

Occlusion

It simply means the contact between teeth. More technically, it is the relationship between the maxillary and mandibular teeth when they approach each other, as occurs during chewing or at rest

Malocclusion is the misalignment of teeth and jaws or more simply, a 'bad bite'
- Malocclusion can cause a number of health and dental problems

Static occlusion refers to contact between teeth when the jaw is closed and stationary, while **dynamic occlusion** refers to occlusal contacts made when the jaw is moving. Dynamic occlusion is also termed as articulation

Centric occlusion is the occlusion of opposing teeth when the mandible is in centric relation. Centric occlusion is the first tooth contact and may or may not coincide with **maximum intercuspation**. It is also referred to as a person's habitual bite, bite of convenience, or intercuspation position

Centric relation is a relationship between the maxilla and mandible (not to be confused with centric occlusion)

Assessing the occlusion

Extra-oral assessment

- Checking the **facial asymmetry** and **skeletal discrepancies**
- **Measuring the lower face height**

Loss of teeth and occlusal stops can result in over-closure causing a reduced face height. Over-closure is unlikely for patients with tooth wear due to dento-alveolar compensation. Over-eruption may occur in patients due to dento-alveolar development in absence of tooth wear which may result in increased face height

- **Temporomandibular joints**

The maximum extent that the patient can open is measured between the incisal edges of the upper and lower incisors. Deviation of mandible on opening or closing should be described. Clicking, crepitus and tenderness of the jaw should be noted as well

Intra-oral assessment

- Inter-cuspal position/ centric position
- Retruded contact position/ terminal hinge axis position
- Excursive movements of the mandible which include protrusion and lateral excursion

Occlusal problems

- Malocclusion is the result of, when the body trying to optimize its function in a dysfunctional environment.
- For example the maxilla can be placed too far anteriorly compared to the mandible
- This would be called a class II malocclusion
- On the contrary in case of class III when the mandible is placed too far anteriorly
- Malocclusion can also be associated with a number of problems:
 - 1- Misaligned teeth
 - 2- Periodontal problems
 - 3- The temporomandibular joints (TMJ and jaw muscles)

Trauma from occlusion

Is a term used to describe pathological alterations or adaptive changes which develop in the periodontium as a result of undue force produced by the masticatory muscles.

- Trauma from occlusion is only one of many terms that have been used to describe such alterations in the periodontium
- Other terms often used are : traumatising occlusion, occlusal trauma, traumatogenic occlusion, periodontal traumatism, overload, etc
- In addition to producing damage in the periodontal tissues, excessive occlusal force may also cause injury in, for example the temporomandibular joint, the masticatory muscles causing painful spasm , the pulp tissue or may cause excessive tooth wear

Acute and chronic trauma

Acute trauma: results from an abrupt occlusal impact as biting on hard objects, restoration or prosthetic appliances that interfere with or alter the direction of occlusal forces

- It results in tooth mobility, sensitive to percussion and increased tooth mobility
- If the force is dissipated by a shift in the position of the tooth or by wearing or correction of the restoration, the injury heals and the symptoms subside
- Otherwise, periodontal injury may worsen and develop into necrosis, accompanied by periodontal abscess formation or may persist as a symptom-free, chronic condition
- Acute trauma can also produce cementum tears

Chronic trauma: is more common than acute form and is greater clinical significance

- It most often develops from gradual changes in occlusion produced by tooth wear, drifting, movement and or extrusion of teeth combined with parafunctional habits such as bruxism and clenching rather than as a sequence of acute periodontal trauma

Types of occlusal forces

Physiological normal occlusal forces in chewing and swallowing: small and rarely exceeding 5N (Newton)

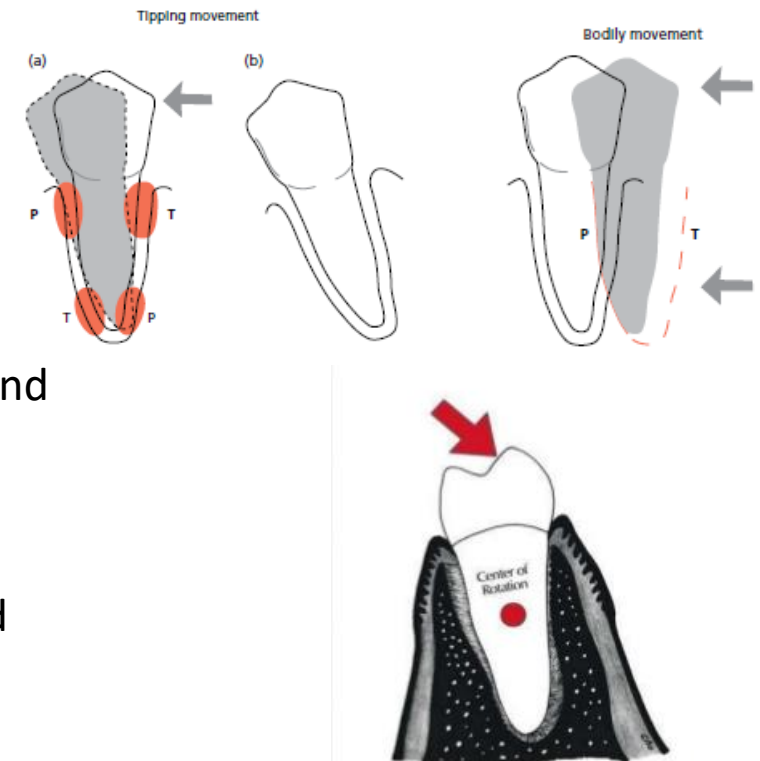
- They provide the positive stimulus to maintaining the periodontium and the alveolar bone in a healthy and functional condition

Impact forces: mainly high but of short duration. The periodontium can sustain high forces during a short period, however, forces exceeding the viscoelastic buffer capacities of the periodontal ligament will result in fracture of tooth and bone

Continuous forces: very low forces (for example, orthodontic forces), but continuously applied in one direction are effective in displacing a tooth by remodeling the alveolus

Jiggling forces: intermittent forces in two different directions (premature contacts on, for example, crowns, fillings) result in widening of the alveolus and in increased mobility

- Under the force of occlusion, a tooth rotates around a fulcrum or axis of rotation, which is in a single rooted teeth in the junction between the middle third and the apical third of the clinical root, this creates areas of pressure and tension on opposite sides of the fulcrum



When jiggling forces, occur which is coming from different and opposite directions, causing more complex histological changes in the ligament

- Theoretically the same events (hyalinisation, resorption) occur, however, they are not clearly separated.
- There are no distinct zones of pressure and tension

Types of trauma from occlusion

The tissue injury associated with trauma from occlusion is often divided into primary and secondary

1- Primary occlusal trauma: the primary form includes a tissue reaction (damage) which is elicited around a tooth with normal height of the periodontium

- Examples include periodontal injury produced around teeth with a previously healthy periodontium as:
- Insertion of high fillings
- Insertion of prosthetic replacement that create excessive force on abutments and antagonistic teeth
- Drifting movement or extrusion of teeth into spaces created by un replaced missing teeth
- Orthodontic movement of teeth into functionally unacceptable position

2- Secondary occlusal trauma: is related to situations in which occlusal forces cause injury in the periodontium of reduced height

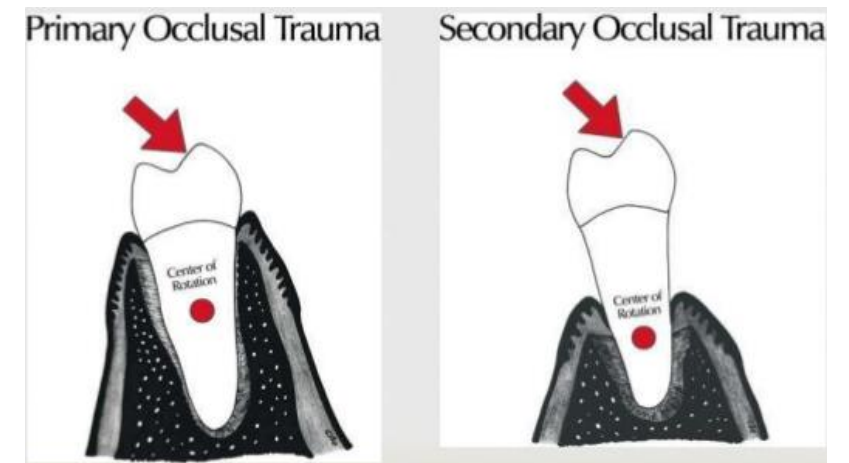
- A third type mentioned in the literature termed and related to secondary trauma from occlusion

Combined occlusal trauma: injury from an excessive occlusal forces on a diseased periodontium in this case, there is a gingival inflammation, some pocket formation and the excessive occlusal forces are generally from parafunctional movements

- This reduces the periodontal attachment areas and alters the leverage on the remaining tissues
- The periodontium become more vulnerable to injury and previously well-tolerated occlusal force become traumatic

The distinction between a primary and secondary form of injury, primary and secondary occlusal trauma-serves no meaningful purpose, since the alterations which occur in the periodontium as a consequence of trauma from occlusion are similar and independent of the height of the target tissue, i.e. the periodontium

- It is however, important to understand that symptoms of trauma from occlusion may develop only in situations when the magnitude of the load elicited by occlusion is so high that the periodontium around the exposed tooth cannot properly withstand and distribute the resulting force with unaltered position and stability of the tooth involved
- This means that in cases of severely reduced height of the periodontium even comparatively small forces may produce traumatic lesions or adaptive changes in the periodontium



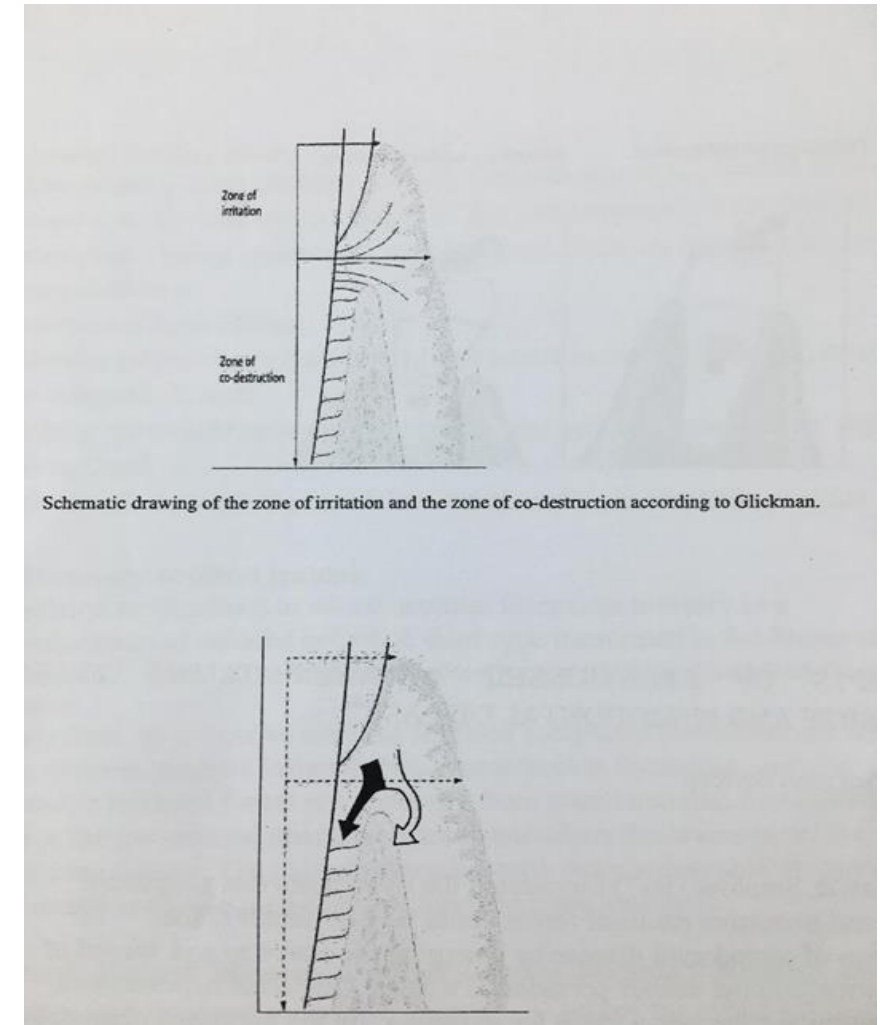
Concepts of relationship between trauma from occlusion and periodontal disease

1- Glickman concept

Glickman and Smulow 1967 formulated a hypothesis that premature contacts and excessive occlusal forces could be a co-factor in the progression of periodontal disease by changing the pathway and spread of inflammation into the deeper periodontal tissues

- Glickman hypothesised that the gingival zone was a **zone for irritation** by the microbial plaque, the supra-crestal fibres were then considered to be a **zone of co-destruction** under the influence of a faulty occlusion

The inflammatory lesion in the zone of irritation can (in teeth not subjected to trauma) propagate into the alveolar bone (open arrow), while in teeth subjected to trauma from occlusion, the inflammatory infiltrate spreads directly into periodontal ligament (filled arrow)



2- Waerhaug's concept

He concluded from his analysis that angular bony defects and infra-bony pockets occur equally often at periodontal sites of teeth which are not affected by trauma from occlusion as in traumatised teeth

- In other words, **he refuted the hypothesis that trauma from occlusion played a role in the spread of a gingival lesion into the zone of co-destruction**
- The loss of connective attachment and resorption of bone around teeth are according to Waerhaug, exclusively the result of inflammatory lesions associated with subgingival plaque
- Waerhaug concluded that angular bony defects and infra-bony pockets occur when the subgingival plaque of one tooth has reached a more apical level than the microbiota on the neighbouring tooth, and when the volume of the alveolar bone surrounding the roots is comparatively large

Periodontal response to trauma from occlusion

Stages of tissue response to increased occlusal forces

Stage I- injury:

Changes in occlusal forces causes injury in this case

- **Repair attempted to restore the periodontium** and this occur if the forces diminished or tooth drifts away from forces
- **Remodeling occurs** if forces are chronic so the periodontium remodelled to cushion its impact. The ligament is widened at the expense of bone, resulting in angular bone defects without periodontal pockets and the tooth become loose

Varying degrees of pressure and tension create varying degrees of changes. The areas of the periodontium most susceptible to injury from excessive occlusal forces are the furcation areas

- Injury to the periodontium produce a temporary depression in mitotic activity and the rate of proliferation and differentiation of fibroblasts, in collagen and in bone formation. These return to normal levels after dissipation of the forces

- **Slight pressure**
 - Resorption of bone
 - Widening periodontal ligament space

- Blood vessels is increased in number and reduced in size

▪ **Slight tension**

- Periodontal ligament fibres thickening
- Apposition of bone
- Blood vessels enlargement

▪ **Greater pressure**

- Compression of fibres which produce areas of hyalinisation
- Injury to fibroblasts, C.T. cells leading to necrosis of areas of ligament
- Vascular changes: within 30 mins, impairment and stasis of blood flow occur; at 2 to 3h, blood vessels appear to be packed with erythrocytes which start to fragment; and between 1 and 7 days, disintegration of blood vessel walls and release of contents into the surrounding tissues occur, in addition to increase of tooth surface resorption
- Bone resorption

▪ **Greater tension**

- Widened periodontal ligament space
- Tearing of ligament and resorption of alveolar bone
- Haemorrhage and thrombosis

Stage II- repair

Repair is constantly occurring in the normal periodontium and trauma from occlusion stimulates increased reparative activity

- **Reparative activity includes formation of:**

- New C.T. cells and fibres, bone and cementum are formed in an attempt to restore the injured periodontium. Forces remain traumatic only as long as the damage produced exceeds the reparative capacity of the tissues

- Thin bone is reinforced with new bone (buttressing bone formation) which is either central buttressing (restores the bony trabeculae) or peripheral buttressing (occurs in the facial and lingual surfaces of the alveolar plate)

Repair occurs as long as reparative capacity exceeds traumatic forces

Stage III- adaptive remodelling

- Forces exceed repair capacity, periodontium is remodeled in an effort to create a structural relationship in which forces may no longer be injurious to the tissues, this results in thickened periodontal ligament, with no pocket formation and angular bone defect

- Following remodeling, stabilization of resorption and formation occurs and return to normal

Reversible traumatic lesions

- **Trauma from occlusion is reversible**
- **Repair or remodeling occurs if:**
 - Teeth can escape from force
 - Periodontium adapts to the force
- **Inflammation inhibits potential for bone regeneration-inflammation must be eliminated**
- **Tooth mobility:**
 - Occurs during injury stage (injured PDL)
 - Also occurs during repair/ remodeling(widened fibres)
 - Tooth mobility greater than normal but not considered pathologic tooth mobility is progressive in nature
- Fremitus (sensitive)
- Pain
- Tooth migration
- Attrition
- Muscle/joint pain
- Fractures, chipping

Radiographic signs of trauma from occlusion

1. Changes in shape of periodontal ligament space, bone loss
2. Thickened lamina dura
 - Lateral aspect of root
 - Apical area
 - Furcation areas
3. Vertical destruction of interdental septum
4. Root resorption, hypercementosis

- These changes do not necessarily indicate destructive changes because they may result from thickening and strengthening of the periodontal ligament and alveolar bone, constituting a favourable response to increased occlusal force

Treatment outcomes

Proposed by American Academy of Periodontology

1. Reduce/ eliminate tooth mobility
2. Eliminate occlusal prematurity's and fremitus
3. Eliminate parafunctional habits
4. Prevent further tooth migration
5. Decrease/stabilise radiographic changes

Therapy

- **Primary occlusal trauma**
 - Selective grinding
 - Habit control
 - Orthodontic movement
 - Inter-occlusal appliance
- **Secondary occlusal trauma**
 - Splinting
 - Selective grinding
 - Orthodontic movement

Unsuccessful therapy

- 1- Increasing tooth mobility
- 2- Progressive tooth migration
- 3- Continued client discomfort
- 4- Premature contacts remain
- 5- No change in radiographs/ worsening
- 6- Parafunctional habits remain
- 7- TMJ problems remain or become worse

Experiments carried out on humans as well as animals, have produced convincing evidence that neither unilateral forces nor jiggling forces, applied on teeth with a healthy periodontium, result in pocket formation or in loss of connective tissue attachment. Trauma from occlusion cannot induce periodontal tissue breakdown

- However, trauma from occlusion results in alveolar bone resorption, leading to increase tooth mobility, in presence of plaque may lead to progressive periodontal tissue loss
- In teeth with progressive plaque-associated periodontal disease, trauma from occlusion may act a co-factor in the destructive process
- **From clinical point of view**, this knowledge strengthens the demand for proper treatment of plaque associated periodontal disease
- This treatment will arrest the periodontal tissue destruction even if the occlusal trauma persists
- The treatment directed to trauma alone, however, i.e. occlusal adjustment or splinting, may reduce the mobility of the traumatised teeth and result in some bone regrowth
- But it will not arrest the rate of further breakdown of the supporting apparatus caused by plaque