sudden stimulants such as shimmering bright lights and extreme noise should be avoided [5,10,28]. Furthermore, even though they may be taking medication, if patients are having more than one seizure per month, their treatment must be postponed unless it is urgent

Local Anesthesia

With regard to the safety of administering **local anesthesia to epileptic patients**, it has been reported that the issue is still inconclusive **and not certain** .

Local anesthetics administrated in therapeutic dosages **do not interact with standard antiepileptic drugs**. In the case of a critical **overdose of local anesthetic**, however, clinical conditions such as **generalized tonic-clonic convulsions** may **be observed** . Although it has been reported that local anesthetic administration **during dental treatment is safe**,it is also proposed that adrenalin in local anesthetics has a potential affect on epileptic seizures by intravenous injection

General Anesthesia

General anesthesia has been said to be the right choice if epileptic seizures are difficult to bring under control.Furthermore, if a patient is mentally retarded, then general anesthesia should be considered necessary in view of the fact that a seizure may be triggered by stress due to difficulties in communication .It has been reported that no complications have been encountered under general anesthesia during the treatment of patients who use anti-convulsive medications regularly . However, local anesthesia should be preferred to general anesthesia as far as possible during the treatment of epileptic patients. This is because the brain may suffer from temporary anoxia during general anesthesia, which may initiate epileptic seizures .

Conscious Sedation

During dental treatment, it has been suggested that **seizure development** can be controlled by **sedation** through **nitrous oxide inhalation** or **intravenous benzodiazepine sedation** .However, sometimes a **seizure** may develop during dental treatment despite **intravenous sedation**; in such a case treatment must be postponed

Trauma

During seizures, injuries such as soft tissue damage, tongue injuries, fractures within the maxillofacial region, temporomandibular joint subluxations, tooth fractures, subluxation or avulsion frequently occur. A broken tooth should be treated following normal procedures but re-implantation of an avulsed tooth should be avoided

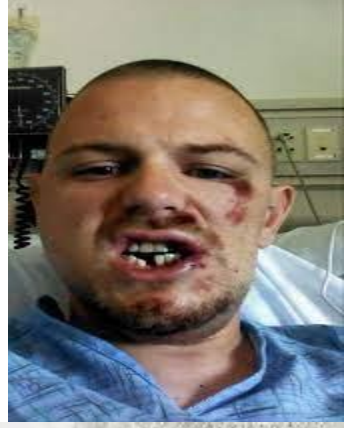
If an avulsed tooth cannot be found, then a radiograph is recommended, given the risk that the patient may have swallowed or inhaled the tooth

Phenytoin and **phenobarbital** both increase **epileptic patients' risk of fractures**, as these **drugs accelerate the excretion and metabolism of vitamin D**.

For these patients, therefore, a combination of **prophylactic anti-epilepsy drugs**, in **tandem with vitamin D and calcium supplements, is recommended** .

When treating a patient who has little or no control over their seizures, and **when dealing with maxillofacial fractures**, it is crucial to make sure that the patient's airway is not blocked. When operating on maxillomandibular fractures, **open reduction** and **fixation should be preferred** and **bimaxillary fixation should be avoided**

Added to these, it also reported that biting the finger of the dentist by the patient during seizure is common. This type of trauma have a risk of **infection for the dentist**, that is not directly belonging to the epilepsy it selfes , using mouth prope will be help to prevent such accident .



Protective Treatment

Factors such as toothache and oral infection, which cause pain and make the patient uncomfortable, may provoke epileptic seizures. It is possible to treat and eliminate these factors during periodic dentist appointments, before complications arise.

The degree of gingival hyperplasia caused by phenytoin should be controlled by preventing the formation of plaque.

However, plaque removal would be ineffective unless hyper-plastic tissue is properly removed during gingivectomy. If hyperplasies recur, the patient should change his medication in consultation with his .

Research indicates that epileptic patients have severely inadequate mouth hygiene, oral health and dental condition, as compared with nonepileptic patients. This is explained by the fact that these patients receive insufficient dental care because they spend only a short time in the dentist's chair due to the risk of seizure. Furthermore, their dental condition is worsened by injuries and damage caused to both hard and soft tissues in the maxillofacial region during seizures. Therefore, protective methods such as the use of chlorohexidine and fluoride, education regarding oral hygiene, regular dental check-ups, and educating children to avoid sugary foods and drinks are crucially important

Restorative Treatment

Treatment should be determined according to the type and intensity of patients' seizures. Metal temporary crowns or implant-supported-bridges are more practical than amalgam or porcelain restorations because of the risk of damage during seizures [5,21]. It has been reported that recently developed composite materials are beneficial for incisor teeth restoration [5]. A rubber dam must be used in light of the risk of seizure during restorative treatment

Prosthetic Treatment

Epileptic patients face a higher risk of tooth loss and lose their teeth earlier than the general population; they also receive less **prosthetic rehabilitation**.

Fixed prosthesis, a nickel-chrome composite material is used more frequently than a metal-ceramic composite material. The patient's socioeconomic status and to arise from inadequate protective, restorative, and prosthodontic care.

It is important that the type of denture provided to an epileptic patient is based on the type of seizure they experience. However, in relation to denture provision, special treatment is not required for patients who have not suffered from a seizure for a long period of time (whether or not they are on medication) or for patients who do not experience involuntary masticatory strokes during seizure . In fact, 70% of epileptic patients fall into this category of not requiring special treatment with regard to denture provision. By contrast, patients who suffer from **tonic-clonic seizures** with **involuntary muscle contractions** that include the masticatory system require special treatment. This is because there is a risk of the inhalation of and damage to the prosthesis if it falls out of its normal position during seizure .Dentures must be supported on a metallic base. If the dental interstice is broad, telescopic supporting dentures with a metallic base would also be beneficial .It is also proposed that a good denture and oral hygiene and a good fit of the dentures decrease the risk of phenytoin induced gingival hyperplasia .

Orthodontic Treatment

Orthodontic treatment can be conducted easily in epileptic patients. A fixed appliance should be preferred over a removable appliance. Otherwise, a removable appliance must have maximum retention .An occlusal splint must also be retentive when used to treat epileptic patients who have temporomandibular disorders

Actions to Be Taken If a Patient Has an Epileptic Seizure during Dental Treatment

The appointment should be given to the patient in **early hours of the day,** treatment sessions should be kept short and **sudden stimulants like shimmering bright lights** and **extreme noise should be avoided** .

- Treatment should be stopped and dental tampons, prostheses and instruments should be removed
- The patient should be helped into the supine position.
- It is not necessary to restrain the patient or move him/her to the floor; neither is it necessary to place an object in the patient’s mouth (e.g. to stop them swallowing their tongue). Preventing injury is the primary, most important goal of assistance
- Any tight clothing the patient is wearing should be loosened.

• If the patient has an aura, thick gauze tampons should be placed in the patient's mouth in order to prevent any kind of injury or damage to the tooth
• Some patients fall into a deep sleep after seizure. In such cases the patient must be monitored closely
• If the seizure lasts **more than 3 minutes** and recurs, **drug administration is required**. like midazolam Oral or IM depending on severity of case of status epilepticus
• The patient should be monitored to make sure his/her airway does not become obstructed. However, if the seizure lasts longer and continues in spite of medication, the patient should be sent to hospital
• After the patient regains consciousness, he/she should be sent home to rest. Treatment should be postponed until the patient feels well again.

Cerebrovascular accidents (stroke):

A neurovascular accident (stroke) is **often fatal** but may be precipitated by multiple non–life-threatening events that if identified, can reduce the risk of an acute and serious outcome when the patient is in dental treatment.
Knowing the clinical signs and symptoms of a stroke is important in managing older patients with longstanding cardiovascular disease.
Prior to and during dental treatment .The clinician should be aware that patients with longstanding hypertension and **cerebrovascular disease** are at **increased risk of a cerebrovascular accident**. Stroke is the **third most common cause of death in the United States.**
The signs of a stroke can be quite subtle. A major event may be associated with many transient ischemic attacks (TIAs), or minor strokes, that last for a few minutes. **In a TIA**, dizziness, diplopia, hemiplegia, and altered speech may occur.

A thorough history of possible patient symptoms prior to treatment may provide useful information regarding the possibility of an impending major event during treatment, as several TIAs occurring close together often precede a major stroke.
This is important because the clinician should be aware that a patient experiencing a minor event in the office may have a major event after leaving the office, leading to mortality.
The warning signs of a severe stroke event include sudden or **temporary weakness** or numbness of the face and other body parts, loss of speech or difficulty speaking or understanding speech, visual changes, and unexplained loss of balance or dizziness
In patients with an identified increased risk of stroke pretreatment or who exhibit signs of a mild TIA occurring during treatment, **a follow-up phone call is recommended**. Any patient exhibiting signs or symptoms of a TIA or stroke requires immediate medical referral.
If an obvious stroke has occurred during a dental procedure, the patient's airway must be maintained until emergency medical personnel arrive.

Clinical Signs and Symptoms of a Stroke.

A severe headache with unknown cause
Sudden numbness of the face, arm, or leg on one side of the body
Sudden confusion, trouble speaking, or difficulty understanding speech
Sudden trouble with vision in one or both eyes
Sudden trouble walking, dizziness, loss of balance, or loss of coordination

Stroke Statistics.

After age 55 the chance of developing a stroke doubles every 10 years
•Nearly 1 in every 4 strokes occur in people who have had a previous stroke
•Pregnancy and birth control increase the risk of stroke in women
•Blacks, Hispanics, American Indians, and Alaska Natives are at higher risk for having a stroke than non-Hispanic whites and Asians

Oral manifestations :

Unilateral paralysis of the face,
Loss of sensory stimuli or oral tissues,
A flaccid tongue with multiple folds, and
Dysphagia. You may also notice that patients
Poor oral hygiene, because patient neglect oral self-care on one side of their mouth.
This is associated with the brain damage that has occurred.
Increased caries, periodontal disease, and halitosis is also common due to challenges with oral self-care.
In patients who have experienced physical deficits (eg, hand-eye coordination problems, arm or hand deficit, masticatory muscle weakness), personal oral hygiene efforts may be compromised.

Dental treatment of patients with stroke residual

When providing care to patients who have had a stroke, dental providers should assess the patient's risk for complications before providing any dental care. Items to consider include the timing of the stroke and type and magnitude of dental procedure."Super Script .

1-Patients who are have experienced a TIA or stroke within the last 6 months are unstable.
2-Elective care should be postponed.
3-A consultation with the patient's physician is recommended.
4-Patients who are taking **Warfarin should report their international normalized ratio (INR).**
A therapeutic range **is 3.5 or less**.
5-Metronidazole and tetracycline interact with warfarin which can **increase the INR**.
6-Dental providers should avoid concurrent use of these drugs.
7-Short stress-free appointments scheduled in the morning reduce the risk for complications.
8-Dental providers should avoid placing a retraction cord impregnated with epinephrine.
9-Effective pain control during the procedure and post-operative will reduce stress and the risk for complications. 10-
11-Dental providers may administer nitrous oxide with oxygen.
12-Local anesthesia should have a limited amount of vasoconstrictor (epinephrine).
13-Patients can be safely given local anesthesia with epinephrine 1:100,000 or 1:200,000.
14-The amount of vasoconstrictor should be ≤ 0.04 mg.
15-Comprehensive oral hygiene instruction that may include instruction on use of an electric toothbrush or a large hand-held toothbrush or water irrigation instrument coupled with plaque-revealing tablets; running a washcloth through the vestibule can help to reduce accumulation of food matter.

THANK YOU

Academic Year 4

Allergy to local anaesthetic agents used in dentistry

Dr.Anas Hammad





Allergy

- Dental management
- Oral complications and manifestations

Allergy:

Is an abnormal response of the immune system to a **substance introduced into the body**. hypersensitivity reactions

Classification of allergy:

There are **four traditional classifications** for hypersensitivity reactions, and these include :

1-Type I hypersensitivity is also known as an immediate reaction and involves immunoglobulin E (IgE) mediated release of antibodies against the soluble antigen(Anaphylactic) . This results in mast cell degranulation and release of histamine and other inflammatory mediators.

Type II hypersensitivity is also known as cytotoxic reactions and engages IgG and IgM antibodies, leading to the complement system activation and cell damage or lysis.

Type III hypersensitivity is also known as immune complex reactions and involves IgG, IgM, and sometimes IgA antibodies. The build-up of these immune complexes results in complement system activation, which leads to polymorphonuclear leukocytes (PMNs) chemotaxis and eventually causing tissue damage.

Type IV hypersensitivity is also known as delayed-type and involves of T-cell-mediated reactions.
T-cells or macrophages are activated as a result of cytokine release, **leading to tissue damage**

Common Allergy Symptoms

Mild and more common allergy symptoms include:

•Sneezing ,Watery eyes, Runny nose,Wheezing.Coughing ,Stomach pain ,Hives ,Itchy mouth or ears

•Swelling of lips, tongue, or throat ,For a full list of symptoms broken down by allergen type, explore the

A reaction is usually **classed as anaphylaxis** if there are changes in a **person's breathing**, **heart rate** or **blood pressure**. Most healthcare professionals consider an allergic reaction to be anaphylaxis when it involves a **difficulty in breathing** or **affects the heart rhythm** or **blood pressure**

AIRWAY -swelling in the throat, tongue or upper airways (tightening of the throat, hoarse voice, difficulty swallowing)

BREATHING - sudden onset wheezing, breathing difficulty, noisy breathing

CIRCULATION - dizziness, feeling faint, sudden sleepiness, tiredness, confusion, pale clammy skin, loss of consciousness

Anaphylaxis :

Anaphylaxis is a severe, potentially life-threatening generalised allergic reaction characterised by rapidly developing **symptoms** and **signs including skin changes (such as redness and itching), mucosal changes (swelling below the skin surface), swallowing and breathing difficulties (due to swollen mouth**, **throat or tongue), wheezing**, **tachypnoea**, **tachycardia and hypotension**

Management of anaphylaxis in the dental practice:

Anaphylaxis is a **severe** and **potentially life-threatening allergic reaction that can occur in the dental practice**.
There are a number of dental-related **causes including mouthwashes**, **local anaesthetics**, **latex** and **antibiotics**.
The dental team must be able to respond effectively and manage the life-threatening situation appropriately following **Resuscitation Council UK guidelines**.
The timely administration of **adrenaline is life-saving**; any delays can **lead to a poor outcome**. With the current national supply issues with adrenaline auto-injector devices, there is an expectation that GDPs should be competent at drawing up adrenaline from an ampoule and **administrating it intramuscularly.**

Causes of anaphylaxis in dental practice

Antibiotics

Antibiotics are among the drugs most likely to **cause anaphylaxis**. Amoxicillin, phenoxymethylpenicillin and metronidazole **are three antibiotics that are prescribed in dentistry**.

Amoxicillin is probably the **one most commonly associated with anaphylaxis**. Deaths from anaphylactic reactions to amoxicillin have been reported.

Antibiotics are the main cause of perioperative anaphylaxis in the some countries., being responsible for almost 50% of cases with an incidence of **4.0 per 100,000 administrations**.

Chlorhexidine:

Chlorhexidine is an effective antiseptic which is widely used in dentistry, being present in a number of dental products including some mouthwashes, toothpastes and dental implants. However, anaphylaxis to chlorhexidine has been increasingly reported worldwide, including two incidents in the UK where chlorhexidine-containing mouthwash had been used to irrigate tooth sockets following a recent tooth extraction; unfortunately, the resulting anaphylaxis resulted in the death of both patients.

Local anaesthetic

Anaphylactic reactions to local anaesthetic (LA) administered in the dental setting is very rare, but they have been reported.
The actual incidence of adverse effects from **LA is about 0.1-1%, with 1% of these cases being confirmed allergic reactions**.
Actual allergic reactions to LAs are **either immediate hypersensitivity reactions (type I: systemic signs)** or **delayed hypersensitivity reactions (type IV: localised reaction at the injection site, contact dermatitis).**

Amide LA agents (for example, lignocaine) are most commonly used in dentistry, but allergic reactions are very rare.

The least allergenic amide LA agents are mepivacaine and **plain prilocaine**.

Allergic reactions are more common with **ester LA agen**ts because they are **metabolised to para-aminobenzoic acid**, a known **allergenic compound**.
Benzocaine is the only ester LA used in dentistry (topical preparations applied before administration of LA).

Many LA-induced allergic reactions are **due to other constituents in the injection solution rather than to the drug itself**.
Excipients such as **preservatives (for example, benzoates used in multi-dose vials)** and antioxidants (for example, metabisulphites used in LA solutions containing adrenaline) can cause allergic reactions.

It is also important to be aware of the risk of allergy **to natural rubber latex (NRL) contained in gloves and dams**, as well as **other dental materials**

Contrary to some reports, the risk of latex allergies from LA carriages is minimal. Following administration of an LA, a few patients may suffer one of a range of unwanted symptoms which sometimes can be mistaken for allergic reactions and patients may be unnecessarily told they are allergic to the anaesthetic. **Most adverse** reactions are psychogenic or vasovagal

General anaesthetic

Anaphylaxis to anaesthetic drugs is not uncommon. There have been a number of cases in oral surgery theatres that have been reported.

Latex

Allergy to NRL (latex) became increasingly common towards the end of the last century (partly due to **increased use of latex gloves in healthcare settings),** though it is now on the decline.

Examples of dental equipment that may contain NRL	NRL-free alternative	Manufacturer
Amalgam carriers	Teflon amalgam carriers	Austinell
Aspirators	Yankauer plastic wide-bore	Tyco-Healthcare Durr
Bunsen burner tubing	Heating device	
Dental dam	Roeko flexi-dam Hygenic non-latex	FE Cardozo Ltd Coltene/Whaledent
Hygenic Wedjets (dental dam stabilising cord)	Not currently available	
Endodontic* stops	Silicone stops	QED
Elastics (orthodontic)	GAC ELF Latex-Free elastics	Orthocare TOC (The Orthodontic Co.)
Mixing bowls** (eg alginate nowls)	NRL-free bowls	Dentsply
Polishing equipment	Prophy cups, prophy heads Disposable prophy angle to be used on nosecone of doriot-style handpiece	Young Dental W+H Dental (UK) Ltd
	Enhance polishing cups	Dentsply
	Shofu Greenie & Brownie polishing points	Minerva
Temporary crowns and matrices	Directa crowns (polycarbonate) Odus cervical matriza Odus Pella Crown Form	Tower Dental Hawes Neos Austinall

Key:
NRL = natural rubber latex
* = endodontic stop is a rubber stop on the hand files / rotary files that are used during root canal treatment and assists in the measuring of canals
** = Mixing bowls (it should read 'e.g. alginate bowls')- these are bowls in which the alginate impression material is hand mixed

Toothpastes

Allergic reactions to toothpaste, including anaphylaxis and even fatal anaphylaxis, have been reported.
In the US, a young person with a known dairy product allergy developed anaphylaxis and died after using a toothpaste containing **Recaldent (a milk-derived protein)** which had been recommended by her dentist.
A similar case was reported recently in Australia **where a child with a milk allergy developed anaphylaxis after a 'tooth mousse' containing Recaldent was used during dental treatment**.

The child began to **complain of discomfort in her mouth**, which progressed to difficulty swallowing which prompted her alert mother to administer **her AAI immediately**.

Iodoform

Iodoform is in a number of endodontic products including Alvogyl. Alvogyl's product information stipulates that it **shouldn't be used in patients with known allergies to procaine (novocaine)-type anaesthetic**,
iodine or compounds related to iodine.

Clinical features and diagnosis

The lack of a consistent clinical picture can sometimes make an accurate diagnosis difficult.
Anaphylaxis is characterised by quick onset and rapid deterioration.

It is more likely to be anaphylaxis if all three of the following criteria are met:

1.Sudden onset and rapid progression of symptoms

1.Life-threatening airway and/or breathing and/or circulation problems

1.Skin and/or mucosal changes (flushing, urticaria, angioedema).

ABCDE	Signs and symptoms
Airway	Swollen tongue Difficulty swallowing/speaking Throat tightness Hoarse voice Stridor
Breathing	Difficult or noisy breathing Chest tightness Persistent coughing Wheeze Tachypnoea
Circulation	Hypotension Tachycardia Pallor Collapse
Disability	Feeling dizzy or faint Confusion Agitation Syncope Loss of consciousness
Exposure	Skin changes: urticarial, angioedema and erythema Rhinitis and conjunctivitis Abdominal pain/cramps Nausea and vomiting Diarrhoea Sense of impending doom

The clinical signs of anaphylaxis usually appear within few minutes; anaphylaxis is graded as follows according to its severity:

Grade I: cutaneous–mucous signs

Grade II: cutaneous–mucous signs with accompanying cardiovascular and/or respiratory signs such as tachycardia and bronchial hyperreactivity/cough

Grade III: cardiovascular collapse with multivesicular signs such as bronchospasm

Grade IV: cardiac arrest

Other symptoms include abdominal cramps, nausea and diarrhoea .

- Tightness of the chest, with wheezing and difficulty in breathing may occur .
- There may be a fall in blood pressure and a rapid thready pulse.





It is possible to mistake a panic attack or a vasovagal attack for anaphylaxis. Following the familiar ABCDE approach will help to distinguish between **a panic attack** and **vasovagal** syncope from anaphylaxis:

•Panic attack: hyperventilation, tachycardia and anxiety-related erythematous (red) rash.

•The absence of urticaria, hypotension, pallor and dyspnoea helps to exclude anaphylaxis

•Vasovagal syncope: pallor, sweating, hypotension, nausea, vomiting and bradycardia.

•The absence of a rash, tachycardia and dyspnoea helps to exclude anaphylaxis.

Urticaria (image courtesy of James Halpern, consultant dermatologist)

Adrenaline

Adrenaline remains the most important **drug in anaphylaxis**, but to be effective, it needs to be administered promptly. Delays in administering adrenaline increases the risk of death and failure to give adrenaline is the most common cause of death associated with anaphylaxis. A study of the UK registry found that, **in almost 40% of all deaths due to anaphylaxis**, **adrenaline had not been administered**

Adrenaline is the **first-line treatment for anaphylaxis**.

Give intramuscular (IM) adrenaline early (in the anterolateral thigh) for Airway/Breathing/Circulation problems.

A single dose of IM adrenaline is well-tolerated and poses minimal risk to an individual having an allergic reaction. ***If in doubt***, give IM adrenaline. 1/1000

Repeat IM adrenaline **after 5 minutes** if **Airway/Breathing/Circulation problems persist**.

Intravenous (IV) adrenaline must be used only in certain specialist settings(hospital), and only by those skilled and experienced in its use.

IV adrenaline infusions form the basis of treatment for refractory anaphylaxis: seek expert help early in patients whose respiratory and/or cardiovascular problems persist despite 2 doses of IM adrenaline.

Benefit of Adrenaline:

- Reverses peripheral vasodilation
- Reduces oedema
- Dilates the airways
- Increases myocardial contractility
- Suppresses histamine and leukotriene release.

Type IV delayed hypersensitivity reactions mediated by sensitized lymphocytes.

They are:

- Usually localised to the injection site.
- Commonly expressed as a contact dermatitis . Allergy to other ingredients Many allergic reactions involving local anaesthetic preparations are due to other constituents in the injection solution rather than to the drug itself.

Excipients such as **preservatives** (e.g. benzoates – used in multidose vials), **antioxidants** (e.g. **metabisulphites** – used in local anaesthetic solutions containing adrenaline) and **antiseptics** (e.g. **chlorhexidine**) can cause **allergic reactions** .

Allergy to natural rubber latex contained in bungs, gloves, dams and other dental materials should also be considered.

Historically, the most sensitizing components in **local anaesthetic solutions** were **preservatives** such as **methylparabens**. **Parabens** are no longer added to ***dental local anaesthetic*** solutions available in some countries like UK.

Higher blood levels may result in **tremors**, **respiratory depression** and **seizures .**
Vasoconstrictor agents such as **adrenaline may also cause adverse effects**.
Adrenaline toxicity can result in **symptoms** such as **anxiety**, **restlessness**, **trembling**, pounding headache, palpitations, *sweating, pallor, weakness*, dizziness and respiratory distress .
Toxic reactions can be minimized by staying within safe dose ranges and using safe injection techniques

Management options to prevent adverse effects occurring :

When a patient experiences **signs** and **symptoms** suggestive of **local anaesthetic allergy**, possible **alternative causes should be considered** such as contact with other **common allergens**, **psychogenic** or **toxic reactions**.
The possible causes of symptoms experienced should be discussed with the patient.
Use of the terms '**allergic**' and '**allergy**' should be avoided when **discussing any adverse event** as this term is **recognized by patients and readily adopted as the explanation** .
Adverse psychogenic or toxic reactions can be minimized by:
 Administering injections with an **aspirating syringe to avoid intravascular injection**.
 Relaxing nervous patients to relieve their anxiety.
For extremely anxious patients, sedation may be required
 Treating patients in a supine position to prevent fainting . Giving injections slowly to reduce discomfort and improve localisation of solution
 Restricting the total dose given to the patient to prevent toxic effects occurring by overdose
The maximum dose for the **individual patient can be calculated using dosage information contained in the package insert or recognised dental resources on local anaesthesia**, and taking into **account age** and **weight of the patient**, any **concomitant drug therapy and underlying medical conditions**

Reassure the patient that they will feel better after several hours and inform them that, although the reaction is unpleasant, it should **not happen again and it is not necessary to avoid that local anaesthetic in the future.**

Management of patients who report they are allergic to local anaesthetic agents

New patients who claim to have had an **allergic reaction to a local anaesthetic** should be carefully questioned to obtain a history of past events.

These details may be more **reliably obtained from the patient's previous dentist**.

Questions to ask the patient or dentist include:

- What symptoms did the patient experience?
- What explanation for the symptoms was given at the time? Who told them this?
- Have they ever had any other dental treatment or surgery in the past that required them to have a local anaesthetic agent – what happened?
- Do they have any other allergies?
- Have they ever been tested for a local anaesthetic allergy?

If so, what was the result? (The allergy specialist should be contacted for confirmation and further information.)

Management :

 If further information obtained strongly suggests an allergy but no details are available, refer the patient **for allergy testing.**

 If further information strongly suggests a **psychogenic reaction**, proceed with care and address the **patient's anxiety.**

 If further information **strongly suggests toxicity**, proceed with care starting with low doses of **local anaesthetic/vasoconstrictor.**

 If no information is available from the patient or dentist, contact the patient's doctor who may have information about previous **local anaesthetic exposure** or other relevant knowledge.

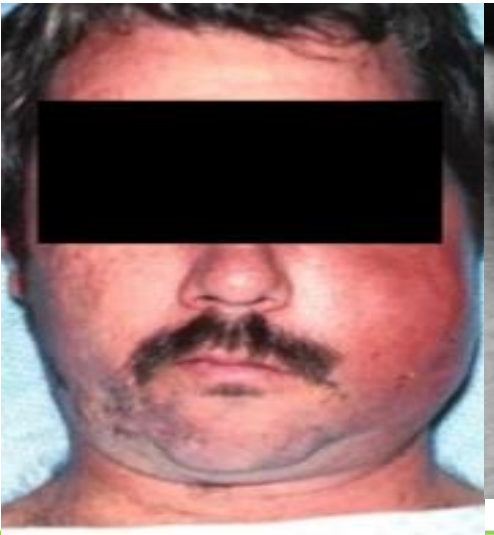
 If it is strongly suspected that the patient has previously suffered an allergic reaction to a local anaesthetic and emergency dental treatment is required, **consider contacting a local hospital dental department to discuss management and referral to a unit that has full resuscitation facilities available**

DO NOT FORGET A PROPER DENTAL/MEDICAL HISTORY TO BE IN SAFESIDE

Academic Year 4

Odontogenic and Fascial Space Infections

Dr.Anas Hammad



Odontogenic infections and fascial space infections

- Odontogenic Infections
- Spread of odontogenic infections
- The factors that influence the spread of odontogenic infections

- Principles of treatment of odontogenic infections
- Principles for the use of appropriate antibiotics
- Sinus formation
- Necrotizing fasciitis

- Fascial space infections
- Infection of spaces in relation to the lower jaw
- Infections of spaces in relation to the upper jaw
- Cavernous sinus thrombosis

ODONTOGENIC INFECTION:

The pathology of odontogenic infections originates from the pulp and periodontal structures. Once the infection spreads from the dentoalveolar structure, it may further infect fascial faces and lead to cellulitis or abscess formation. Among the various fascial spaces, the first to be involved in odontogenic infection is the submandibular space. Similar to the masticatory space, the involvement of the submandibular space leads to severe symptoms such as **trismus**, **neck rigidity, respiratory distress**, **dysphagia**, **sialorrhea**, and **pyrexia.**

Microbiology

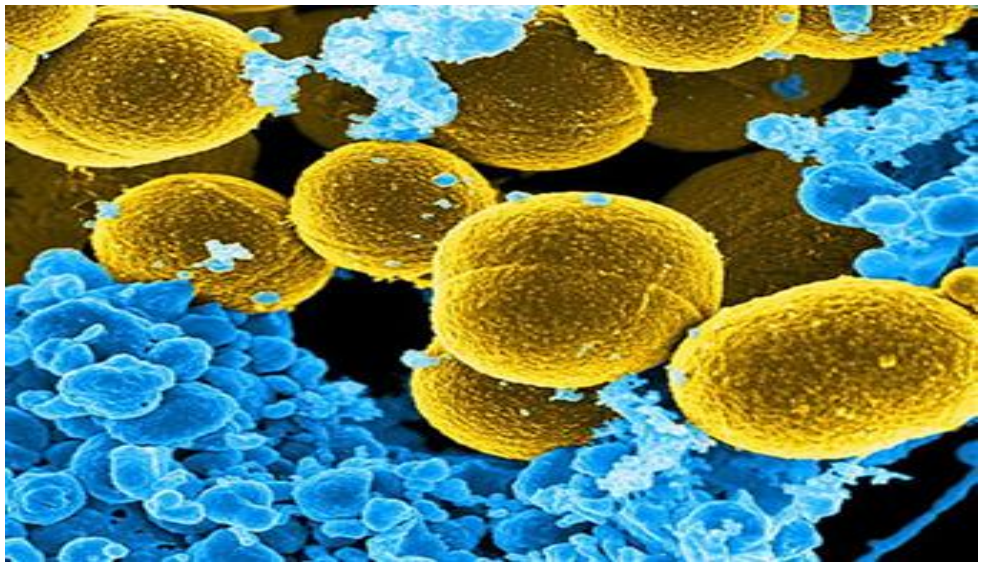
It was concluded that odontogenic infections were mixed aerobic-anaerobic infections. Anaerobic as well as aerobic cultures were necessary to isolate all pathogens. Successful management of these infections depends on changing the environment through **decompression**, **removal of the etiologic factor** and by **choosing the proper antibiotics.**

The mandibular 3(rd) molar was found to be the most commonly **offending tooth**, followed by the **mandibular 2(nd) molar**. The submandibular space was the most frequently involved **fascial space** both in **single fascial space infections** and **multiple fascial space infections.** Mixed growth (**aerobic** and **anaerobic**) was seen in culture smears, only **aerobic bacterial growth was seen samples of patients** and anaerobic bacterial growth was seen in culture smears of samples of patients .

Streptococcus viridans was the most frequently isolated bacteria among the **aerobes**, whereas **Bacteroides** and **Prevotella** were the most common **bacterial species among anaerobes**.

Empirical antibiotic therapy in the form of **Co amoxiclav(Amoxicillin + Clavulanic Acid)** =(Augmentin) and **Metronidazol**e was given.

Incision and **drainage** followed by , **Endo or extraction of the offending tooth/teeth was carried out**

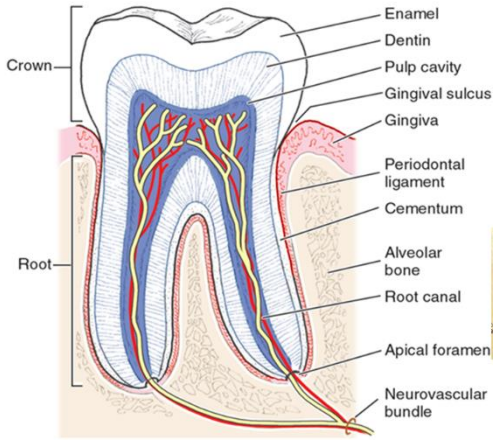


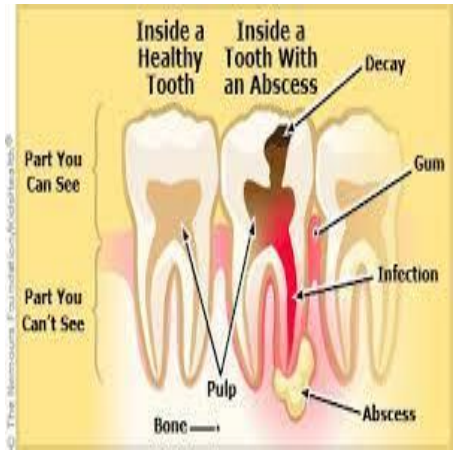
Pus producing (or pyogenic) infections associated with the teeth and surrounding supporting structures such as the periodontium and the alveolar bone.

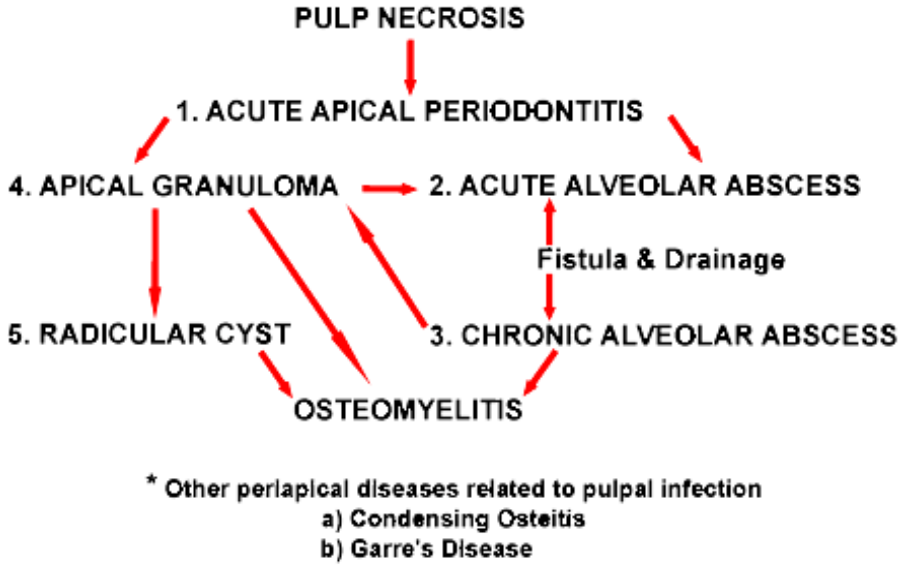
The clinical presentation of dentoalveolar infections depends on the **virulence** of the causative microorganisms, the **local** and **systemic defence** mechanisms of the host, and the **anatomical features** of the region.

The resulting infection may present as:

- an abscess localised to the tooth that initiated the infection
- a diffuse cellulitis that spreads along fascial planes
- a **mixture of both.**

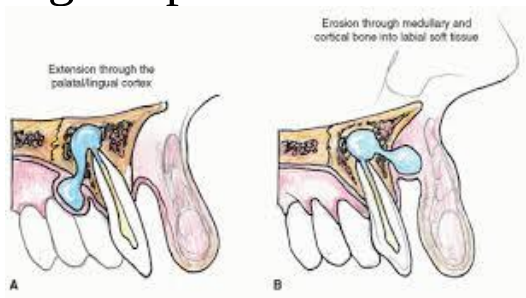






The Odontogenic infection develops by the extension of the initial carious lesion into dentine and spread of bacteria to the pulp .The pulp responds to the **infection** with **acute inflammation which causes necrosis**.

Once pus formation occurs, it may **remain localised** at the **root apex** and **develop into either an acute** or a chronic abscess, develop into a focal osteomyelitis or, as hydrostatic pressure increases, it can track along the path of least resistance to the tissue spaces. **Potential for local and distant spread.**



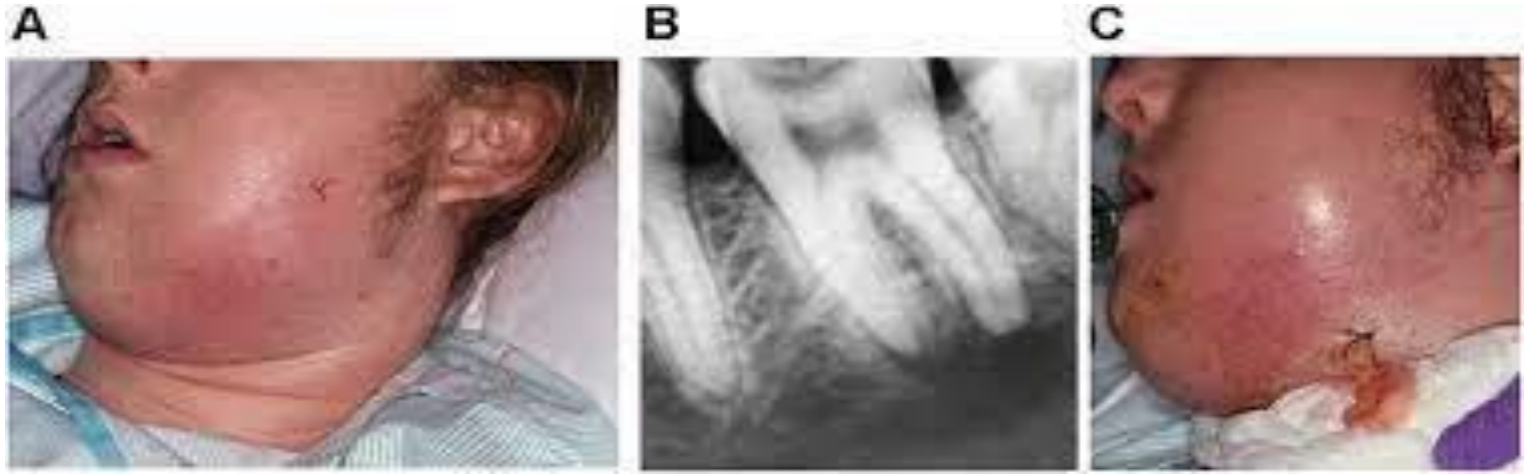
Local measures

Abscesses can compress other structures and reduce blood supply.
Abscesses have **poor blood supply** and **therefore antimicrobials wont reach them.**
Correct treatment is DRAINAGE and REMOVAL OF CAUSE
Drainage can be though the **tooth** or via **Hiltons method (**Incision and Drainage) to the abscess.

Find most dependent point of abscess (flactuant),and incise **through mucosa** and **periosteum**
Blunt dissection to break down lobules of pus

General measures

Analgesics – paracetamol, ibuprofen,
Supportive – fluids, rest, diet
Antibiotics systemic involvement, cellulitis, compromised host defences involvement of fascial spaces.



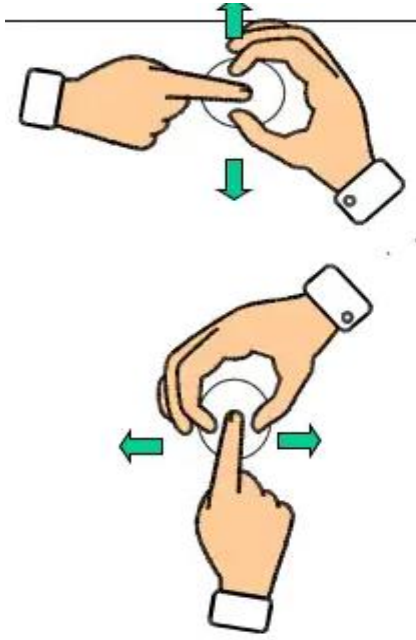
Technique Fluctuant Examination

Fluctuation can be tested by placing the index and middle finger of the one hand (somewhat apart) on the swelling, with the index finger of the other hand placed in between these two fingers.

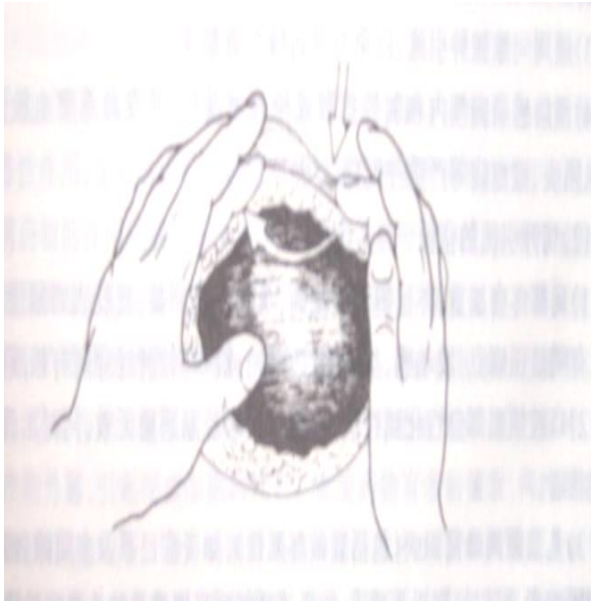
Alternate downwards pressure over the lesion with these fingers.

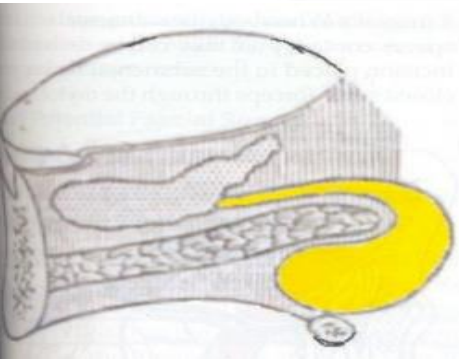
Fluctuation occurs when the finger of the one hand is forced upwards when pushing downwards with the fingers of the other hand.

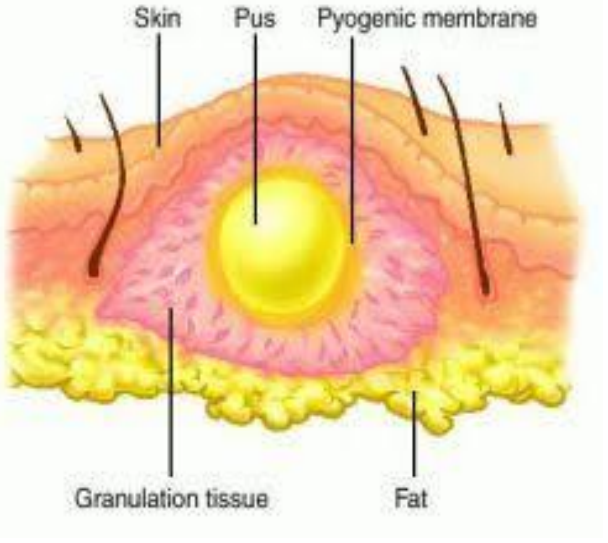
Use a balloon partially filled up with water to practice this technique



- Two digits are placed either side of the apex of the swelling
- Pressure is applied to the apex
- This is repeated with the digits at 90°
- The finding is positive if the two digits are pushed away in both directions
- If a swelling is fluctuant, it suggests the presence of fluid within the swelling.







Acute dental Abcess :

(1) acute suppurative pulp open early, every effort should be made to open the pulp, Pott from the drainage canal, **reducing stress**.

(2) As inflammatory exudation in periapical tissue, and sometimes open the pulp still not achieve the purpose of drainage, There was thus a need **to remove inflammation of the pulp and light to operate at this time**, to avoid the spread of infection pulp deep. After pulling myeloid not sealed to facilitate drainage.

(3) Once the abscess incision abscess limitations, we must incision, the incision under local anesthesia, the incision to be as deep as the periosteum, avoid cutting nerves and blood vessels.

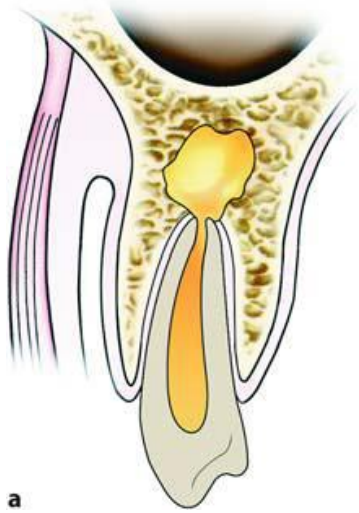
(4) use of anti-inflammatory drugs and analgesics in acute alveolar abscess significant systemic symptoms, or systemic diseases such as **diabetes**, abscesses after incision, the government should provide medical treatment and systemic antibiotic therapy.

(5) in the treatment of teeth to control inflammation, according to **extraction of teeth** or **root canal therapy**

Acute periapical abscess

The usual causes of infective:

- A carious cavity.
- Contamination of a traumatic exposure of the pulp.
- A sterile necrosis, as when the apical vessels are ruptured by a blow on the tooth.
- Following chemical or thermal damage to the pulp during coronal restoration.
- The necrotic pulp subsequently becomes infected via the periodontal lymphatics from the gingival crevice.
- Exacerbation of a pre-existing chronic periapical infection.



Acute periodontal abscess :

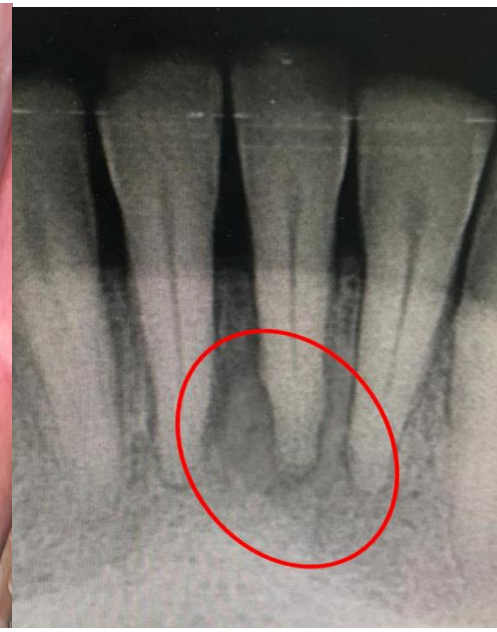
While less common than an endodontic abscess, a periodontal abscess is the third most frequent dental emergency requiring immediate intervention due to their rapid onset of pain

The causes:

- Food impaction.
- Repeated occlusal trauma Acute periodontal abscess produces redness and swelling of the gingival margin, interdental papilla and of the mucoperiosteum later al to the tooth. The pain is usually continuous, dull or throbbing but rarely as severe as a periapical abscess. The pus usually discharges via the gingival pocket, but may produce a sinus on either the inner or outer aspect of the alveolar process.

The management of acute lesions includes establishing drainage via pocket lumen, subgingival scaling and root planing, curettage of the lining pocket epithelia and seriously inflamed connective tissue,

There are two main etiologies . **Firstly**, in cases with a background of periodontitis, the condition is possibly due to untreated periodontitis or occurring during periodontal therapy . **Secondly**, in cases that are not related to periodontitis, the main causes are usually the presence of foreign objects and radicular abnormalitie



The management of acute lesions includes **establishing drainage via pocket lumen, subgingival scaling and root planing, curettage of the lining pocket epithelia and seriously inflamed connective tissue**, compressing pocket wall to underlying tooth and periodontal support, and maintaining tissue contact.

Treatment predominantly consists of two phases:

Acute management and definitive treatment once the acute phase has been resolved. **Acute treatment** aims to **alleviate the symptoms** and **reduce the risk of the spread of infection**.

The abscess must be drained by incising through the periodontal pocket or over the area of greatest fluctuant swelling on the gingiva.

Drainage should be accompanied by the mechanical scaling of the periodontal pocket and antiseptic rinse, removing necrotic tissue and bacterial load. This enables the host immune response to tackle the infection.

Postoperatively, warm salt water rinses are encouraged, and copious fluid intake to reduce the swelling.

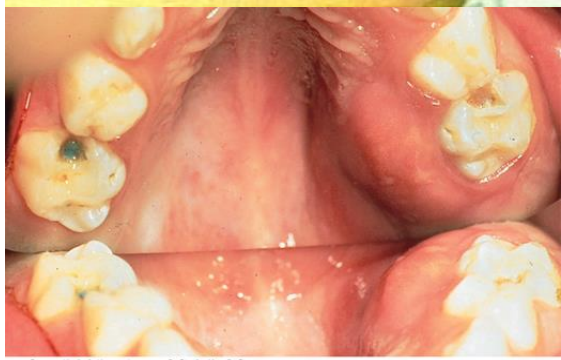
Dental practitioners must reassess the lesion and develop a **long-term treatment plan** as necessary, usually consisting of periodontal therapy.

Exodontia is indicated when the clinician deems tooth **prognosis poor or hopeless**, whether from **periodontal disease** or the **destruction** caused by the abscess.

If the cause of the abscess is an **embedded foreign object**, this must be **removed through debridement**, and drainage through the gingival sulcus should be performed either with a periodontal probe or by smooth scaling.

A pericoronal abscess:

- that food collects between the crown of the tooth and the overlying gum flap
- pressure on the operculum to express
- to the overlying pad of gum from the cusps of an opposing tooth
- The virulence of the bacteria within the pericoronal space
- Lowering of the host resistance appears



Source: Kevin J. Knoop, Lawrence B. Stack, Alan B. Storrow, R. Jason Thurman: The Atlas of Emergency Medicine, 5e

A pericoronal abscess arises around the crown of a partially erupted vital tooth, usually the 3rd molar, and therefore, resembles a periodontal abscess.

A **partially erupted** or **impacted 3rd molar (wisdom tooth)** is the most common site of **pericoronitis** and **pericoronal abscesses**.

The accumulation of food and debris between the overlying gingival flap and crown of the tooth creates a focus for pericoronitis and subsequent abscess formation.

The gingival flap becomes irritated and inflamed, and the tissue is repeatedly traumatized by the opposing molar tooth.

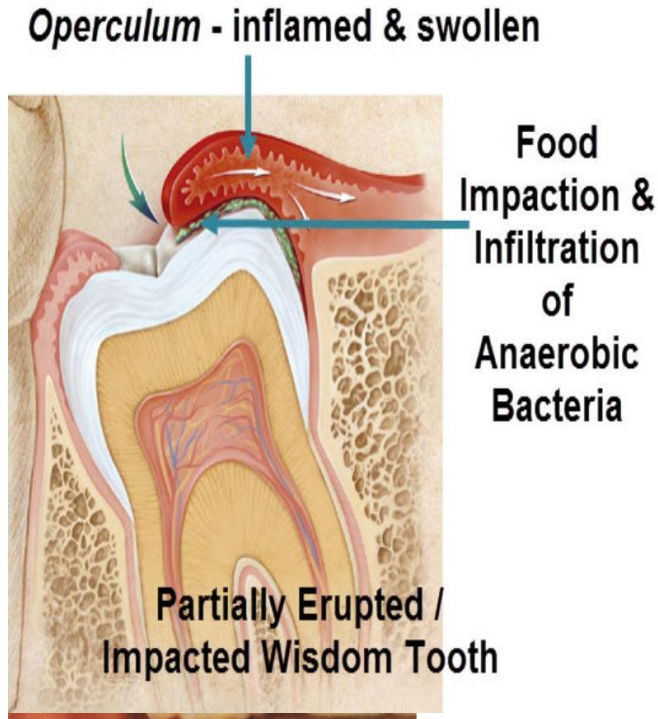
The inflamed gingival process may eventually become infected and form an abscess. Foul taste, inability to close the jaw, and fever may occur.

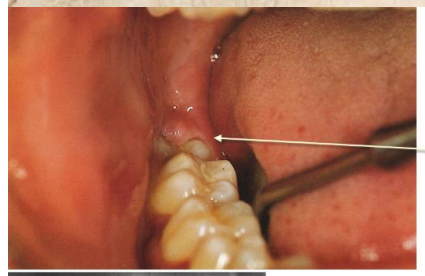
Swelling of the cheek and angle of the jaw and localized lymphadenopathy are also characteristic. More advanced disease may spread posteriorly to the base of the tongue, oropharyngeal area, and deep cervical spaces with resulting Ludwig angina and peritonsillar abscesses.

Pericoronitis:

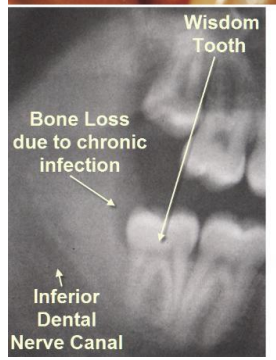
Pericoronitis is inflammation in the soft tissues (such as the gingiva and dental follicle) surrounding the crown of a partially erupted tooth, usually the lower 3rd molar (wisdom tooth).
It generally does not arise in teeth that erupt normally; usually, it is seen in teeth that erupt very slowly or become impacted and it most commonly affects the lower 3rd molar.
, it is thought that bacterial infiltration into the follicular space initiates the infection. **Once the follicle of the tooth communicates with the oral cavity**

The soft tissue covering over a partially erupted tooth is known as peri-coronal flap or gingival operculum. Maintenance of oral hygiene in such area can be very difficult to achieve by normal methods of oral hygiene.





LR8 - Partly erupted, inflamed & swollen *operculum*



Pericoronitis **- Clinical & Radiographical Appearances**

LR8 - X-Ray showing an '*arcuate*' zone of radiolucency behind the wisdom tooth, indicating chronic infection

Cellulitis: initial stage of infection:

- Diffuse, reddened, soft or hard swelling that is tender to palpation.
- Inflammatory response not yet forming a true abscess.
- Microorganisms have just begun to overcome host defenses and spread beyond tissue planes.

BACTERIA :

A streptococci of the **viridans group** and **Staphylococcus aureus** or **epidermidis are the major pathogens in alveolar or tissue space abscesses of odontogenic origin**. A mixed population of,3-4 species is usually recovered

Classifications

Pericoronitis is classified into:

- acute
- Subacute
- Chronic

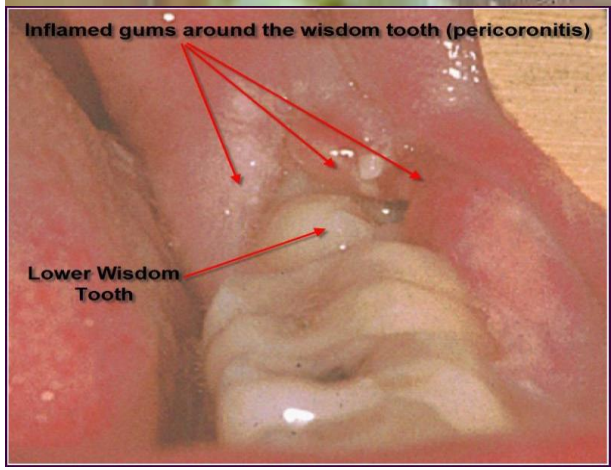
Acute pericoronitis

- facial swelling is common
- Limitation of opening may be marked
- pain is throbbing and severe and may interfere with sleep
- pyrexia, severe malaise and anorexia
- The regional lymph nodes are tender and enlarged
- If untreated the infection is likely to spread to the adjacent tissue spaces.

Acute pericoronitis is associated with a wide range of symptoms including severe pain, swelling and fever

Subacute pericoronitis

- a well localized dull pain
- the gum pad is swollen, tender and red
- Sometimes pus can be seen oozing from beneath the anterior margin of the gingival flap
- Fetor oris or halitosis
- The patient may complain of slight discomfort on swallowing
- some difficulty in opening the mouth
- The submandibular lymph nodes on the affected side are enlarged and tender.



Chronic pericoronitis

Pericoronitis may also be classified as **chronic / recurrent**. Acute pericoronitis occur repeatedly and periodically. It may cause few symptoms but some signs are visible at the time of intra-oral examination. **The chronic type mostly seen with good-moderate oral hygiene.**

The main complaint is of a dull pain or mild discomfort lasting a day or two, with remission lasting many months. Cacogeusia (bad taste) may also be present. Pregnancy and fatigue are associated with an increased occurrence of pericoronitis.

Chronic Pericoronitis –

Clinical Features:

•Localised tissue swelling & redness
•Soreness
•Continuous dull pain

Localised rise in temperature

•Lymphadenitis +

The most common site of **pericoronitis is impacted or partially erupted lower 3rd molar**.

The most common cause behind peri-coronal inflammation is the entrapment of plaque and food debris between tooth crown and overlying operculum (gum flap). This is an ideal area for the growth of bacteria and it is difficult to keep clean; also, there is the constant possibility of acute inflammation of peri-coronal (around the crown of the tooth) sites. It may be due to trauma, occlusion or entrapment of foreign body below the peri-coronal flap / operculum

The patient is usually asymptomatic except for the occasional mild discomfort or bad taste due to a discharge of pus from, beneath the gum flap

Management:

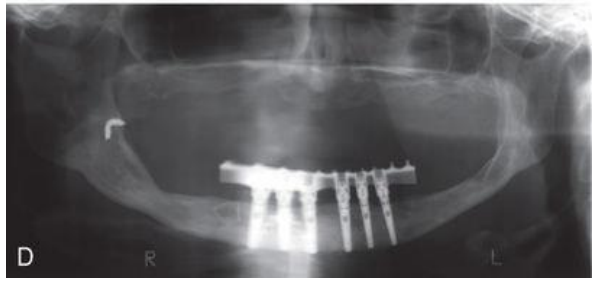
These include debridement of plaque and food debris, drainage of pus, irrigation with **sterile saline**, **chlorhexidine** or **hydrogen peroxide** & **elimination of occlusal trauma**.
Ozone has been put forward as a local antimicrobial that might be a useful adjunct in the treatment of pericoronitis; however, there is no research available to show its efficacy as yet.
In addition to local pain and swelling, if the patient is exhibiting regional or systemic signs and symptoms, **antimicrobial therapy** (such as metronidazole) is recommended; however, it should be emphasised that it is as an adjunct rather than a **1st line treatment**. These are all active against anærobic bacteria, which are the predominant microflora found in pericoronitis.
Once the acute phase of the pericoronitis has passed, operculectomy has been used as a preventive measure.

Operculectomy is a **minor surgical procedure where** the affected soft tissue/ the flap of gum over the wisdom tooth, is cut away, preventing further build-up of debris and plaque, and subsequent inflammation

Other abscess may also arise in association with:

- Infected cysts
- Odontomes

- tooth and bone fractures
- subperiosteal and endosteal implants
- foreign bodies



Clinical Features

- Inflammation is tissue response to injury or invasion by microorganisms that involves vasodilation, capillary permeability, mobilization of leukocytes, and phagocytosis.
- Cardinal signs of inflammation:
  - Red, hot, swelling, pain, with loss of function
- Other findings: regional lymphadenopathy, fever, elevated white blood cell count, tachycardia, tachypnea (rapid breathing), dehydration, malaise.

The 5 ancient cardinal signs of inflammation are

Rubor :– redness — Rubor and calor are due to histamine-mediated vasodilation of arterioles

Tumor:-swelling — Due to a histamine-mediated increase in permeability of venules

Calor: – warmth — A combination of increased blood flow and the release of inflammatory mediators

Dolor :– pain — mediated by PGE2 and bradykinin

Functio Laesa :– loss of function

Spanish language

Factors Contributing to the Spread of Odontogenic Infections:

1-Spreading odontogenic infections **remain surprisingly common**.

2-Poor oral hygiene

3-Social deprivation

4-Tobacco smoking

5-Patients with immune suppression.

Immunity against intraoral infection is composed of three sets of mechanisms(host factors)

1-Humoral factors In presence of infection, histamine, serotonin, prostaglandins support inflammation → vasodilation and increased vascular permeability.

(Circulating immunoglobulins, along with complement, combine with microbes to form opsonins that promote phagocytosis by macrophages. ,IgA prevents colonization of microbes on oral mucosal surfaces.

2-Cellular factors (Phagocytes engulf and kill microbes, removing them, preventing replication.,Lymphocytes produce lymphokines and immunoglobulines (aids humoral),Lymphokines stimulate reproduction of other lymphocytes, and kills antigens.

3-Local factors, oral hygiene, smoking ,

Decrease one of these mechanisms and it increases the potential for infection.

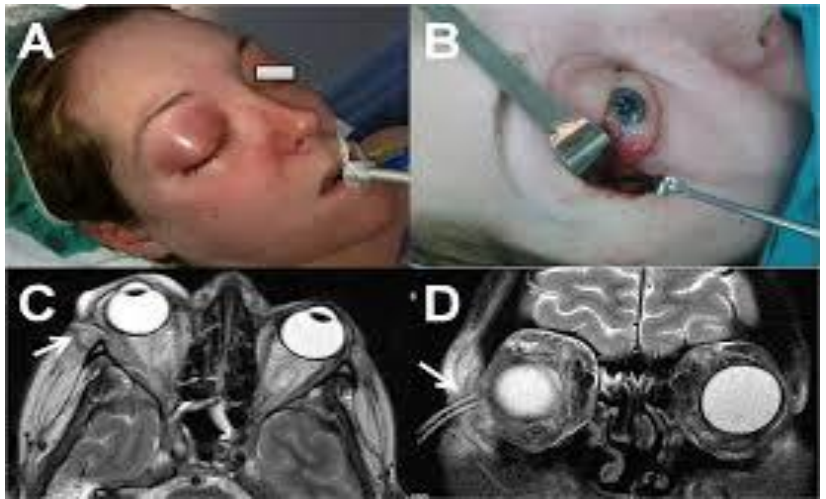
Spread to fascial spaces

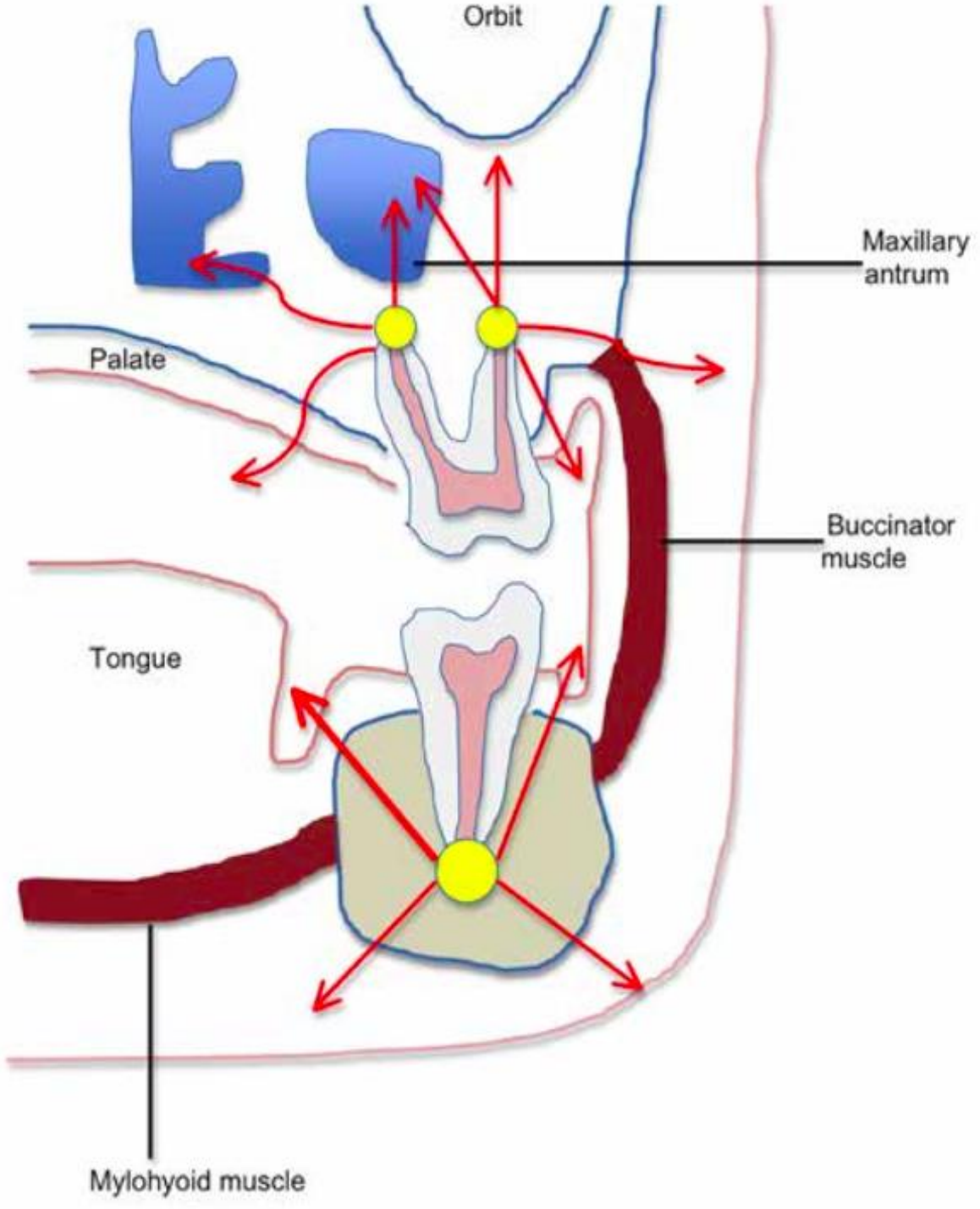
One of the most serious and potentially life-threatening complications

Whatever the cause, spread of infection through the potential spaces in the neck poses a risk to the airway.

It may also result in systemic compromise and cardiovascular collapse.

Furthermore, infection can spread inferiorly into the mediastinal or **pleural cavities**; or superiorly to the peri-orbital or orbital tissues, and *via* the facial vein to the **cavernous sinus.**





Initial assessment of the patient should include the following:

- Taking a comprehensive medical and dental history
- Checking for presence of fever, malaise, fatigue, dizziness or other debility
- Measuring the **pulse** and **temperature** (normal axillary temperature is **36.3-37**)
- Defining **nature location** and **extent of the swelling**
- Identifying the **cause of the infection**

Patients **admitted** to hospital with ***neck space infection*** will undergo blood tests, possible further imaging including ultrasound and/or CT scan, and eventual microbiological investigation. **Where possible, a sample of pus is obtained for microbiological culture and antibiotic sensitivity testing**. Most often, pus is obtained at the time of operation.

The acute odontogenic abscess is usually polymicrobial in nature, comprising facultative anaerobes (for example, viridans streptococci and the *Streptococcus anginosus* group), and strict anaerobes like *Prevotella* and *Fusobacterium* species.

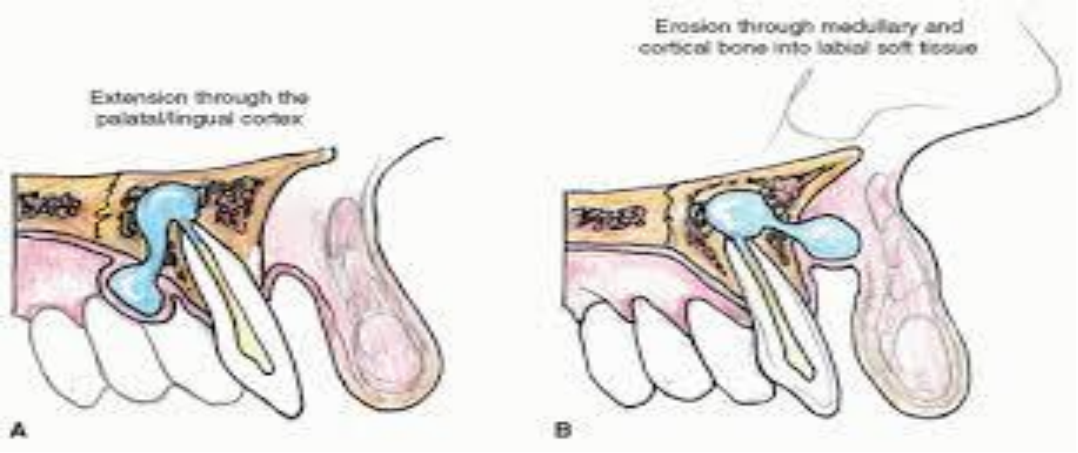
Vital signs

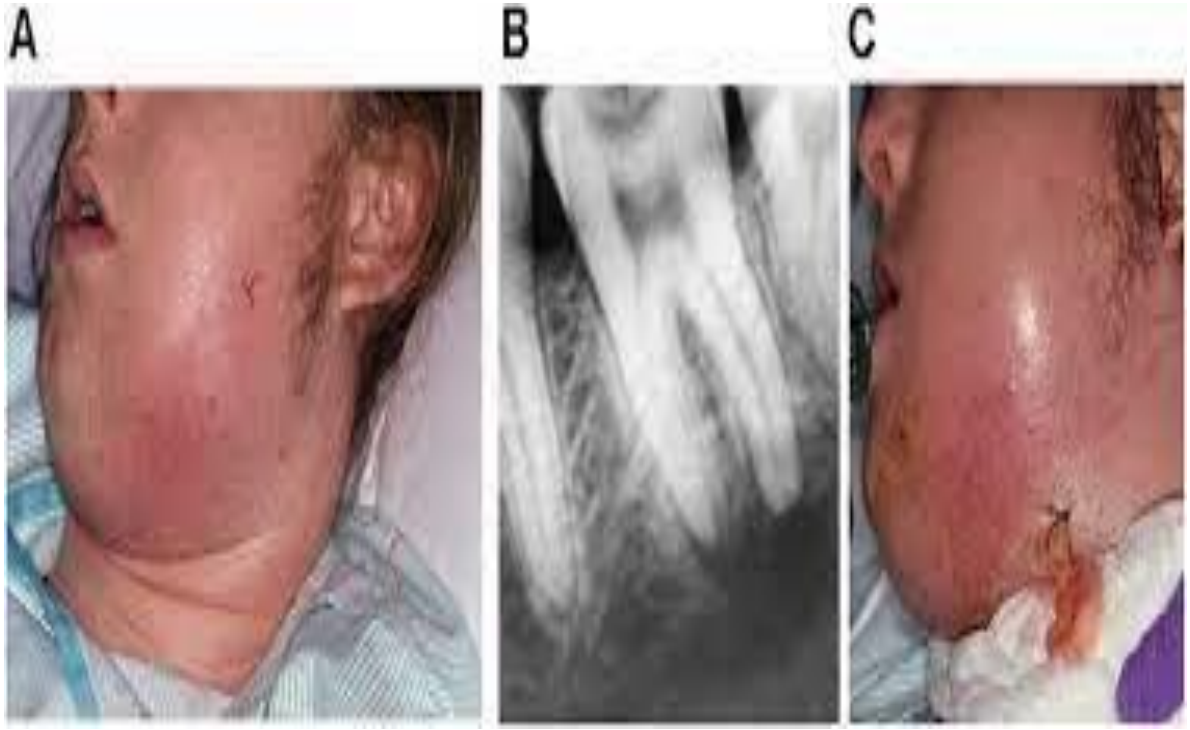
- Septic patients may be tachycardic (pulse rate >90 beats per minute) and pyrexial. If there is an abscess, a swinging pyrexia may be seen.
- The respiratory rate is a sensitive sign that may increase before an abnormality is seen in other vital signs. A rate of >20 breaths per minute is abnormal in an adult.
- The combination of a high respiratory rate, tachycardia, very high or very low temperature, with a very high or very low white blood cell count is the **systemic inflammatory response syndrome** (SIRS).
- Sepsis is defined as the presence of SIRS in addition to a confirmed infective process.
- Septic shock occurs when a septic patient remains hypotensive despite aggressive attempts at restoring the blood pressure.
- Importantly, it is well recognized that the prognosis of septic patients is improved when appropriate treatment is delivered promptly.

When to refer

Following this assessment the clinician should decide whether treatment can be provided in primary care or whether a referral is necessary for example if there is/ are:

- Signs of septicaemia such as grossly elevated temperature (above 39.5), lethargy, tachycardia
- Spreading cellulitis (rapidly progessing infection)
- Breathing or swallowing compromised
- Severe trismus
- Compromised host defences
- Swellings that may compromise the airway or cause difficulty in swallowing or closure of the eye
- Dehydration
- Significant trismus associated with a dental infection
- Failure to respond to previous treatment
- An uncooperative patient



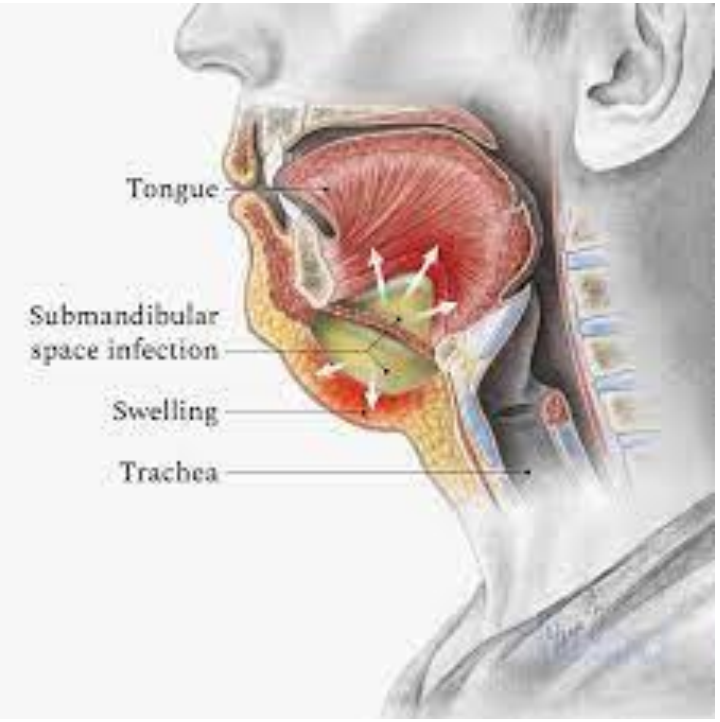


Principles of the surgical management of deep neck space infection

The patient presenting with suspected neck space infection should be assessed immediately for **Airway**, **Breathing**, and **Circulation (ABC).**

- This gauges the urgency of the need for referral to hospital.
- **A stable patient** with localised swelling and minimal soft tissue involvement is likely to be suitable for early, **local treatment including pulp extirpation** or **extraction of the tooth**, **with or without systemic antibiotics.**
- For those patients referred to hospital, the principles of establishing surgical drainage, removal of the source of infection, and systemic antibiotics also apply.
- Septic patients will be treated aggressively with fluid resuscitation and early, empirical administration of antibiotics.
- Drainage of neck space infections will usually take place in the operating theatre under general anaesthetic.
- Severe airway compromise may necessitate placement of a tracheostomy tube and post-operative admission to intensive care.
- In **Ludwig's angina**, there is often no collection of pus, but surgical exploration of the affected spaces is performed to 'decompress' the neck. Surgical drains are placed until resolution of the infection. **Corticosteroids (eg dexamethasone) may be given to help reduce the oedema associated with these infections.**
- Early recognition and management of dento-alveolar infections is critical because patients (particularly children and immunocompromised patients) can become systemically ill within a short time. If untreated, local infections can spread, giving rise to serious life threatening sequelae.

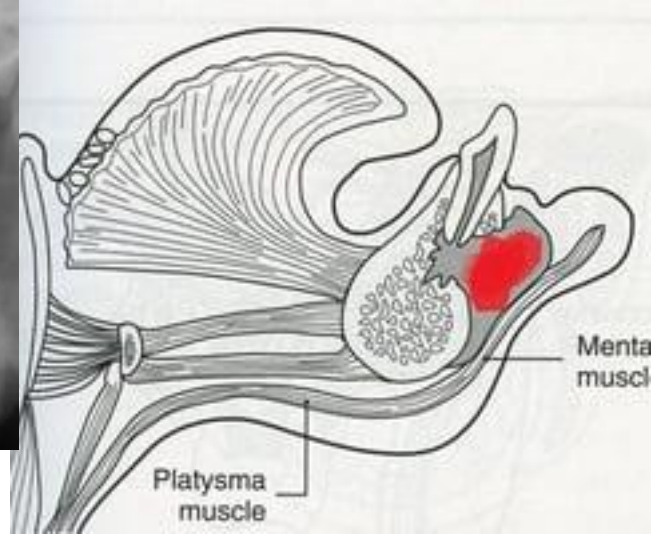
Ludwig’s angina



Ludwig's angina is **a bacterial infection (cellulitis) that affects your neck and the floor of your mouth**. It is not contagious. It typically starts from a tooth infection (abscessed tooth). This rare type of cellulitis can spread rapidly, causing life-threatening swelling that can affect your ability to breathe

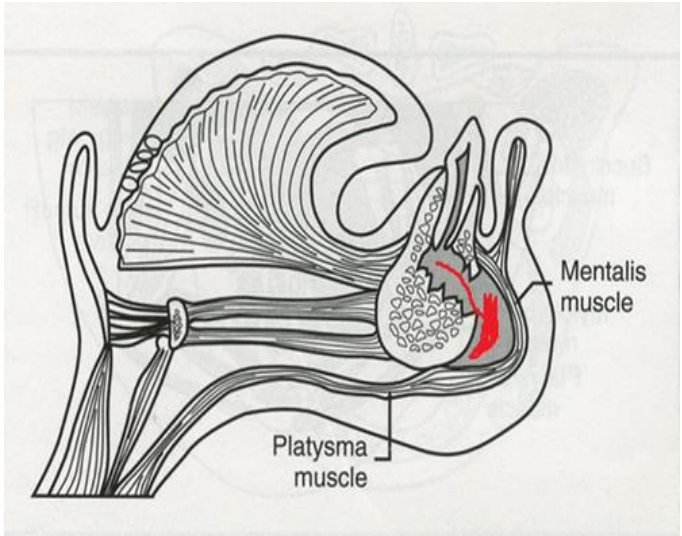
Mandibular buccal vestibule

Between buccal cortical plate and mentalis muscle



Mental space Abcess :

Bounded by Mentalis muscle superiorly, Platysma muscle inferiorly These spaces may be created by pathology, e.g., the spread of odontogenic infection. Commonly the origin of the infection is an anterior mandibular tooth with associated periapical abscess which erodes through the buccal cortical plate of the mandibular at a level below the attachment of the mentalis muscle.



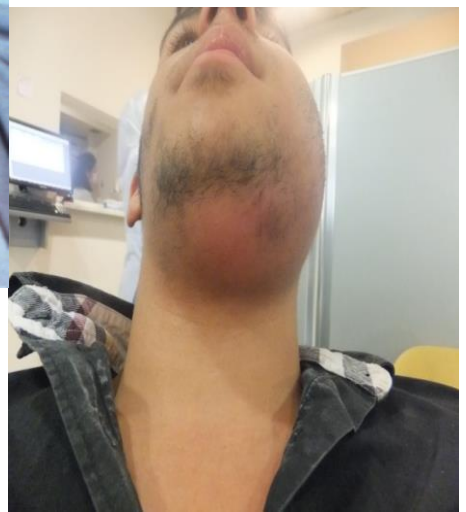
Spreading of infection to the surrounding spaces :

Determination of the severity of infection, **evaluation of host defences**, **surgical management**, **medical support**, **administration of antibiotics**, and **frequent evaluations of the patient** are the mainstays of the management of odontogenic infections. Bone, muscle, aponeurosis or fascia, neurovascular bundles, and skin can all act as barriers to the spread of infection. However, no tissue barrier or boundary is so restrictive or confining to universally prevent spread of infection into contiguous anatomical spaces

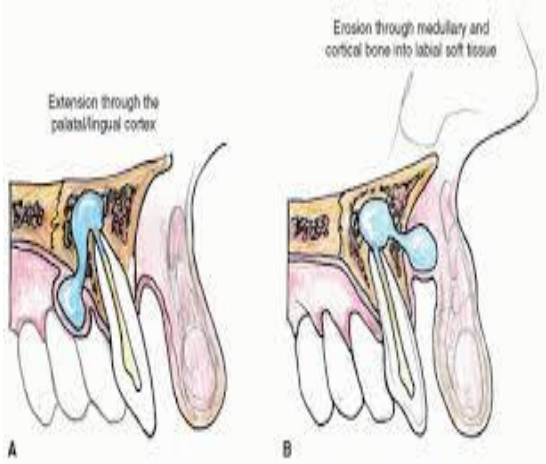
Three major factors must be considered when determining the **severity of an infection** of the head and neck:
anatomical location,
rate of progression, and **airway compromise**

Anatomical Spread of Infection:

Bone, muscle, aponeurosis or fascia, neurovascular bundles, and skin can all act as **barriers** to the spread of infection. However, no tissue barrier or boundary is so restrictive or confining to universally prevent spread of infection into **contiguous anatomical spaces**



There are a number of points for spreading the infection :



Upper lip

Infection at the base of the upper lip typically originates from the upper anterior teeth. It spreads to the orbicularis muscle, from the labial sulcus between the levator labii superioris muscle and the levator angularis oris muscle.

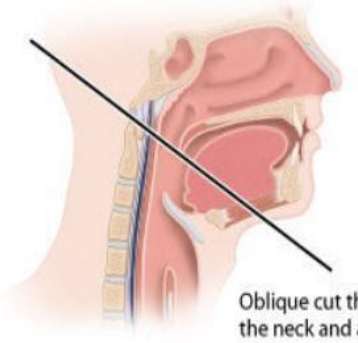
Canine fossa

Spread of infection to the canine fossa usually originates from maxillary canine or upper premolar teeth, often presenting above the buccinator muscle attachment. These swellings obliterate the nasolabial fold. This space is in close proximity to the lower eyelids, and therefore early management is essential to avoid circumorbital infection. There is a risk of spread cranially, via the external angular vein, which may then become thrombosed

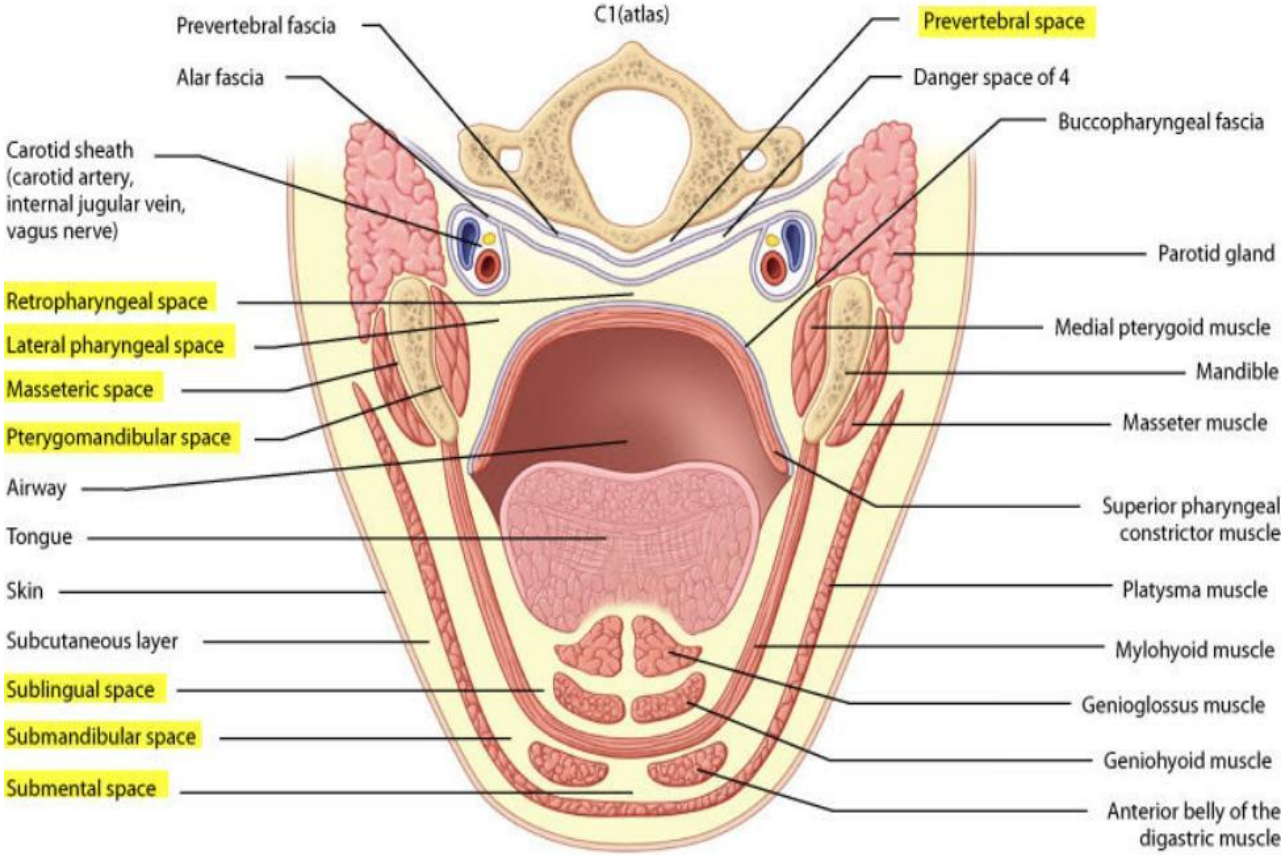
Buccal space

The attachment of the buccinator muscle to the base of the alveolar process can control the spread of infection in the region of the mandibular and maxillary molars. An infection spreads intraorally, superficial to the buccinator muscle, in front of the anterior border of the masseter muscle. Thus, the clinical manifestations of infection in this space are characterized by swelling confined to the cheek. However, infection may spread superiorly, towards the temporal space, inferiorly, to the submandibular space, or posteriorly, into the masseteric space. In some cases, infection may spread to the surface of the skin, leading to fistula formation

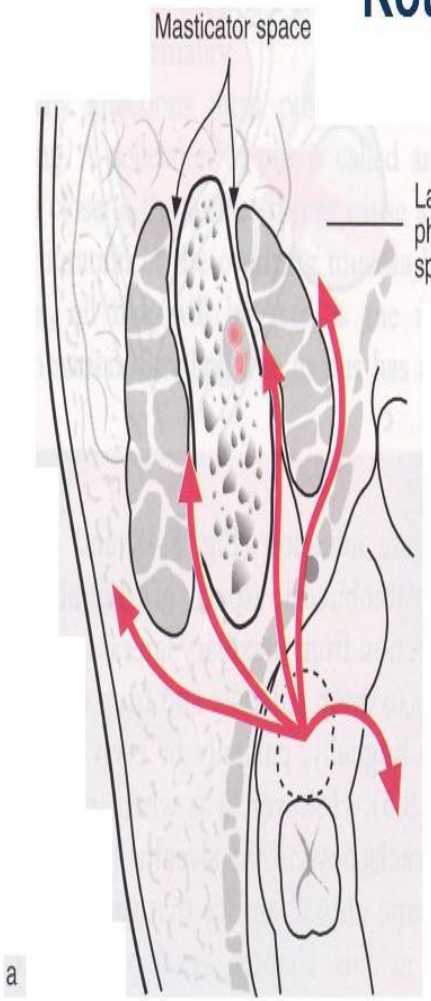
Sagittal section through neck

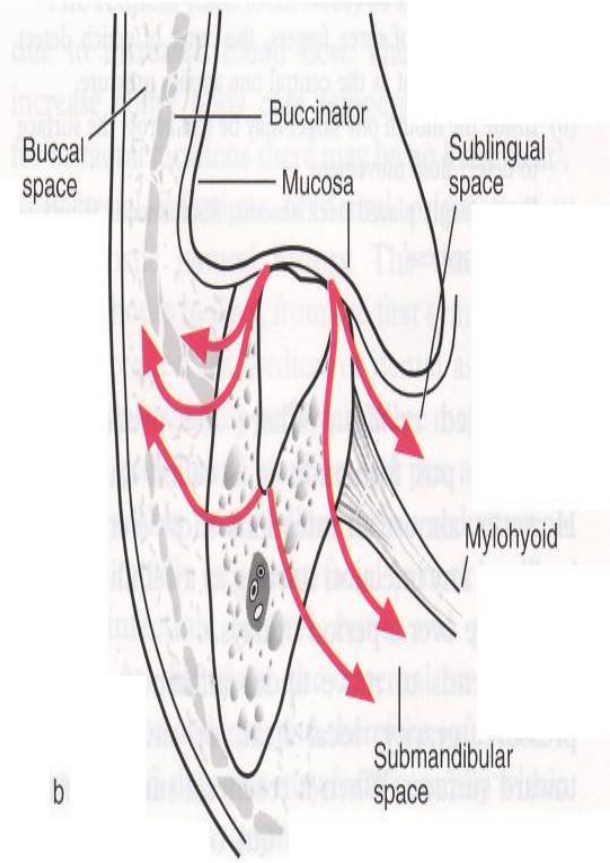


The *Fascial Spaces* seen as a transverse section cut at an oblique angle.



Routes of Spread of Infection from a Lower 3rd Molar

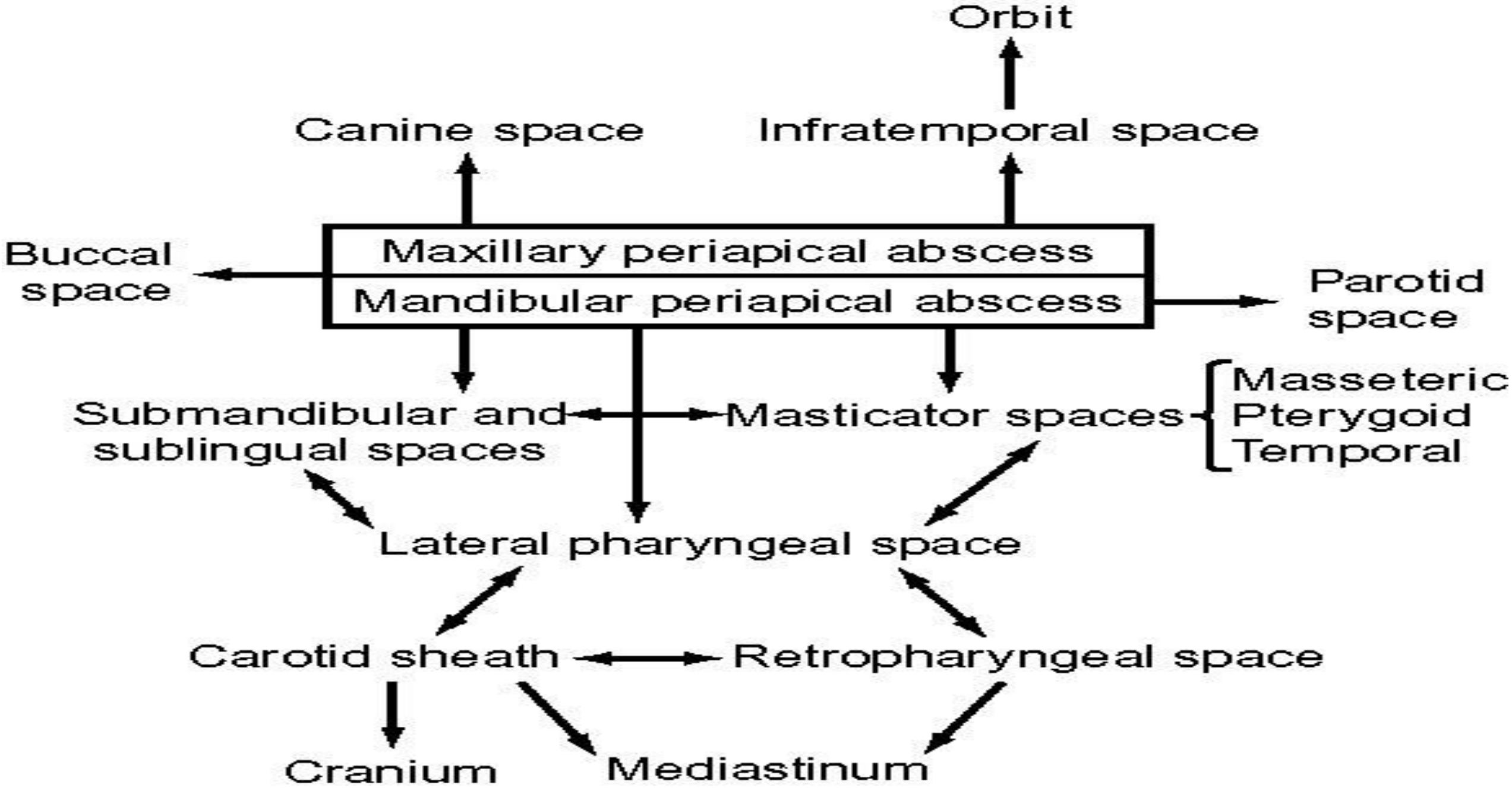




(a) When seen in horizontal section, infection may track laterally into the *buccal space*, posteriorly, either side of the mandible into the *masticatory space*, further medially into the *lateral pharyngeal space*, or lingually into the *sublingual space*.

(b) When seen in coronal sections, routes to the *buccal*, *submandibular* and *sublingual spaces* are visible.

Potential pathways of spread into deep fascial space infections of the head and neck.

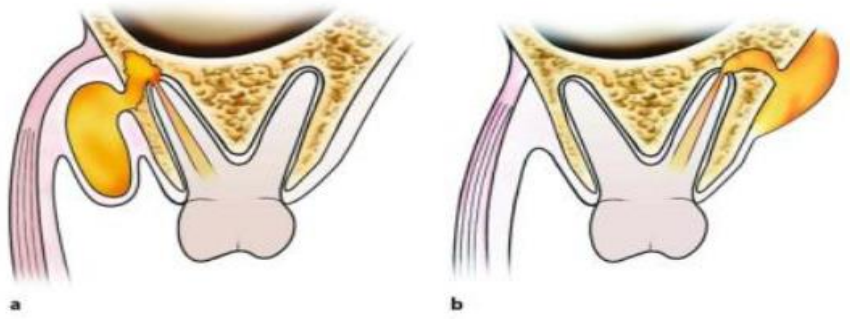


The fascial spaces around the mouth and face, which are most commonly implicated in odontogenic infections, are shown in

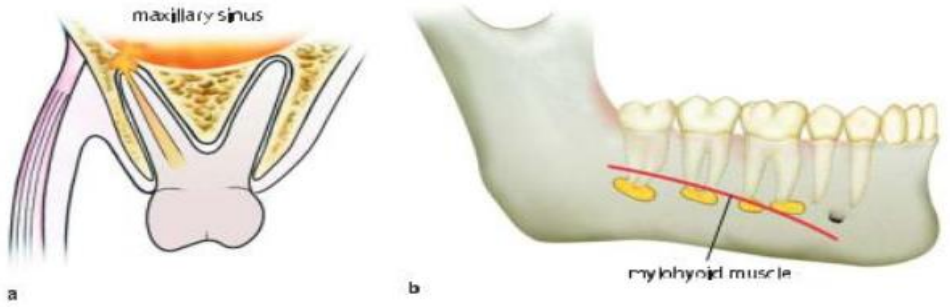
Other non-odontogenic sources of infection include suppurative parotitis, peritonsillar abscess, sinusitis, and mastoiditis.

The main clinical presentation of various orofacial odontogenic infections are summarized in

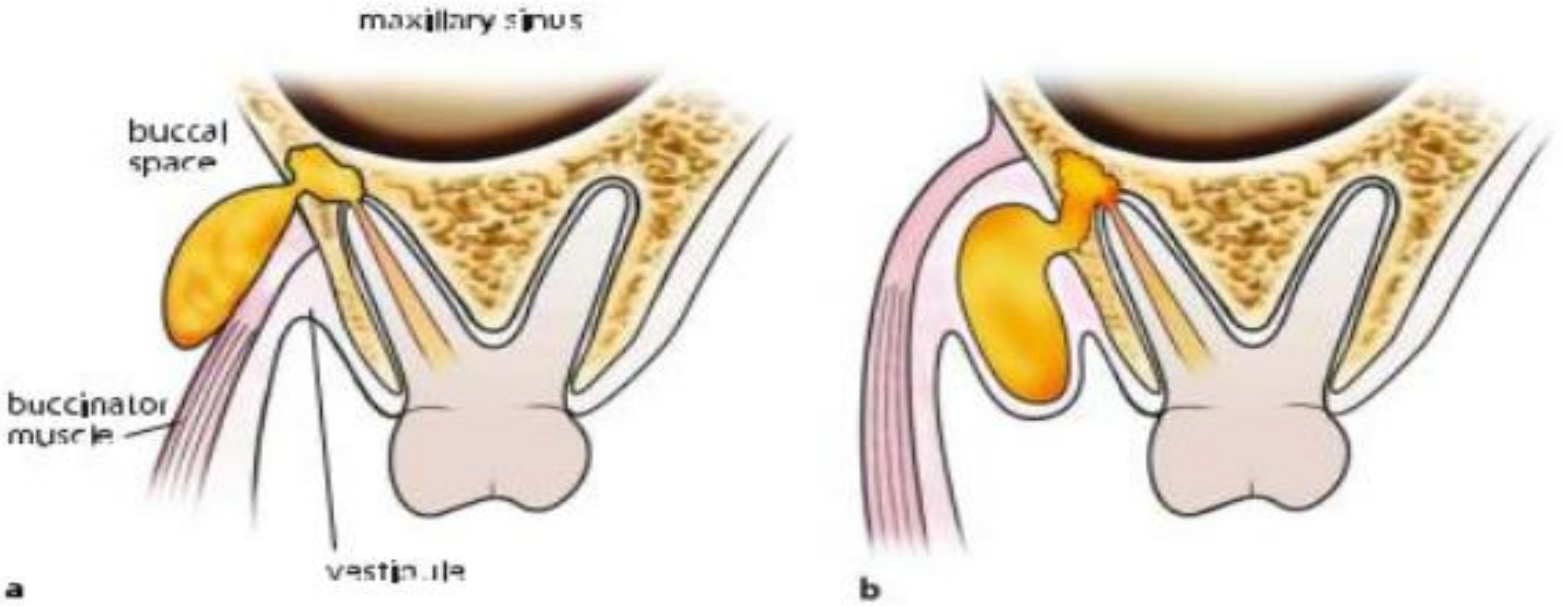
The location of these space infections can be helpful in identifying the underlying infected tooth and suggests the potential pathways for spread into deeper fascial space infections of the head and neck.



Diagrammatic illustrations showing spread of infection (propagation of pus) of an acute dentoalveolar abscess, depending on the position of the apex of the responsible tooth.
a Buccal root: buccal direction.
b Palatal root: palatal direction



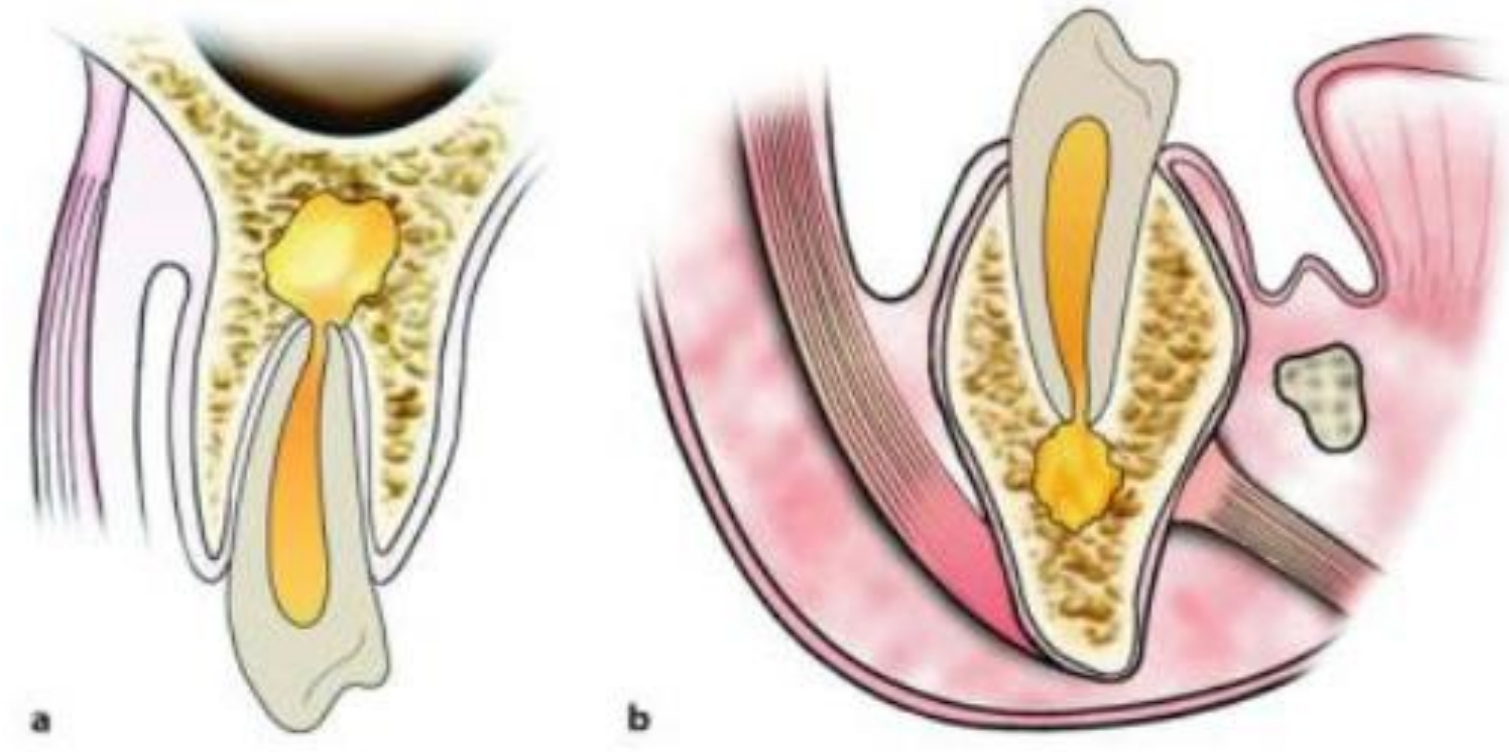
Spread of pus towards the maxillary sinus, due to the closeness of the apices to the floor of the antrum. **b** Diagrammatic illustration showing the localization of infection above or below the mylohyoid muscle, depending on the position of the apices of the responsible tooth



Spread of pus depending on the length of root and attachment of buccinator muscle.
a Apex above attachment: accumulation of pus in the buccal space.
b Apex beneath the buccinator muscle: intraoral pathway towards the mucobuccal fold

A- Intraalveolar abscess of maxilla and mandible

B - Diagrammatic illustrations show accumulation of pus at a portion of the alveolar bone in relation to the periapical region



Subperiosteal abscess with lingual localization

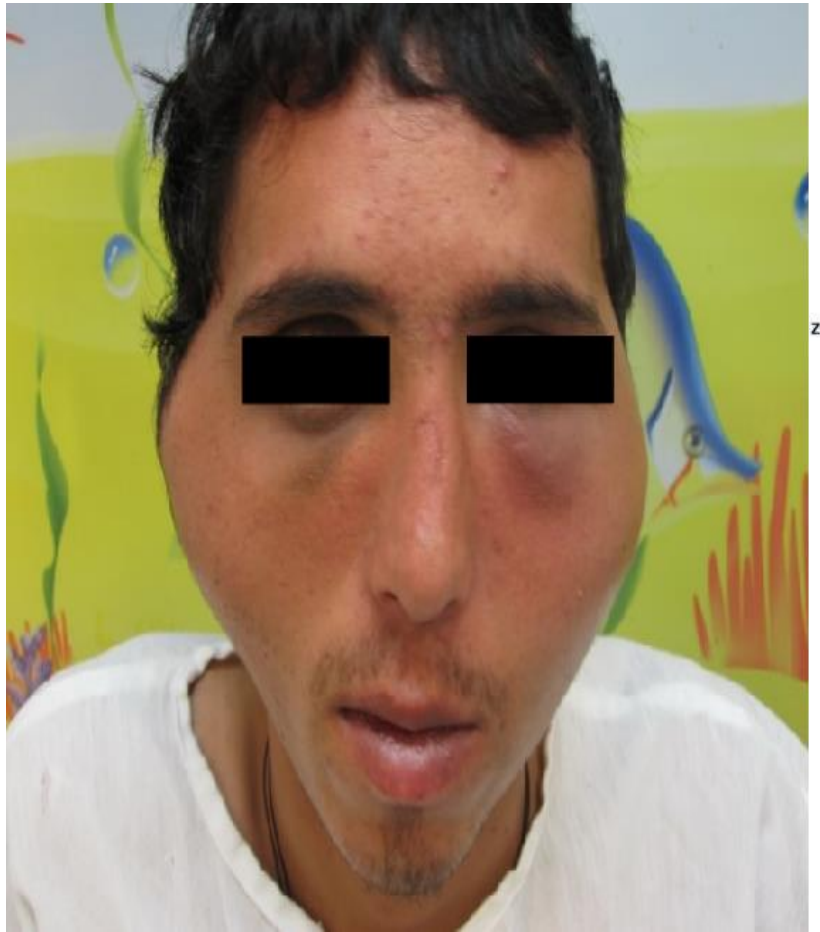
It is in direct communication with the **lateral pharyngeal space posteriorly**. **The temporalis muscle** divides the superior part of this space into two portions, the superficial temporal space, which is bounded by temporalis muscle medially, and the deep temporal space, with the temporalis muscle laterally and the periosteum of the temporal bone medially. Severe trismus due to spasm of the masseter muscle is a characteristic feature of involvement of this fascial space.

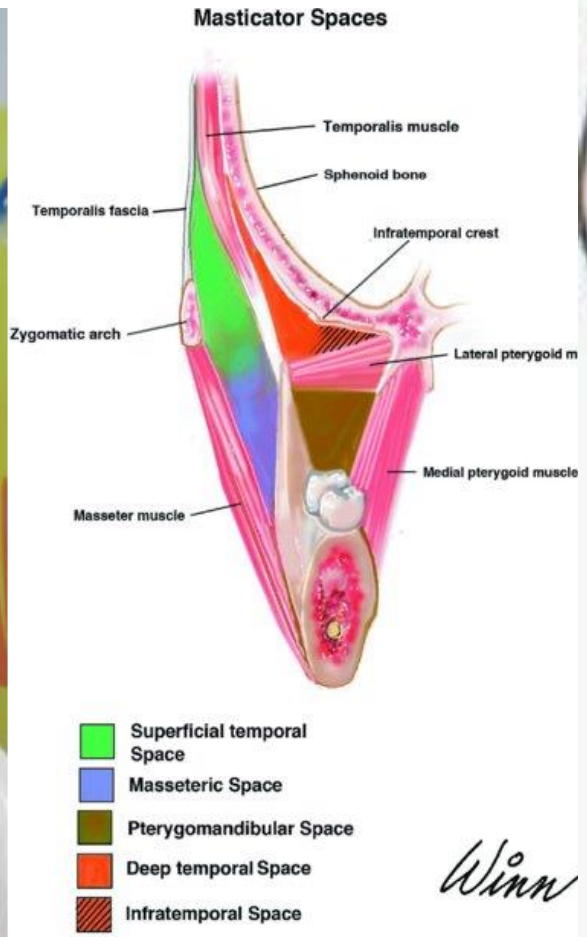
Infection abscess drainage in sub masseteric space

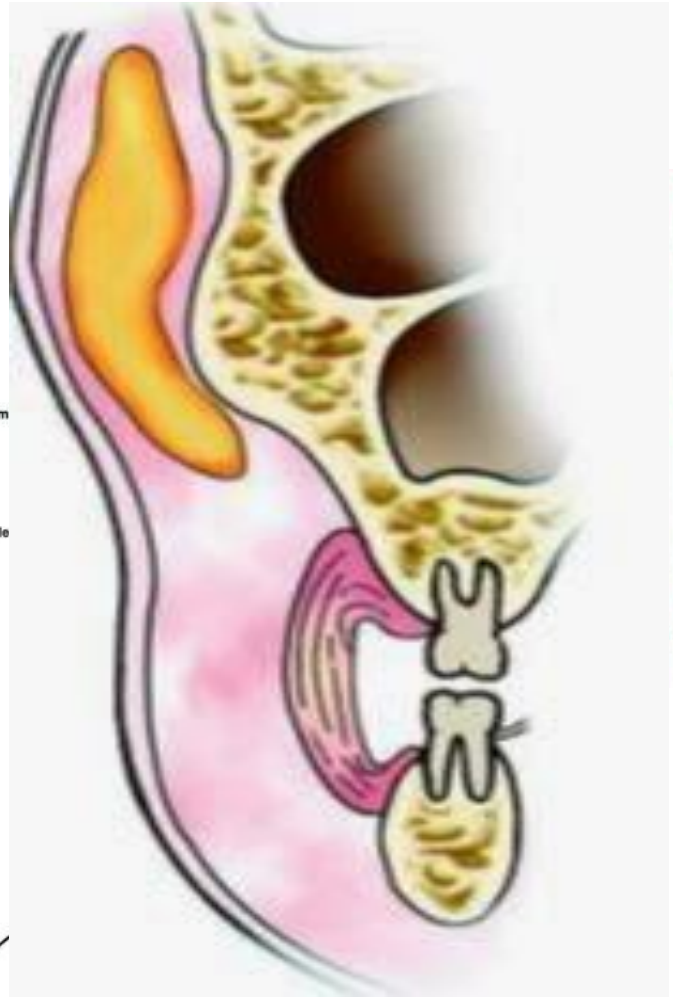
Infratemporal space

Extension of infection from maxillary molars can pass into this space. Infection may also spread from the pterygomandibular, parotid, or lateral pharyngeal region to the infratemporal space. The patient then complains of pain, particularly with mouth opening, some dysphagia, and difficulty with lateral mandibular movements. This space is located behind the zygomatic bone posterior to the maxilla and medial to the insertion of the medial pterygoid muscle.

The infratemporal space is bounded superiorly by the greater wing of the sphenoid and is in close proximity to the inferior orbital fissure, with a possible risk of spread of infection to the orbit.







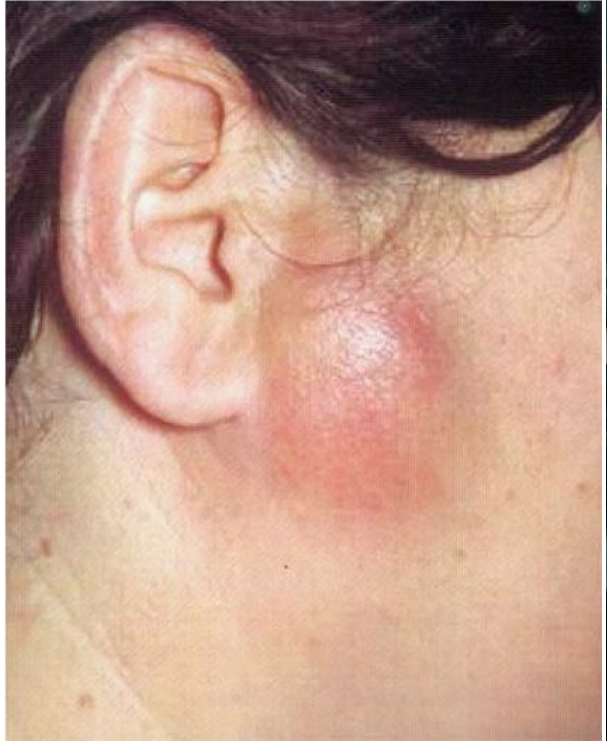
Clinical Presentation. Trismus and pain during opening of the mouth with lateral deviation towards the affected side, edema at the region anterior to the ear which extends above the zygomatic arch, as well as edema of the eyelids are observed

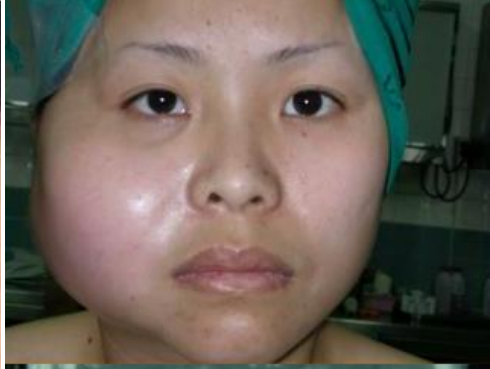
Treatment. The incision for drainage of the abscess is made intraorally, at the depth of the mucobuccal fold,and, more specifically, laterally (buccally) to the maxillary third molar and medially to the coronoid process,in a superoposterior direction .
A hemostatis inserted into the suppurated space, in a superior direction.
Drainage of the abscess may be performed extraorally in certain cases. The incision is performed on the skin in a superior direction, and extends approximately 3 cm.
The starting point of the incision is the angle created by the junction of the frontal and temporal processes of the zygomatic bone.
Drainage of the abscess is achieved with a curved hemostat, which is inserted through the skin into the purulent accumulation

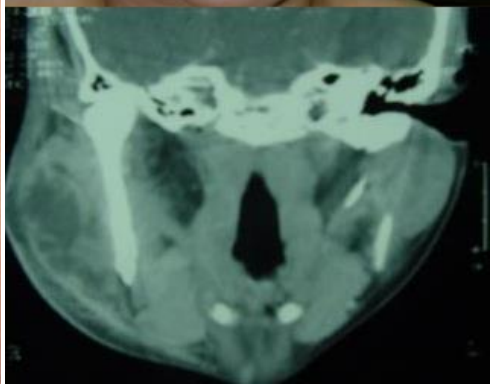
Infratemporal abscess. **a**Diagrammatic illustration showing the spread of the abscess into the infratemporal space. **b** Clinical photograph of an infratemporal abscess. Swelling of the region of the right zygomatic arch and edema of eyelids. **c** Incision at the depth of the vestibular fold for incision and drainage of an infratemporal abscess

Parotid space

Involvement of this space may be an extension of infection in the **middle ear or the mastoid region**. Infection in the masseteric or the lateral pharyngeal space may also spread to the parotid region. Thus, the most characteristic feature of involvement of this space is swelling of the parotid gland region, below the ear lobe. This space contains several important structures that may be affected by infections. **These include the 7th cranial nerve**, the auriculotemporal nerve, the facial vein, the parotid lymph node, and, more deeply, the external carotid with its branches.

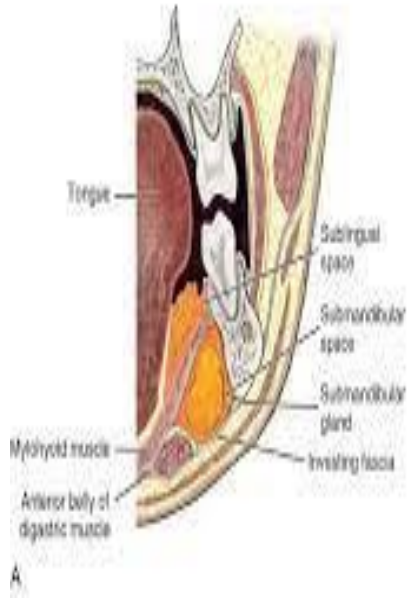


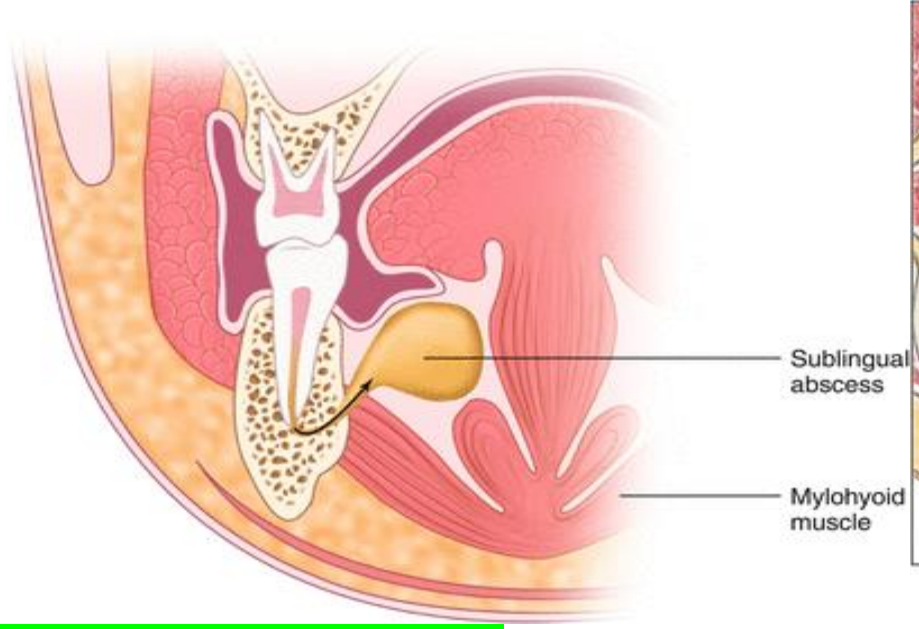


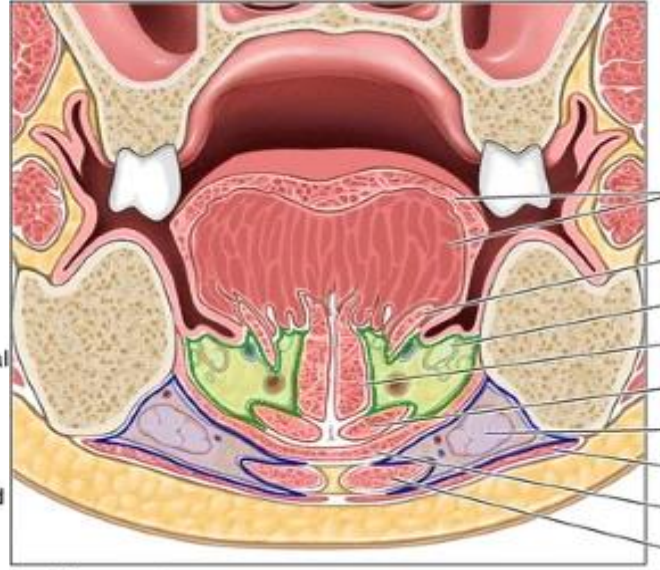


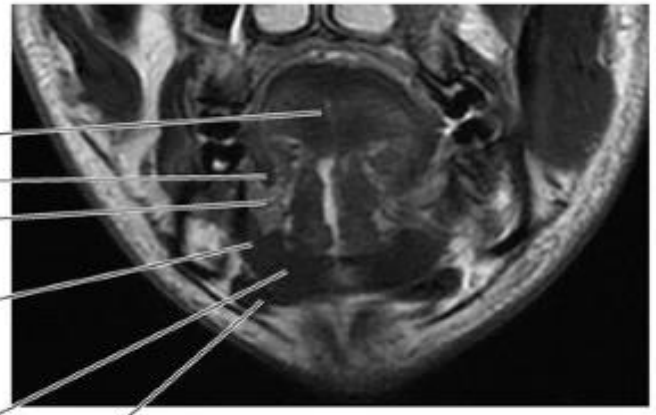
Submandibular space

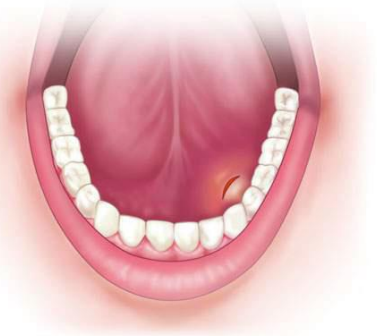
This space is located below the mylohyoid muscle, medial to the ramus and the body of the mandible. It is bounded anteriorly by the attachments of the anterior belly of the digastric muscle and posteriorly by the posterior belly of digastric muscle and the stylomandibula











Sublingual space infection

Anatomic boundaries:

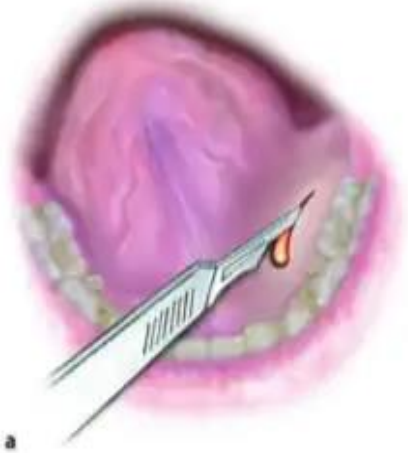
this is a V-shaped space, it is bounded anteriorly and laterally by the mandible, superiorly by sublingual mucosa, inferiorly by the Mylohyoid muscle and medially by Genioglossus, Geniohyoid and Styloglossus muscles.

Signs and symptoms of a sublingual space infection might include a **firm, painful swelling in the anterior part of the floor of the mouth**. A sublingual abscess may elevate the tongue and cause ***drooling*** or ***dysphagia (difficulty swallowing)***. There is usually little swelling visible on the face outside the mouth

Source of infection it is usually from the premolar and less commonly from molar teeth when the infection perforates the lingual cortex of the mandible above the attachment of the Mylohyoid muscle.

Indirectly the infection may spread from submental and submandibular spaces.

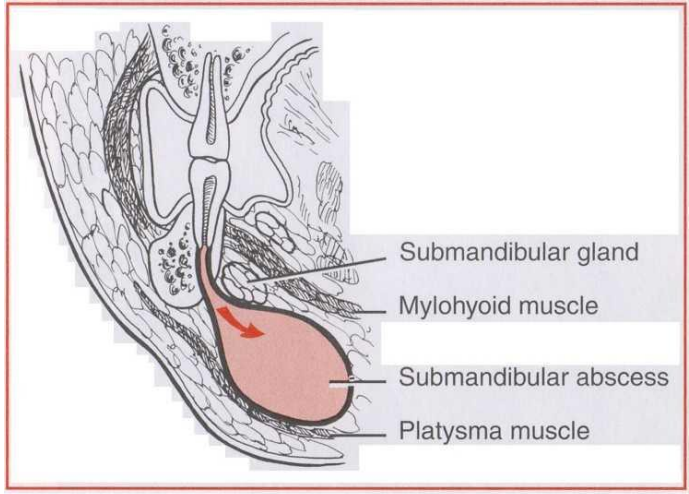
Infection from sublingual space may invade the **submandibular and pharyngeal spaces**



Clinically : there is erythematous swelling of the floor of the mouth that may extend through the midline since the barrier between the two sublingual spaces is weak, usually there is elevation of the tongue.

Site of incision and drainage: intraorally by an incision through the mucosa only parallel to **Wharton's duct** and lingual cortex in anteroposterior direction and away from the sublingual fold.

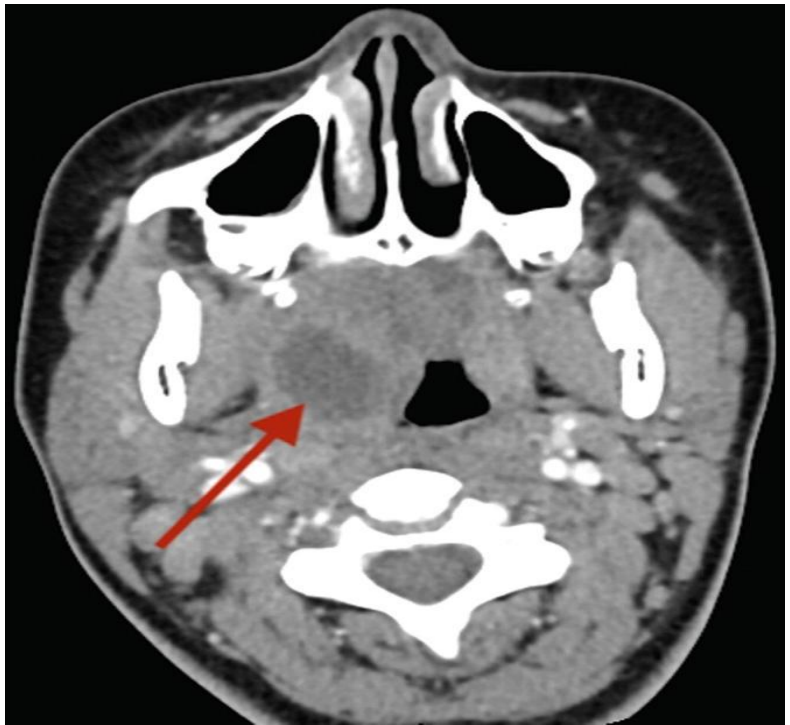
This space may be drained extraorally through submandibular and submental incisions through the Mylohyoid muscle if the infection of these latter spaces is also evident.



Submandibular Space. This space lies between the mylohyoid muscle and skin and superficial fascia. Primarily 2nd & 3rd molars infect it. muhadharaty.com

Parapharyngeal space infection

Parapharyngeal abscesses can also cause **trismus** and neck swelling above the level of the hyoid bone. Anterior parapharyngeal space abscesses may result in a bulging appearance of the tonsil and lateral pharyngeal wall associated with swelling in the areas of the parotid gland and angle of the mandible.



Parapharyngeal abscesses can also cause trismus and neck swelling above the level of the hyoid bone.

The imaging modality of choice is a contrast-enhanced CT scan of the neck. Some patients will not be able to tolerate lying supine and may require endotracheal intubation prior to the imaging procedure

Needle aspiration or incision and drainage is a common method of treating abscesses in the head and neck, although intratonsillar abscesses are usually not treated surgically unless the tonsils become obstructive.

General anesthesia is necessary for surgical drainage of other deep neck space abscesses.

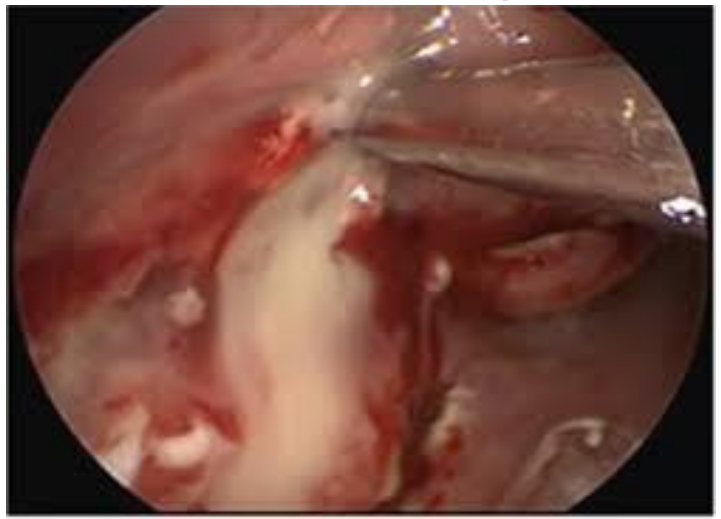
Although suppurative infections of the deep neck spaces are often regarded as being more acute and in need of surgical drainage, nonsuppurative infections can be just as severe and, in some cases, more serious than deep neck space abscesses. One of these conditions is Ludwig's angina.

This condition refers to a rapidly spreading cellulitic infection of the submental, sublingual, and submandibular areas, typically due to an infection originating in the teeth. The swelling of the sublingual space displaces the tongue superiorly and posteriorly. The swelling impairs speech and ability to swallow. As the infection progresses, the patency of the airway becomes compromised.

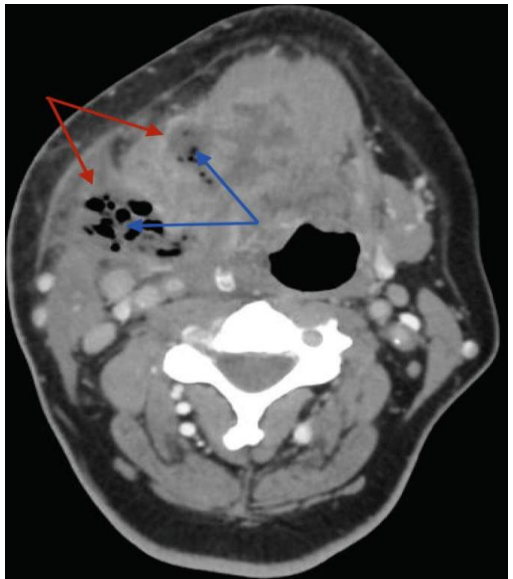
On physical examination, the patient has a muffled voice and appears distressed. Trismus may prevent examination of the oropharynx. The structures of the superior neck are indurated with a marked elevation of the tongue and floor of mouth. Ludwig's angina is a surgical emergency. The treatment priority is establishing a protected airway, typically by tracheostomy. Once the airway is protected, the infection is incised and drained and the area debrided as necessary.

Broad-spectrum intravenous antibiotics are used. Ideally the dental source of the infection is also addressed, but severe trismus typically prevents access during the incision and drainage procedure.

Intraoperative findings. (a) There was peritonsillitis containing mucus and pus from the posterior pillar on the right side. (b) Incision at the left lateral and posterior pharyngeal walls. A large amount of pus flowed out from the peritonsillar and lateral pharyngeal wall



Shown is an axial CT scan of the neck revealing hypodense areas without peripheral enhancement (red arrows) and the abnormal presence of gas pockets (blue arrows) within the soft tissue. Surgical debridement of this area revealed necrotic tissue, confirming a diagnosis of necrotizing fasciitis



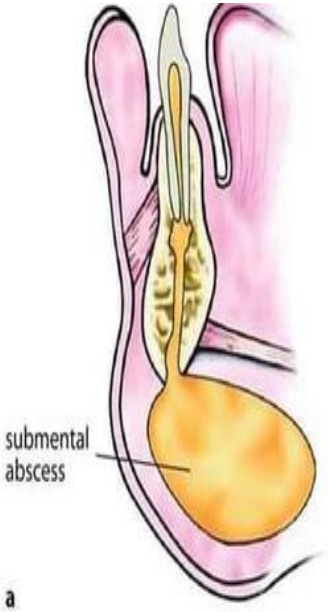
Submental space:

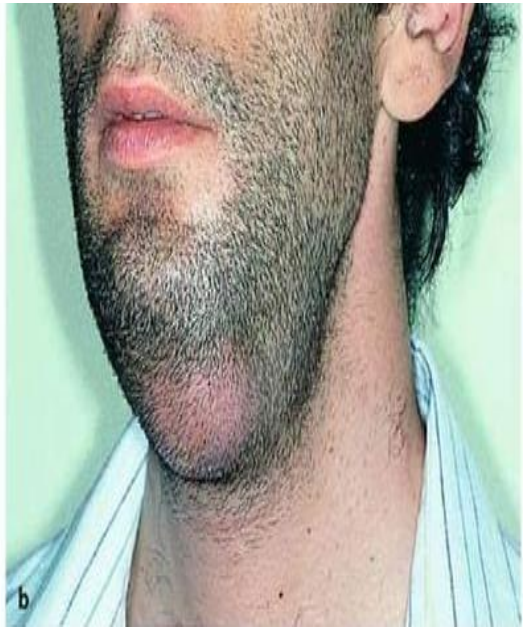
Infection can **result directly** due to infected mandibular incisor or **indirectly** from the submandibular space

Space located between the anterior bellies of the digastric muscle laterally, deeply by the mylohyoid muscle, and superiorly by the deep cervical fascia, the platysma muscle, the superficial cervical fascia, and the skin

Dependent drainage of this space is performed by placing a horizontal incision in the most dependent area of the swelling extraorally with a cosmetic scar being the result

Treatment:





Maxillary Sinusitis of Endodontic Origin

Many factors and conditions can contribute to the development of odontogenic sinusitis. These include spread of endodontic infection in the maxilla, periapical cysts, granulomas, and displacement of foreign bodies into the sinus such as endodontic materials, tooth fragments, implants, or augmentation grafts.

Otolaryngologists and dentists should always suspect an odontogenic origin for sinusitis cases and refer to an endodontic specialist if needed.

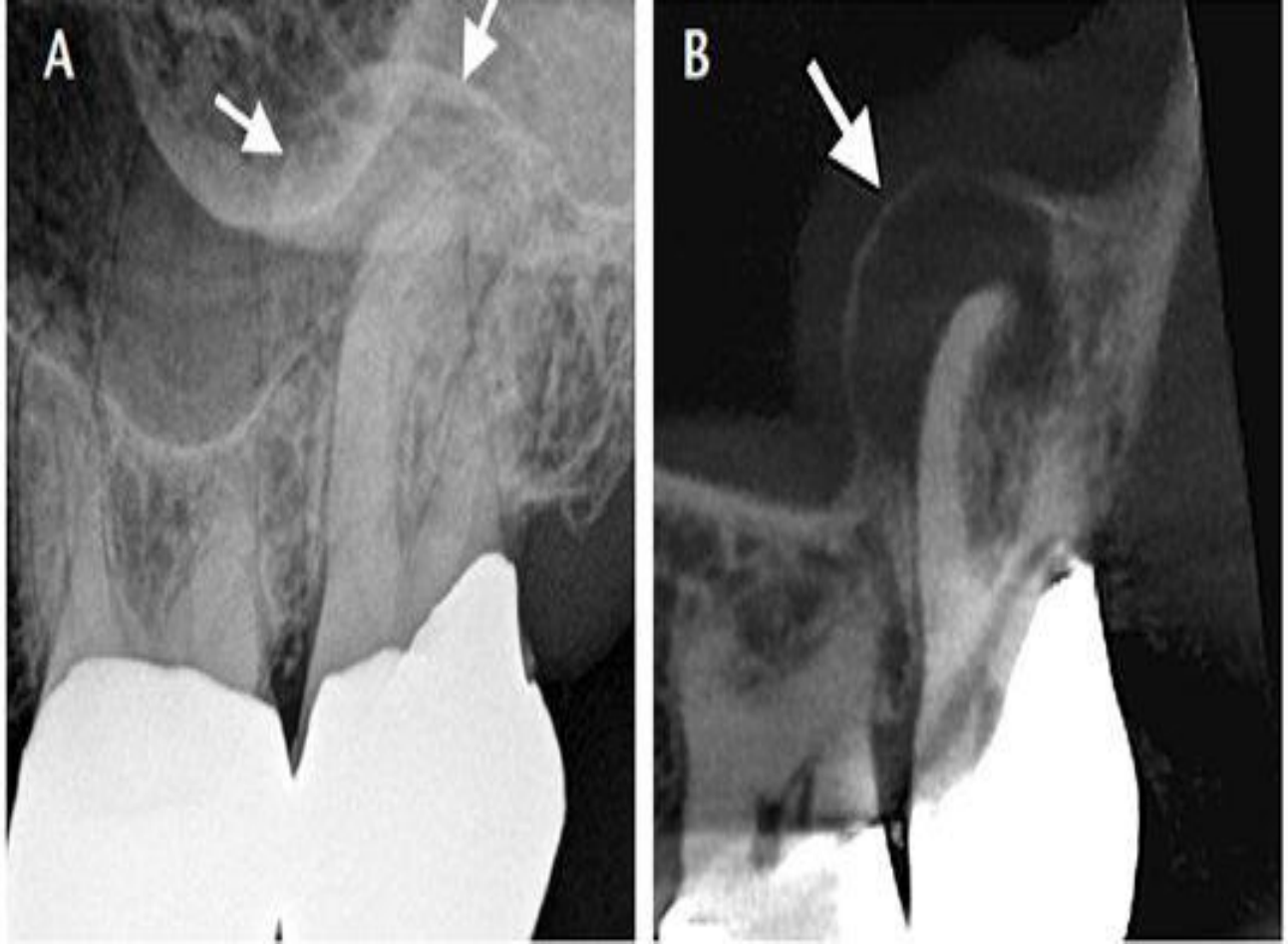
Biofilms involved in **odontogenic sinusitis** are generally characterized as polymicrobial. Acute bacterial sinus infections of non-odontogenic sources typically involve nasal cavity aerobic commensals, including ***Staphylococcus aureus***, ***Haemophilus influenzae***, ***Moraxella catarrhalis***, and others.

In odontogenic sinusitis, the sinonasal environment changes to that characteristic of chronic sinus infections with predominance of anaerobic bacteria.The most common isolates found were oropharyngeal flora that were also **predominate in periodontal and endodontic infections**. These included ***Peptostreptococcus, Fuso-bacterium, Prevotella spp.*, and *Porph-yromonus spp***.

Radiographic Examination:

While periapical radiographs are the most widely used imaging modality in endodontics, the posterior maxilla presents significant and unique interpretation challenges when using conventional two-dimensional imaging. Anatomic structures — such as the zygoma, palatal process, maxillary sinus and buccal cortical plate — are often superimposed onto the dental roots, obscuring or concealing periapical infection. Conventional periapical radiographs also do not consistently reveal mucosal thickening or fluid in sinuses,

The increased availability of CBCT in dental offices in recent years has allowed for improved recognition of odontogenic sinusitis. In all three of the cases in this study, periapical infection was missed on routine dental examination and was not discovered until CBCT imaging was performed. Once the source of infection was established and the appropriate treatment was performed, the patient's dental and sinonasal symptoms resolved. Collectively, the literature strongly supports interdisciplinary action among physicians, dentists, and dental specialists to provide a patient-centered approach for treatment and management of maxillary odontogenic sinusitis.**Further progression of the disease process can cause a partial or**



Periapical radiograph of a left maxillary second molar with a periapical osteoperiostitis or "halo" lesion (arrows) over the mesiobuccal root (A); the clinical examination confirmed pulpal necrosis. Sagittal cone beam computed tomogram of the same necrotic molar displaying the periapical osteoperiostitis (arrow), with associated mucosal edema of the left maxillary sinus (B).

CLINICAL EXAMINATION

A thorough clinical endodontic examination is essential for diagnosing or ruling out a potential endodontic source.When diagnosing a possible endodontic etiology in patients with sinusitis, the clinician must look carefully for any teeth with pulpal necrosis, and evaluate all prior endodontic treatments for possible failure in the suspected quadrant. Because MSEO is a bacterial disease, typically only teeth with an **infected necrotic pulp** or **failing endodontic treatment** will cause significant **sinonasal disease** or **sinonasal symptoms**. When examining maxillary posterior teeth with existing root canal treatment, providers must carefully look for any untreated or suboptimally filled canals, inadequate core restorations, or leaking coronal restorations that may provide evidence of endodontic failure and a bacterial source for MSEO.

TREATMENT

The objectives for treating MSEO are removal of pathogenic microorganisms, their by-products, and pulpal debris from the infected root canal system that are responsible for the sinus infection. Appropriate treatment options include nonsurgical root canal therapy, **periradicular surgery** (when indicated), intentional replantation, or extraction of the infected tooth. Patients should be informed of all treatment options and the prognosis of each, including the risks of no treatment.

Clinicians performing endodontic treatment in the posterior maxillary dentition should have extensive knowledge of maxillary root canal anatomy, the necessary armamentarium (including magnification), and requisite clinical skill considering the anatomic complexities and challenges in this region. Maxillary molars typically have the most complex anatomy in the dentition, and inadequate root canal treatment, particularly missed mesiobuccal canal systems, is a common cause of endodontic failure in maxillary molars.

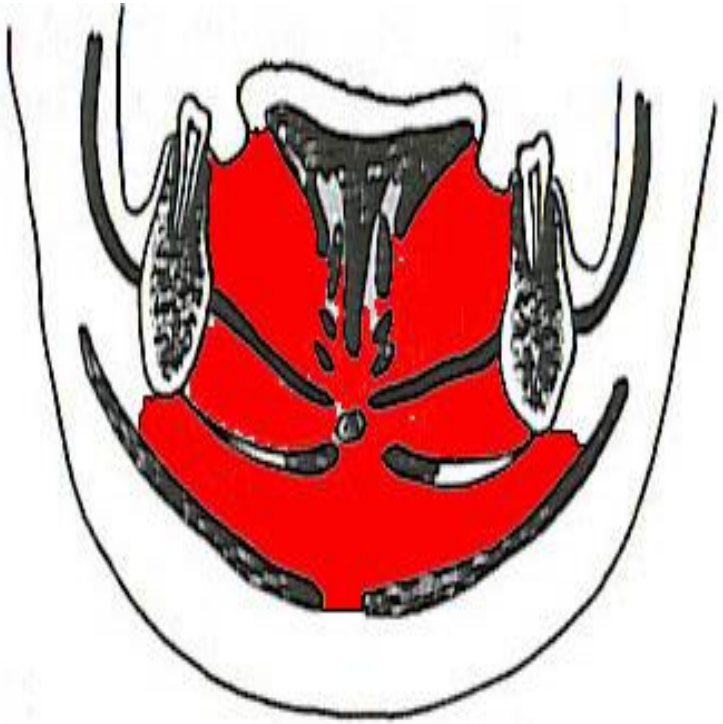
The close anatomic proximity of maxillary molar root apices to the floor of the maxillary sinus can lead to persistent MSEO if canals are left untreated or root canal failure occurs in these teeth. Endodontists are specialists in managing complex root canal systems and should be heavily relied upon for root canal treatment of maxillary molars.

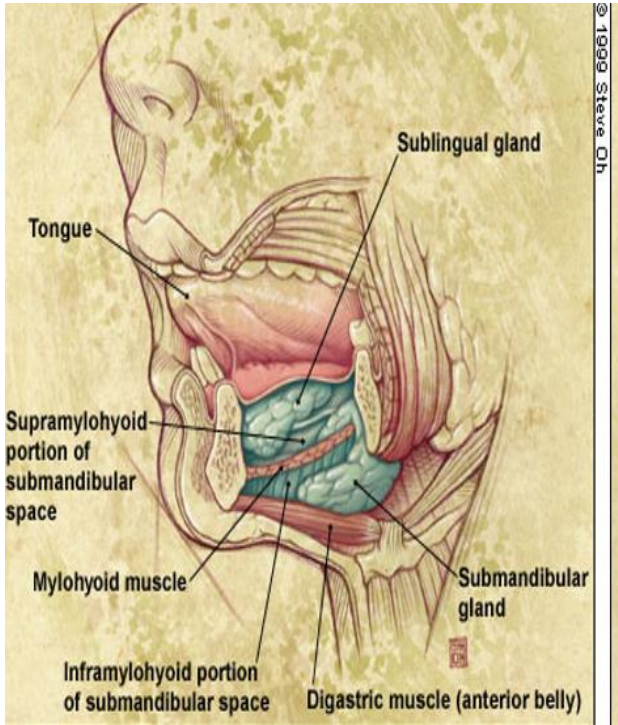
Use of systemic antibiotics to manage MSEO should follow the guidelines set forth in the *AAE Guidance on the Use of Systemic* ***Antibiotics in Endodontics***. Apart from spreading infections, antibiotic therapy is unwarranted in the treatment of MSEO and ineffective as a definitive solution. While antibiotic therapy may offer temporary relief of symptoms by improving sinus clearing, its sole use is inappropriate without definitive debridement and disinfection of the root canal system.

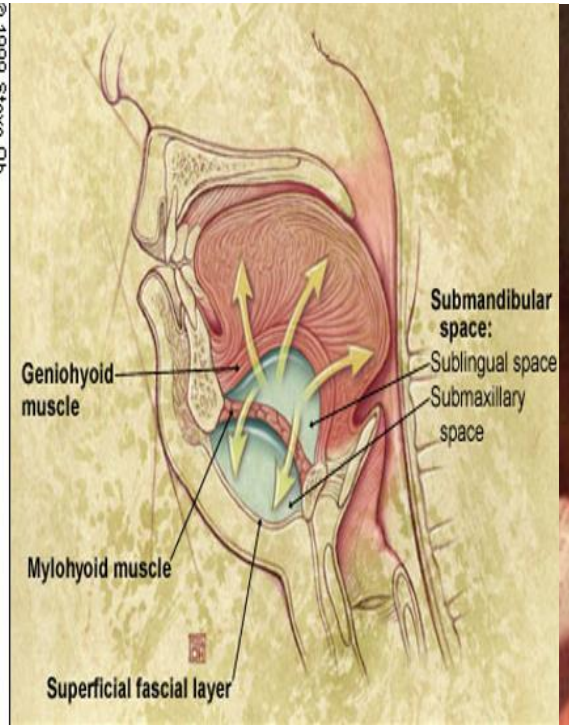
COMPLICATIONS OF ODONTOGENIC INFECTIONS:

Complications include **Ludwig's angina, airway obstruction, mediastinitis, necrotizing fascitis, cavernous sinus thrombosis, sepsis, thoracic empyema, Lemierre's syndrome, cerebral abscess, orbital abscess, and osteomyelitis**. The incidence of these "space infections" has been greatly reduced by **modern antibiotic therapy**

Ludwig's angina







Ludwig's Angina

Ludwig's Angina is **infection in multi-space, considered** severe form of cervico-fascial infection / cellulitis which usually arises from the **lower second or third molars (wisdom teeth).**

Deep fascial space infections cause gross inflammatory exudates (a fluid with a high content of protein and cellular debris which has escaped from blood vessels and has been deposited in tissues or on tissue surfaces, usually as a result of inflammation. It may be septic or non-septic) and tissue **edema (swelling),** associated with **fever** and **toxæmia (blood poisoning).** Before the advent of antibiotics, the mortality was high and the disease is still life-threatening if treatment is delayed.

The main fascial spaces involved in Ludwig's Angina are the sublingual, submandibular and para-pharyngeal.

Normally, the spaces both side of the midline (ie bilateral) are effected.

The characteristic features are:

- diffuse swelling, pain, fever and malaise.
- The swelling is tense and tender, with a characteristic 'board-like' firmness.
- The overlying skin is taut and shiny.
- Pain and edema (swelling) that limit opening the mouth and often cause dysphagia (difficulties in swallowing)
- Systemic upset is severe, with worsening fever, toxemia (blood poisoning) and leucocytosis.
- The regional lymph nodes are swollen and tender.
- In Ludwig's Angina particularly, airway obstruction can quickly result in asphyxia.


A


B


A

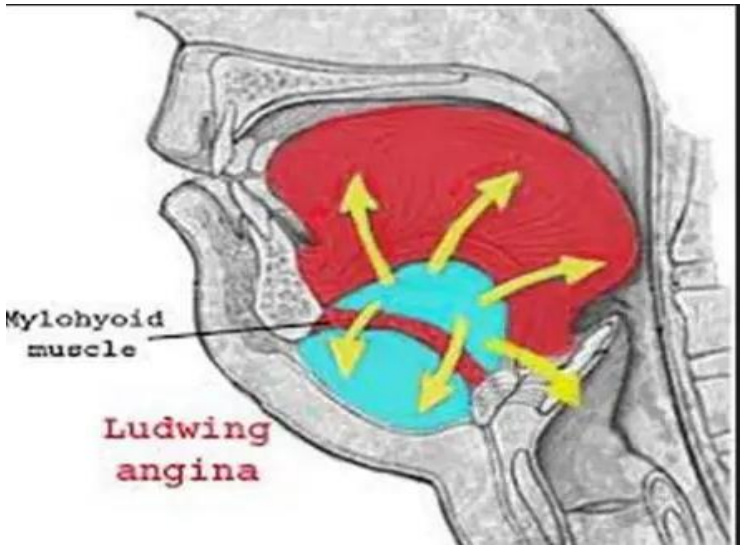

B

The Cervicofacial necrotizing Fasciitis can always be a cause of death if not intervened promptly; this extensive disease entity is commonly caused by an Immunocompromized state of host, malnutrition, diabetes, and ignored dental infections, surgical and non-surgical trauma.

The mainstay of the treatment includes **prompt surgical debridement**, **intravenous antibiotics**, **fluids and electrolytes management** and **analgesia** along with meticulous attempt to reverse the immunocompromized state of the patient, thus improving their general condition.

Pathology

Anærobic bacteria are primarily **responsible** and **infection mainly spreads from mandibular third molars (lower jaw wisdom teeth) whose apices (root tips) are closely related to several fascial spaces**.

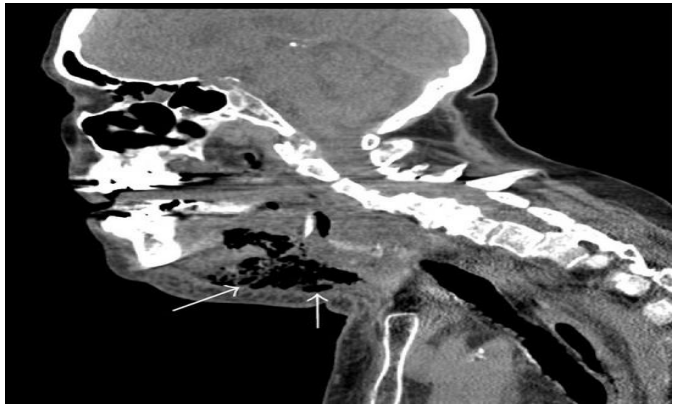


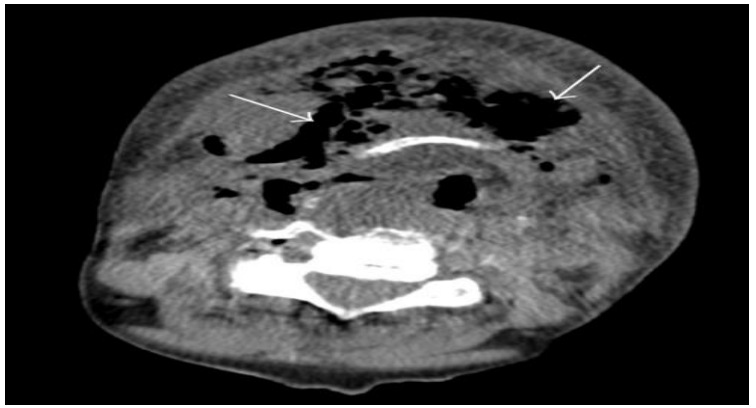
Management

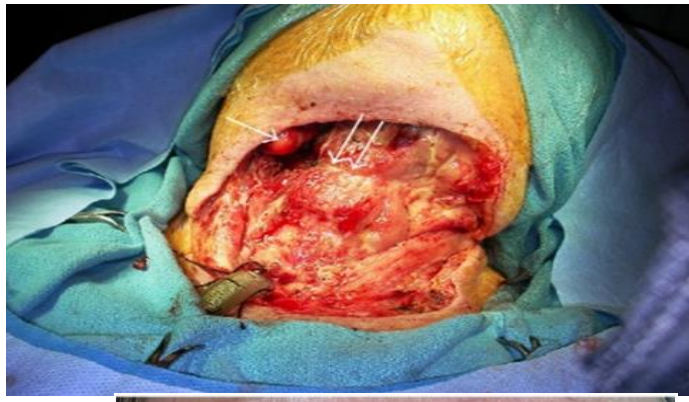
The main requirements are:

- immediate admission to hospital
- procurement of a sample for culture and sensitivity testing
- aggressive antibiotic treatment
- securement of the airway by tracheostomy if necessary, and
- drainage of the swelling to reduce pressure.

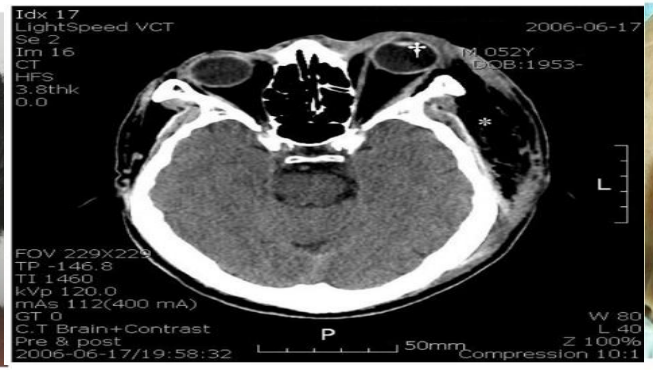
Ludwig's Angina Complicated by Cervical Necrotizing Fasciitis



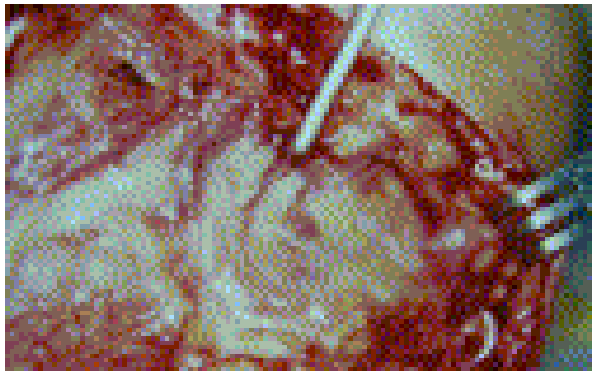


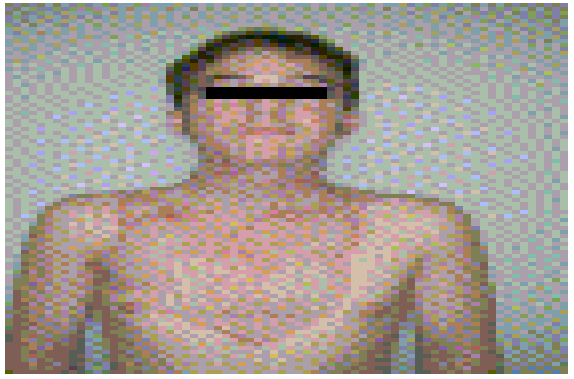


Necrotizing Fasciitis of Odontogenic Origin



Pediatric necrotizing fasciitis complicating third molar extraction



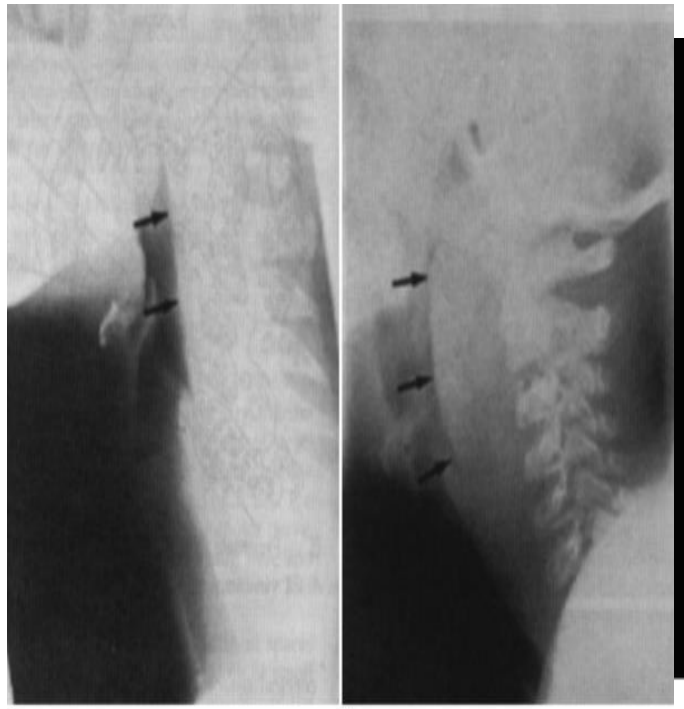


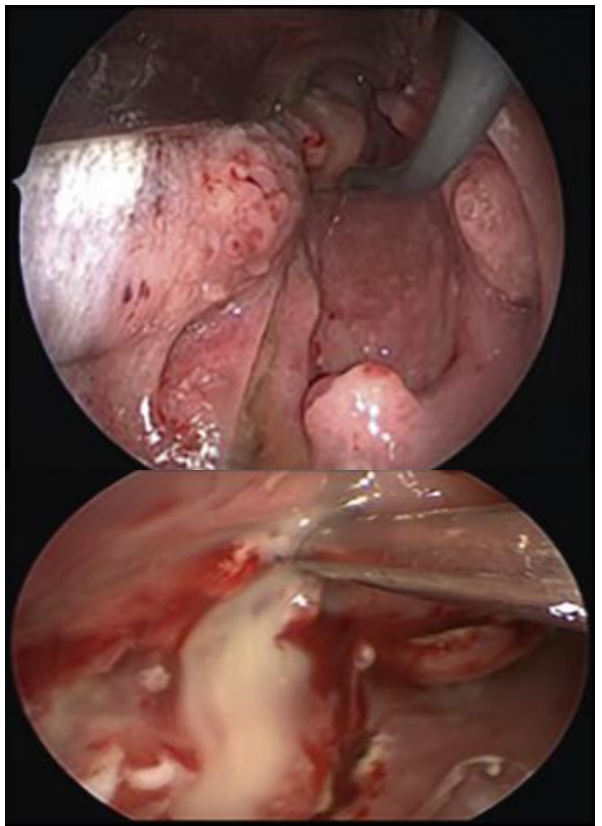
Lateral Pharyngeal Space Abscess

A parapharyngeal abscess is a deep neck space abscess of the parapharyngeal space (or pharyngomaxillary space), which is lateral to the superior pharyngeal constrictor muscle and medial to the masseter muscle. This space is divided by the styloid process into anterior and posterior compartments

Symptoms include fever, sore throat, painful swallowing, and swelling in the neck.

An anterior space abscess can cause lockjaw (spasm of jaw muscle), and hard mass formation along the angle of the mandible, with medial bulging of the tonsil and lateral pharyngeal wall. A posterior space abscess causes swelling in the posterior pharyngeal wall, and lockjaw is minimal. **Other structures within the carotid sheath may be involved**, causing **rigors**, **high fever**, **bacteremia**, **neurologic deficit**, or a **massive haemorrhage** caused by carotid **artery rupture**





EXTRA ORAL, INTRA ORAL APPROACH FOR ABCESS DRAINAGE

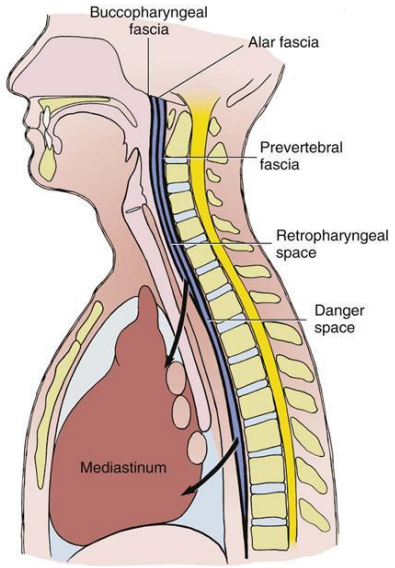
lateral Pharyngeal Space :

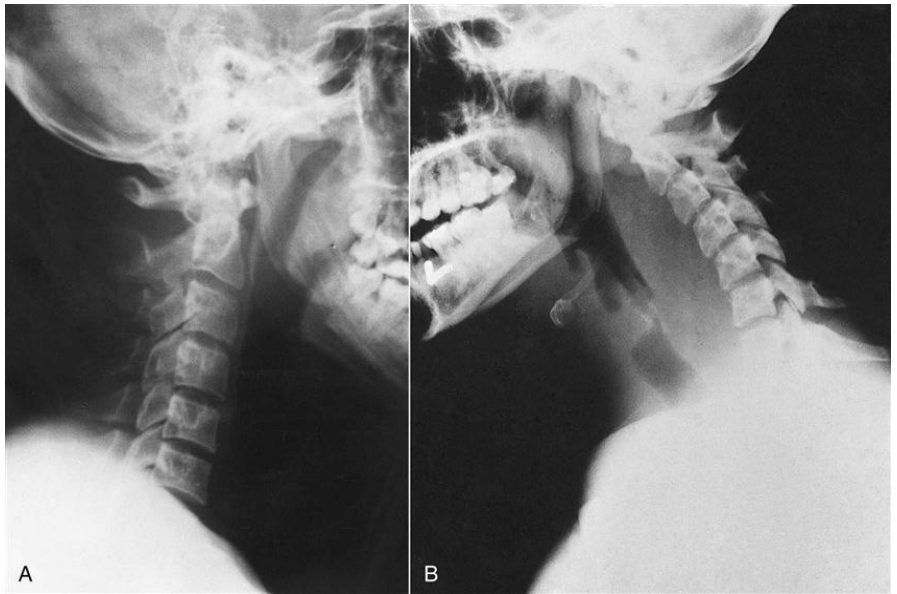
Patients who have infection of the lateral pharyngeal space have **several serious potential problems.**

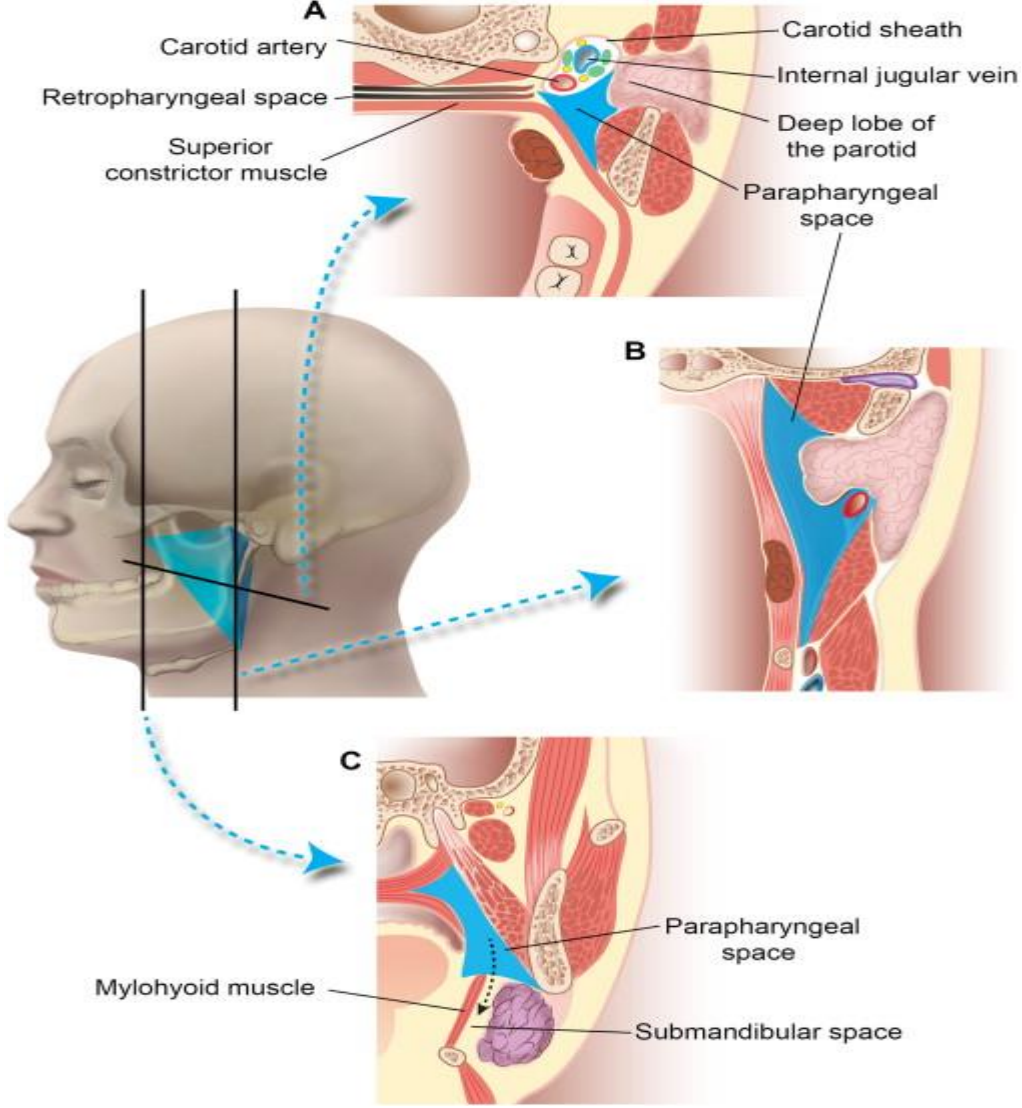
When the lateral pharyngeal space is involved, the odontogenic infection is severe and may be progressing at a rapid rate.

Another possible problem is the **direct effect** of the infection on the contents of the space, especially those of the posterior compartment. **These problems include thrombosis of the internal jugular vein**, **erosion of the carotid artery** or its branches, and interference with cranial nerves IX, X, and XII.

A third serious complication arises if the infection progresses from the lateral pharyngeal space to the retropharyngeal space or beyond



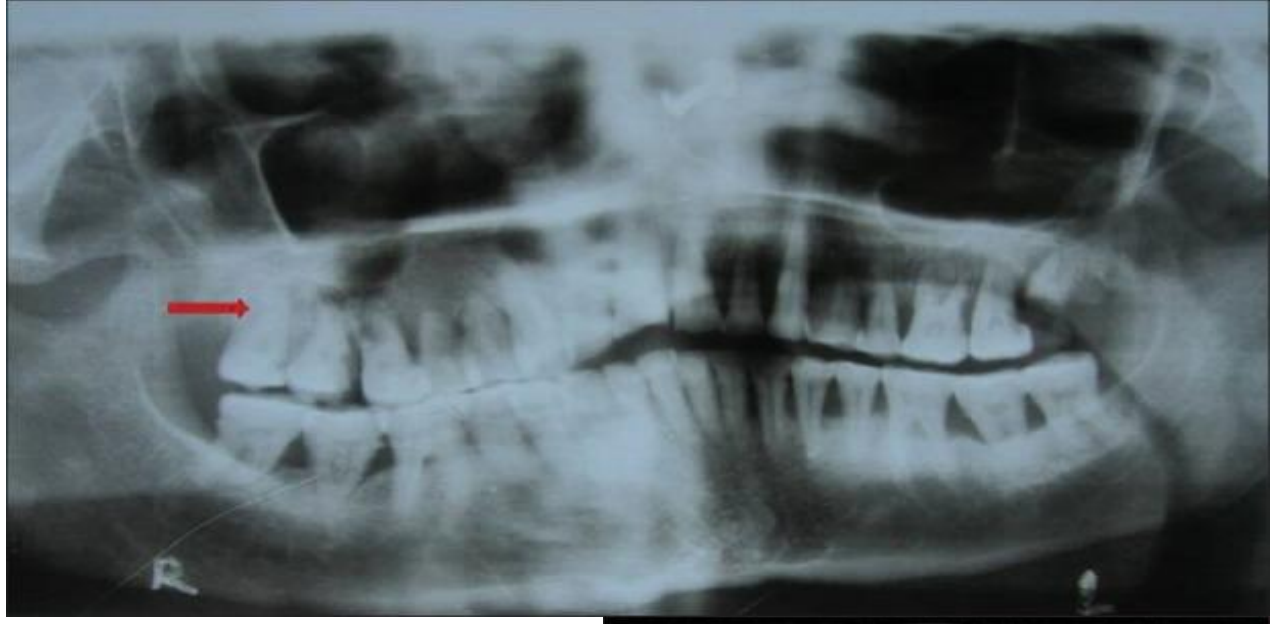




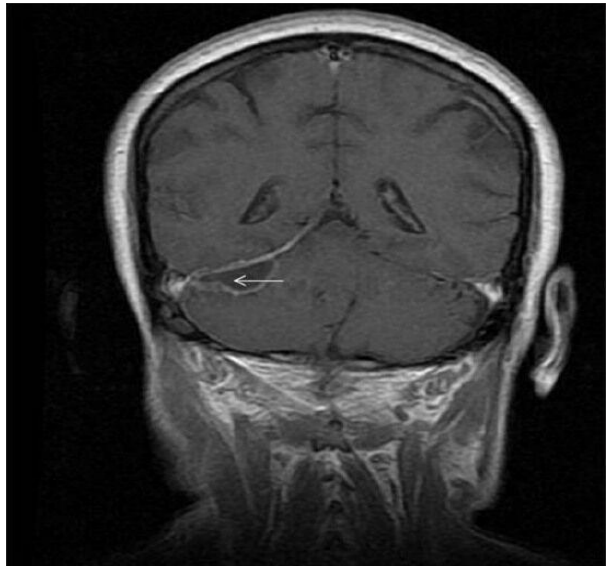
The normal retropharyngeal soft tissue shadow is narrow (6 mm or less) at C2 and 20 mm or less at C6 on plain radiographic films. **B,** When the retropharyngeal space is infected, the soft tissue becomes substantially thicker, and the width of the oropharyngeal air shadow decreases

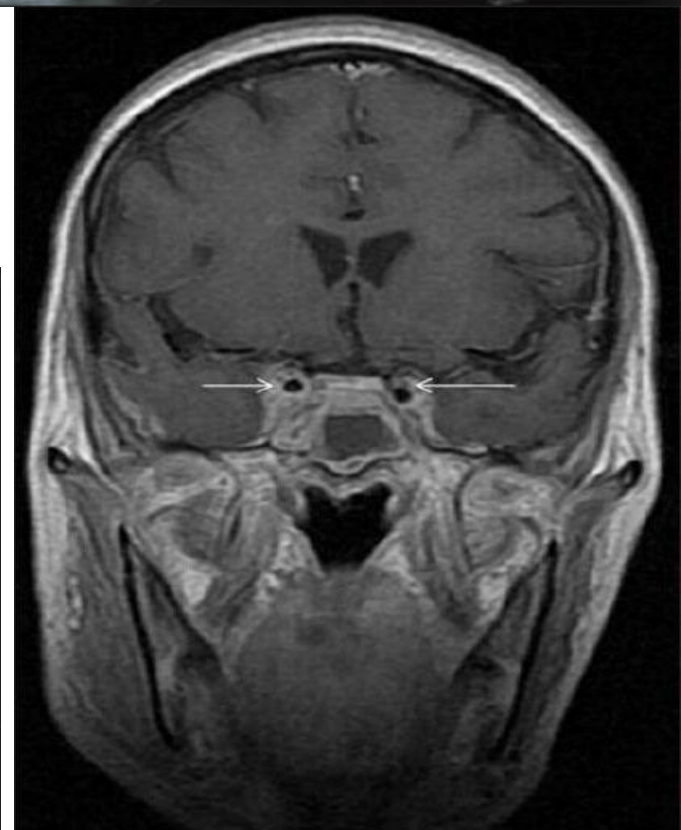
Septic cavernous sinus thrombosis (CST)

Septic CST can be defined as thrombophlebitis of the cavernous sinus of infectious origin. Facial infections and paranasal sinusitis are among the most important causes of septic CST. However, less commonly it may be caused by pharyngeal, otogenic, and odontogenic infections Septic cavernous sinus thrombosis (CST) related to dental infection is a rare clinical event. The septic CST is a disease of high morbidity and mortality. The prompt diagnosis and timely treatment of septic CST is cornerstone of successful outcome. The dental infection should be given due attention, as to prevent CST. In this case report of immunocompetent female, we highlighted the role of dental abscess in producing bilateral CST and facial palsy. **The close collaboration between dentist and neurologist and early institution of antibiotics led to complete recovery at follow-up after 3 months**. The dental infection should never be neglected as it is the interface of serious intracranial complication like CST.



Coronal contrast-enhanced T1 WI showing multiple defects in the enhancing bilateral cavernous sinuses (arrows)





MRI-brain showing right cerebellar abscess (arrow)

Pathology of SCST

The most important dural sinuses are cavernous sinuses, sagittal sinuses, straight sinus, transverse sinuses, and sigmoid sinus, which are all interconnected. The right and left cavernous sinuses are situated on the lateral aspect of the **sella turcica**. They extend from the superior orbital fissure to the petrous apex of the temporal bone. They are interconnected by anterior and posterior intercavernous sinuses that encircle the pituitary gland.

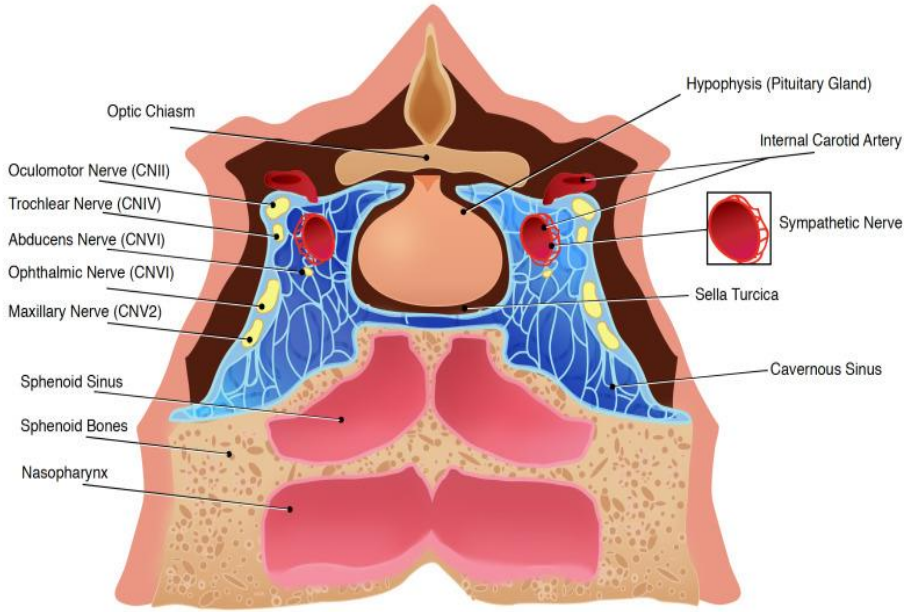
Cavernous sinuses receive blood from the **ophthalmic veins, the superficial middle and inferior cerebral veins**, and the **sphenoparietal** and **sphenoid sinuses**.

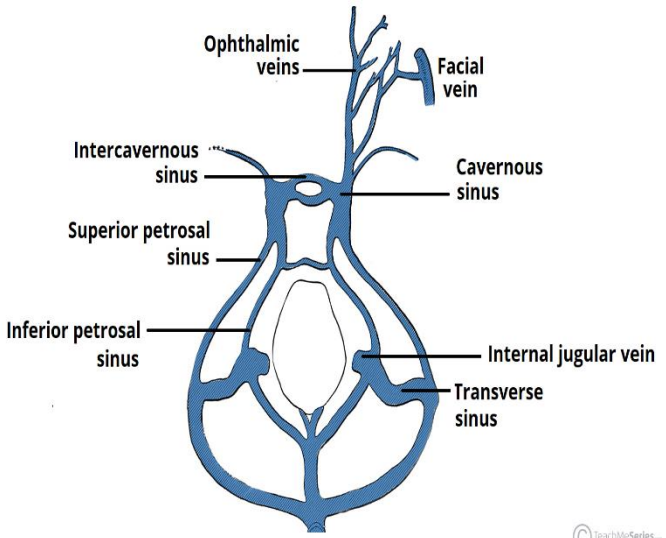
The cavernous sinuses **in turn drain into** the **pterygoid venous plexus** via **emissary veins**, and **into the internal jugular vein** and the **sigmoid sinus** via **the inferior and the superior petrosal sinuses respectively**.

Absence of valves in the cavernous sinuses and their connections favor bidirectional spread of infection. This can give rise to extensive thrombi throughout the network of sinuses.

Most commonly, CST results from spread of infection from the **sinuses**, especially the **sphenoid**, **ethmoid**, and **frontal sinuses**, or from the middle one third of the face. **Less commonly infection from teeth**, **nose**, **tonsils**, **soft palat**e, and **ears may constitute primary source of the infection**.

The dental infection most commonly **spreads via** the **pterygoid venous plexus**, where an infected thrombus may **extend or disseminate septic emboli**





Antibiotics are the main treatment for cavernous sinus thrombosis. Treatment will be started as soon as possible, even before tests have confirmed if a bacterial infection is responsible. If tests later show that a bacterial infection did not cause the condition, antibiotic treatment may be stopped

Incision for drainage of a palatal abscess, parallel to the greater palatine vessels

D-Antisepsis of the area with an antiseptic solution before the incision.

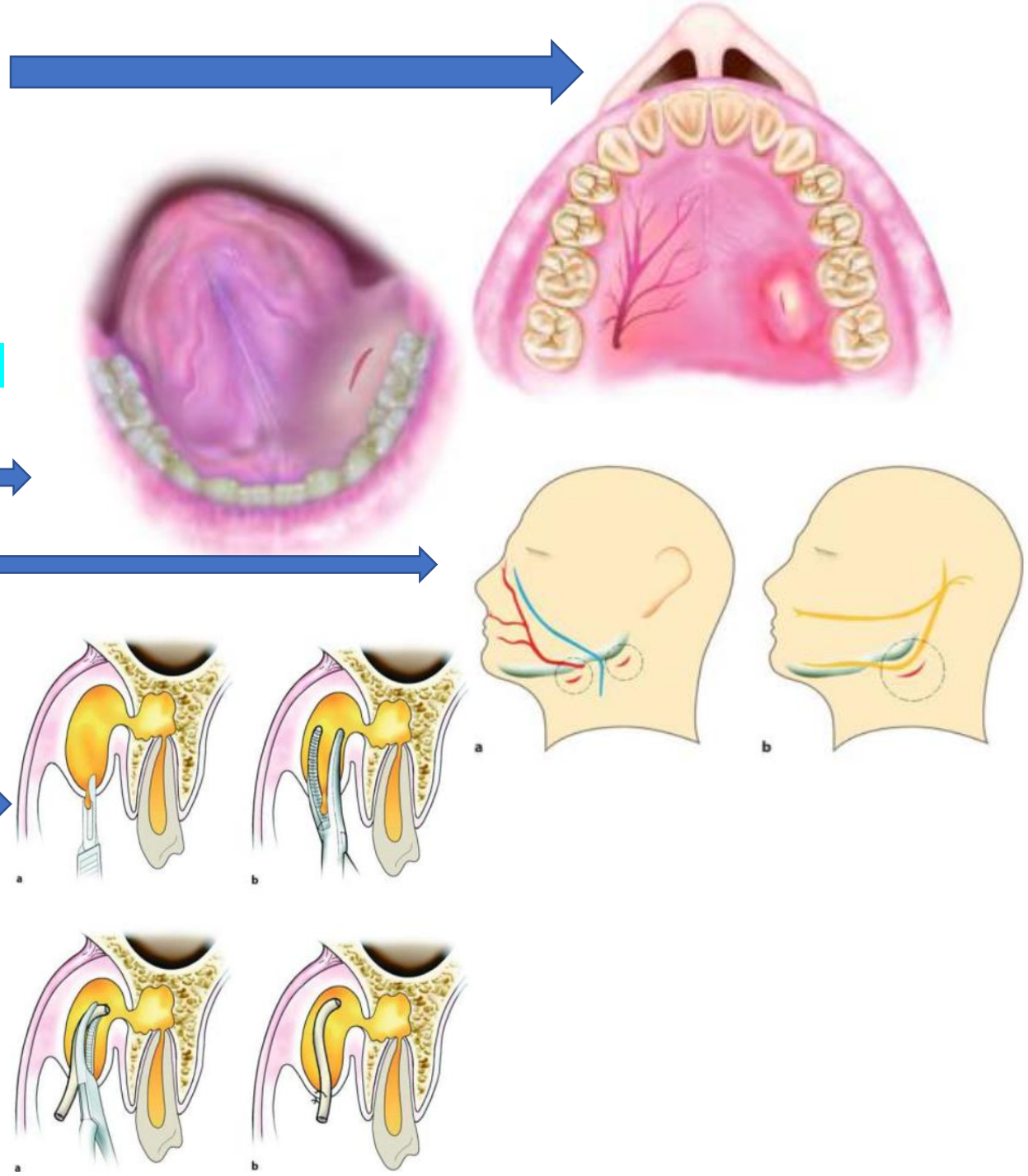
E-Anesthesia of the area where **incision and drainage** of the abscess are to be performed, **with the block technique together with peripheral infiltration anesthesia at some distance from the inflamed area**, in order to **avoid the risk of existing microbes spreading into deep tissues**.

F-Planning of the incision so that:

–Injury of ducts (Wharton, Stensen) and large vessels and nerves is avoided

–Sufficient drainage is allowed. The incision is performed superficially, at the lowest point of the accumulation, to avoid pain and facilitate evacuation of pus under gravity–The incision is not performed in areas that are noticeable, for esthetic reasons; if possible, it is performed intraorally.

G-Incision and drainage of the abscess should be performed at the appropriate time. This is when the pus has accumulated in the soft tissues and fluctuates during palpation, that is when pressed between the thumb and middle finger, there is a wave-like

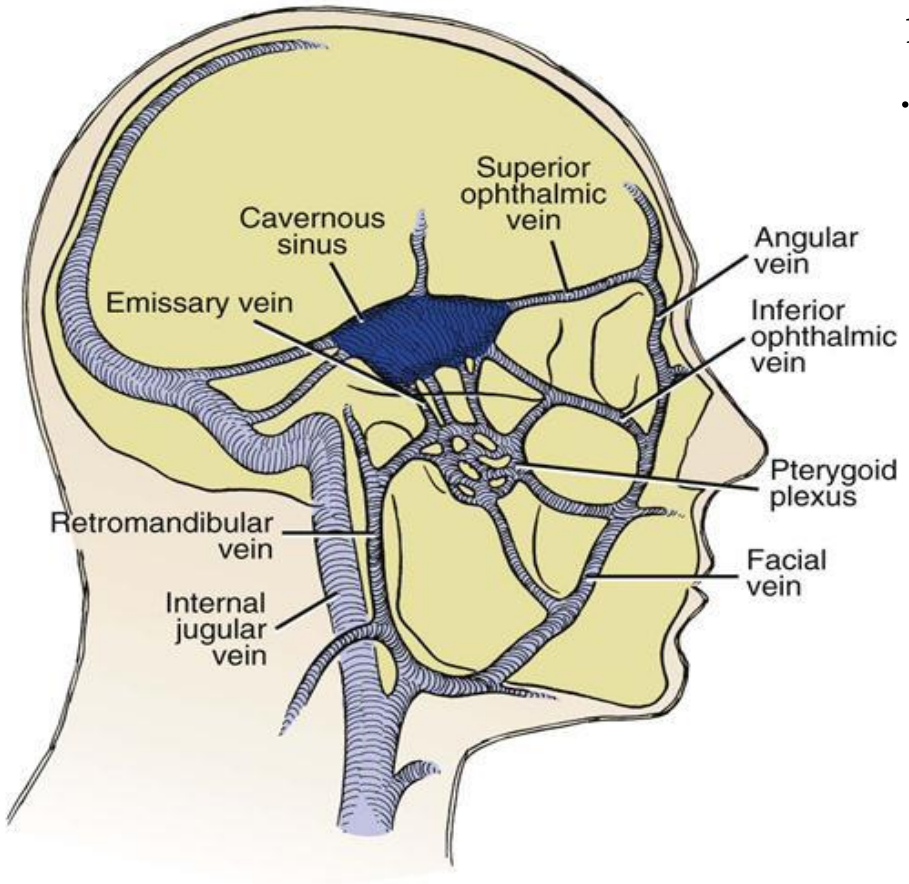


When maxillary odontogenic infections **erode into the infraorbital vein in the infraorbital space** or **the inferior ophthalmic vein via the sinuses**, they can follow the **common ophthalmic vein through the superior orbital fissure** and **extend directly into the cavernous sinus**. This is the anterior route to the cavernous sinus. Intravascular inflammation caused by the invading bacteria stimulates the clotting pathways, resulting in a septic cavernous sinus thrombosis. Cavernous sinus thrombosis is an unusual occurrence that is rarely the result of an infected tooth. Like orbital cellulitis, cavernous sinus thrombosis is a serious, life-threatening infection that requires aggressive medical and surgical care.

Cavernous sinus thrombosis has a high mortality even today. illustrates the rapid extension of a case of orbital

fortunately, the most vulnerable structure in the cavernous sinus, the

.



General Principles in Treatment of Oral and Paraoral Infections

1-Remove the cause.

2-Establish drainage.

3-Institute antibiotic therapy.

4-Supportive care, including proper rest and nutrition.

Goals of management of odontogenic infection:

Airway protection

Surgical drainage#

Medical support of the patient

Identification of etiologic bacteria

Selection of appropriate antibiotic therapy

Principles for choosing appropriate antibiotic

causative organism

sensitivity

specific, narrow-spectrum antibiotic

least toxic antibiotic

drug history(success, allergic and toxic)

Antibiotic Therapy

Removal of the cause, drainage, and supportive care more important than antibiotic therapy.

Infections are cured by the patient's defenses, *not* antibiotics.

Risks of allergy, toxicity, side effects, resistance and superinfection causing serious or potentially fatal consequences must be considered.

Oral infections are typically polymicrobial.

Antibiotic effectiveness dependent upon adequate tissue (not serum) concentration for an appropriate amount of time.

Antibiotics should be prescribed for at least one week – adequate tissue concentration achieved in 24-48 hours, with bacteriocidal activity occurring over the next 3-5 days.

Principles of antibiotic administration

Proper dose ,Proper time interval, Proper route of administration(oral, parenteral), Combination antibiotic therapy

How to judge the pus formation?

Characteristic

Three stages

Inoculation

↓

Cellulitis

↓

Abscess

- Duration--- >5 days
- Palpation---Fluctuant
- Appearance--- Reddened
- Needle aspiration
- B-ultrasound
- CT

Surgical drainage and incision

- How to judge the pus formation?
- Purposes of surgical drainage and incision
- Principles of surgical drainage and incision

Fundamental Principles of Treatment of Infection:

In order to treat an **acute dentoalveolar infection** as well as a **fascial space abscess correctly**, the following are considered **absolutely necessary:**

A-Take a detailed medical history from the patient.

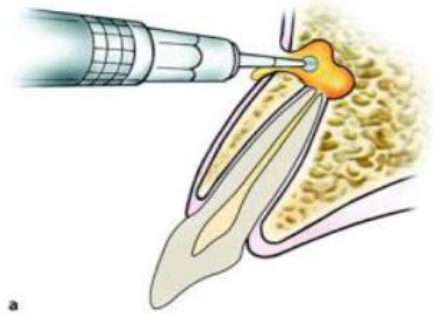
B-Drainage of pus, when its presence in tissues is **established**.

This is achieved

(1) by way of the root canal,
(2) with an intraoral incision,
(3) with an extraoral incision, and
(4) through the alveolus of the extraction. Without evacuation of pus, that is with administration of antibiotics alone, the infection will not resolve.

C-Drilling of the responsible tooth during the **initial phase of inflammation**, to drain exudate through the root canal, together with heat therapy. In this way, spread of inflammation is avoided and the patient is relieved of the pain.

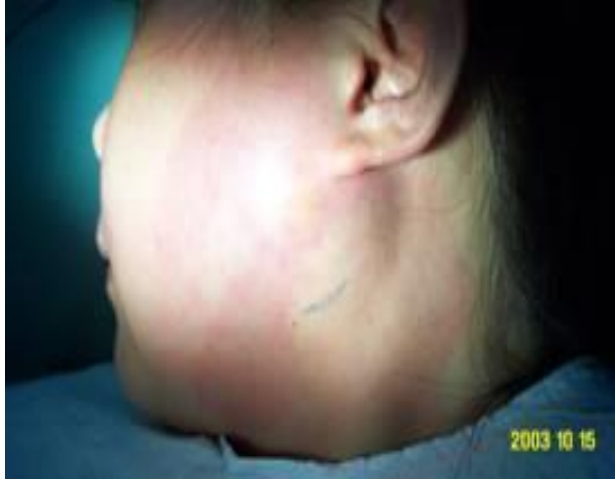
Drainage may also be performed with **trephination of the buccal bone**, when the root canal is inaccessible.

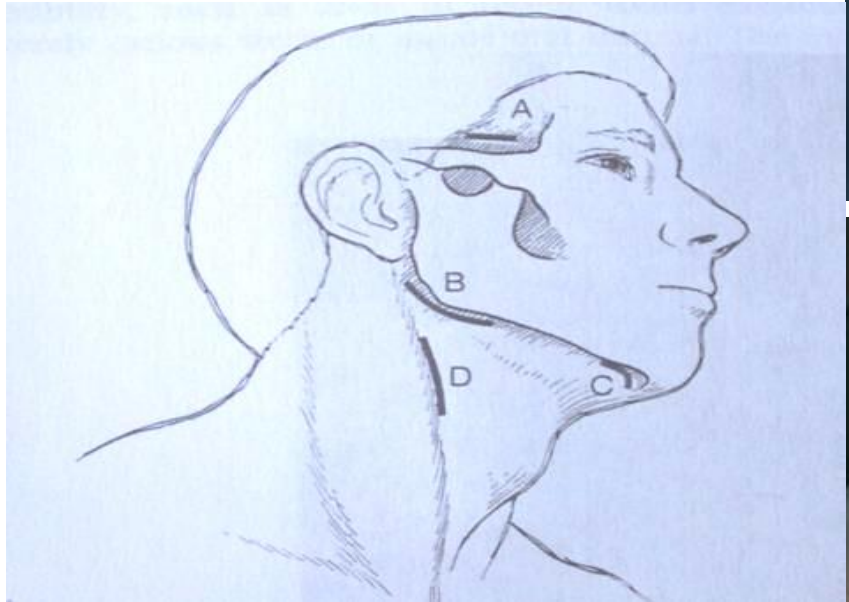


Trephination of buccal bone for drainage of an abscess. **a** Diagrammatic illustration. **b** Clinical photograph

Purposes of surgical drainage & incision

- Rid the body of toxic purulent material
- Decompress the tissues
- Allowing better perfusion of blood containing antibiotics and defensive elements
- Increased oxygenation of the infected area
- Place the incision in an esthetically acceptable
- Place the incision in a dependent position to encourage drainage by gravity
- Dissect bluntly through deeper tissues and explore all portions of the abscess
- Place a drain and stabilize it with sutures





Therapeutic considerations:

Although **surgical drainage of loculated pus** and **dental extraction are the mainstay of therapy**, **antibiotic** treatment is required to **halt local spread of infection and prevent hematogenous dissemination**.

Anti-infective agents are generally indicated if **fever** and **regional lymphadenopathy** are present or **when infection has perforated the bony cortex and spread into surrounding soft tissues**.

Severely immunocompromised patients are particularly at risk for rapidly spreading orofacial infections and bacteremia. Empiric antimicrobial therapy should be initiated promptly in such patients.

The choice of specific antimicrobial regimens for odontogenic orofacial infections is empirical based on anticipated **causative pathogens** and **immune status of the host**.

This is because specimens obtained extraorally to avoid contamination by the oral commensal flora are rarely available.

Odontogenic orofacial space infections are usually polymicrobial involving both strict anaerobes and facultative bacteria within unique ecosystems of the dental plaque and gingival crevice.

The most **prevalent anaerobic bacteria include gram-positive cocci**, such as **Peptostreptococcus spp**., and **gram-negative rods**, such as Bacteroides spp., Fusobacterium spp., Prevotella spp. and Porphyromonas spp. The most prevalent aerobes are facultative gram-positive cocci such as Streptococcus mutans, and viridans streptococci. Facultative gram-negative bacilli and S. aureus (including MRSA) are uncommon in immunocompetent hosts but may be more important in immunocompromised patients

Antibiotic therapy

Penicillin (bacteriocidal) drug of choice for treatment of odontogenic infections (5% incident of allergy).
Clindamycin (batericiodal) 1st line after penicillin; effective against anaerobes; stop taking at first sign of diarrhea.
Cephalosporin (slightly broader spectrum and bacteriocidal); cautious use in penicillin-allergic patients → cross-sensitivity; if history of anaphylaxis to penicillin, do not use.
Erythromycin (bacteriostatic) good 2nd line drug after penicillin; use enteric-coated to reduce GI upset.
Metronidazole (bacteriocidal) excellent against anaerobes only.
Augmentin (amoxicillin + clavulanic acid) kills penicillinase-producing bacteria that interferes with amoxicillin; expensive.

Single or combined therapeutic depending on the severity of infection, normal person or immunocompromised person. ,
Immunocompromised Host may need more stronger antibiotics like :

Cefotaxime 2 g IV q 6h, **OR**
Orceftriaxone 1 g IV q 12h, **OR**
Orcefepime 2 g IV q 12h; **OR**
Ciprofloxacin 400 mg IV q 12h OR
Imipenem 500 mg IV q 6h; OR
Meropenem 1 g IV q 8h

plus

Metronidazole 500 mg IV q 6h;

LOCAL ANAESTHESIA IN OROFACIAL INFECTION

The in efficient so not is anesthesia Local ,Therefore. **pH acidotic** of because pus of presence of effect the augment to needed is analgesic potent a .dissection tissue deep allow to anesthetic local the agonist-muacting short-ultra strong a is **Remifentanil and sedation** and **analgesia for used been has which also has It**.
Anumber of reasons why local anaesthesia may not work as well as it should do.
The reasons are:
1.poor technique
2.anatomical variation
3.local infection (a “hot tooth”), acidic environment of the abcess .
4.hypersensitivity due to fear
5-some forms of Ehlers-Danlos syndrome(**Ehlers–Danlos syndromes** (EDS) are a group of genetic connective-tissue disorders

Sinus formation :

An odontogenic cutaneous sinus tract is a pathologic channel that initiates in the oral cavity and **exits at the cutaneous surface of the face or neck**. It might **resemble** an **ulcer**, **cyst**, **furuncle**, or **retracted, sunken skin.**

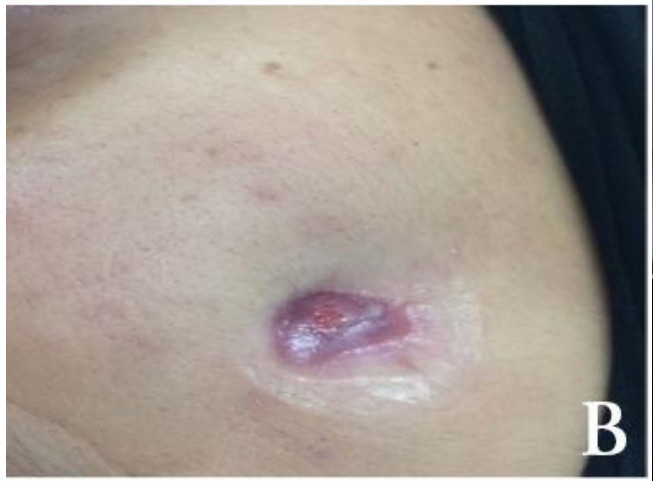
Notably, it is commonly **misdiagnosed**, due to the rarity of its occurrence and the **lack of associated symptoms**.2

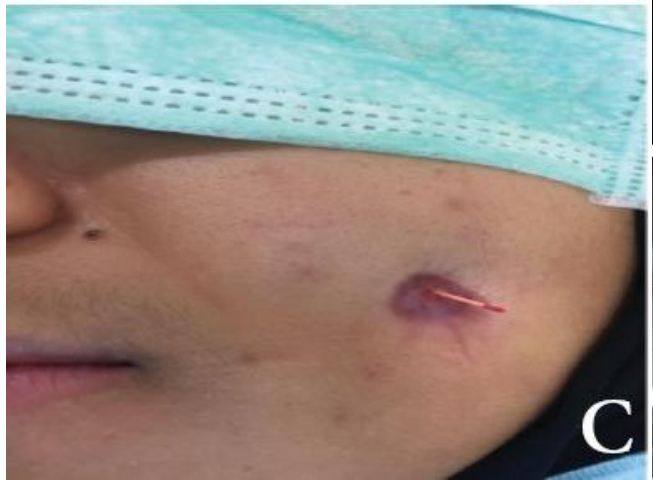
This typically results in unsuitable treatment (namely, surgical excision, **antibiotics**, **biopsy**, or **radiotherapy)** and **subsequent relapse of the cutaneous sinus tract**.**Patients require multiple visits to the physician to receive a proper diagnosis**.

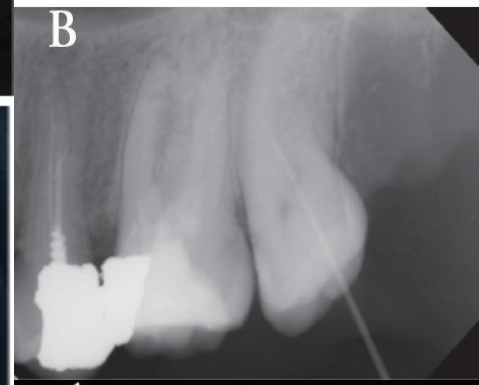
Approximately 50% of affected patients may undergo multiple ineffective attempts at **incision, drainage**, and **long-term use of antibiotics**, **due to improper diagnosis and lack of treatment of the infectious dental etiology**.

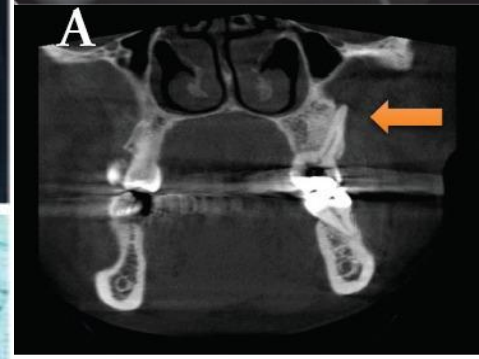
Approximately **80%** of cutaneous dental sinus tracts originate from **mandibular teeth** and nearly 50% of these lesions are associated with anterior mandibular teeth.

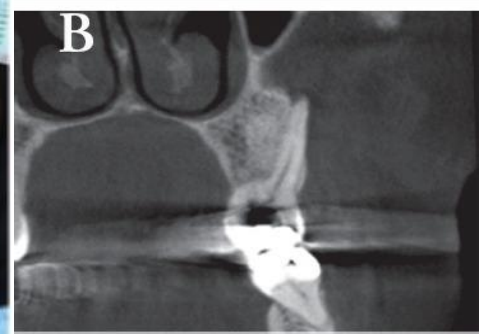
However, **eradication of the cause of the infection**, either through **endodontic treatment (if the tooth can be restored),** or **extraction (if the tooth cannot be restored),**











provides simple and effective resolution of the sinus tract.

Odontogenic cutaneous sinus tracts arise due to **pulp infection**, **root fracture**, **chemical irritation**, chronic apical periodontitis, or **dental trauma**.

Affected teeth become necrotic and **exhibit apical periodontitis due to spread of infection** into the **periradicular area**.


THANK YOU