Advances in periodontal management

Periodontitis is a dynamic disease process characterised by periods of disease progression, remission and exacerbation

Diagnosis of periodontal disease includes different levels

1- Diagnosis of periodontal health versus disease
2- Classify the different types and severity of gingivitis and periodontitis
3- Decide whether the patient periodontitis is **active** or **arrested** or **in remission**

In conventional diagnosis and classification of periodontal disease, it depends on clinical assessment with many factors as:

1- presence or absence of clinically detectable inflammation
2- Extent and pattern of clinical attachment loss
3- Rate of progression
4- Patient age and onset
5- Presence or absence of miscellaneous signs and symptoms including pain, ulceration and amount of observable plaque and calculus

In most cases, the conventional diagnostic procedures are sufficient to design an effective treatment plan
- However, these methods have poor sensitivity in diagnosis patients with active sites of disease progression

Therefore, currently the scientists introduce other factors in the progress of diagnosis as risk factors which may predispose individuals to disease initiation and progression

The hope is to find a better way in diagnosis of periodontal disease through
- Differentiation between periodontal disease
- Identifying people and teeth that are susceptible to disease initiation and progression
- Monitor the response to treatment

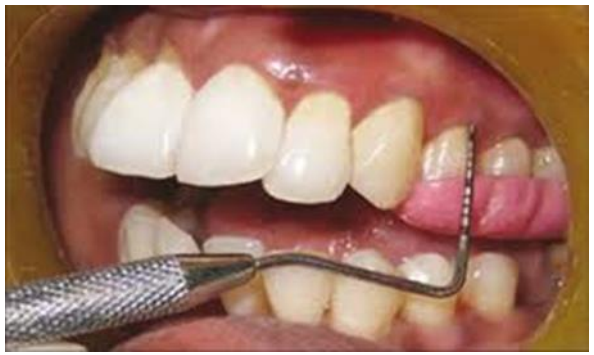
Advances in clinical diagnostic methods

1- Gingival bleeding is an indicator of inflammatory lesion but its relation to disease activity is not clear yet
- The normal force applied on probing is 0.25 N
- The presence of positive bleeding on probing is not an indicator, however; negative or absence of bleeding indicate health condition

2- Probing technique, controlled force, standardized probes

The periodontal probe is the most widely used diagnostic tool for clinically assessing connective tissue destruction as consequences to periodontitis

Problems associated with conventional probe are:



1- Probing technique
2-Force
3-Probe diameter and angulations
4-Presence of inflammation

Several automated probes have been recently developed to overcome some of error source

1- Automated Florida disc periodontal probe gives a certainty of 99% detection of the less than 1mm loss of attachment level

- It utilises a reproducible occlusal landmark or a customised stent margin as a reference land mark
- The probe hand piece connected to a monitor for digital read out and foot switch all to computer
- -It applied a constant force through a coil spring inside the probe
- **Advantage:** applied a constant force and no need for assistance
- **Disadvantage:** lack of tactile sensation, under estimation of deep probing points and fixed probing force

2- Automated Foster-Miller probe: it registers the CEJ as its attachment level landmark

- Some investigations reveal that this probe detect up to 0.2mm loss in attachment
- The disadvantage of such probe is time consuming

3- Pressure sensitive probe: it has a standardised, controlled insertion pressure

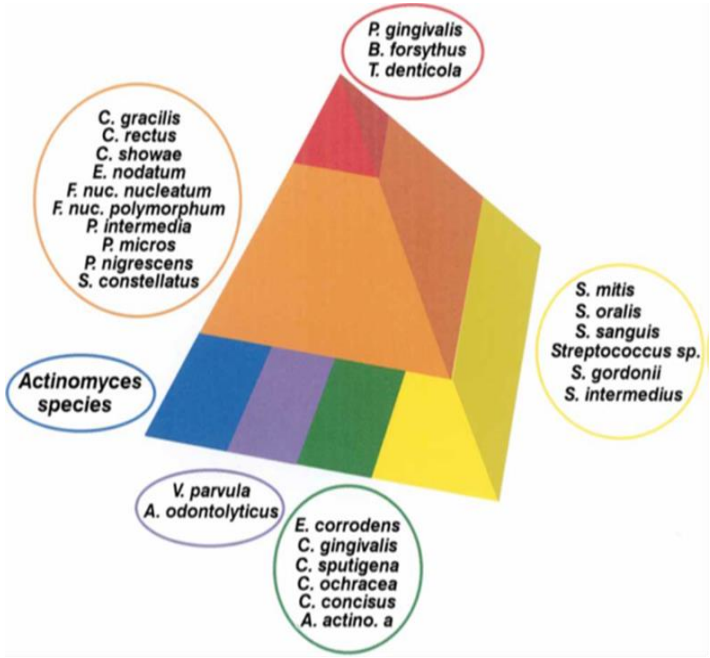
- 30 gm ⟶ tip with the junctional epithelium

- 50 gm ⟶ periodontal osseous defect

It uses a fabricated stent for reproducibility

Advances in microbiologic analysis

- Although more than 300 bacterial species make up the oral flora, it is currently thought that only a few either alone or in combination initiate the progression of periodontitis
- Evidence related to Actinomyces, *actinomycetemcomitans* (AA), *porphyromonas gingivalis (Pg), Bateriodes forsythus (Bf)*
- In addition, there is other microorganisms which are thought to have etiologic role such as: Comphylobactor rectus, Euobacterium nodatum, Fusobacterium nucleatum and Prevotella intermedia



Uses of Microbiologic analysis

1- Support the diagnosis
2- Aid in treatment planning
3- Good indicator of disease activity

Culture techniques have been the primary method of identifying putative pathogens, It allows:

- Characterising subgingival flora in terms of count , motility and morphology
- For specification and antibiotic susceptibility testing

In case of plaque; it can be done under anaerobic condition using selective and non selective media

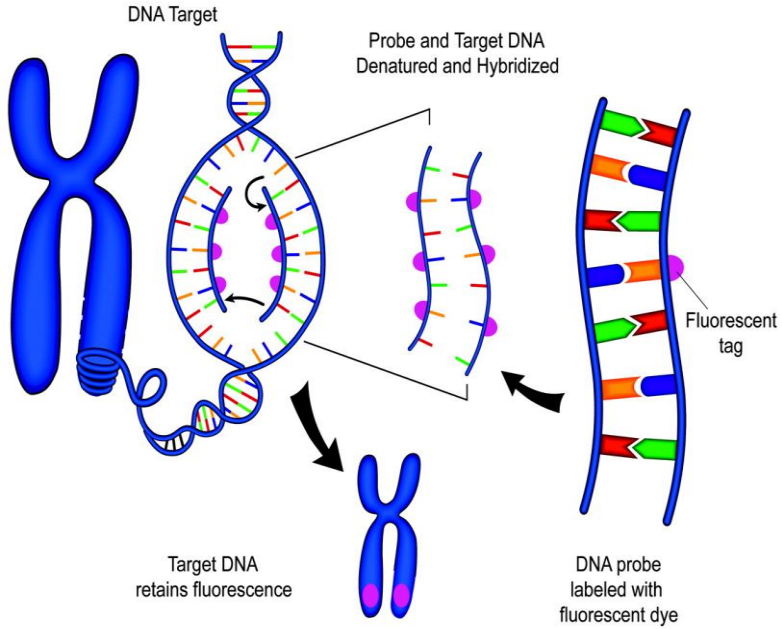
Limitation of cultures:

1- Technical problems
2- Cultivating micro-organisms can be both time consuming and costy
3- Low sensitivity, organisms lesser than 10^3 is difficult to be detected

Molecular biology techniques

The principal base is to analyse DNA and RNA and protein structure. This relies on species specific genomic for microbial identification

1- DNA- analysis method: includes DNA probe and oligonucleotide probe



Analysis steps:
First: a labelled DNA (probe)s are constructed with a radioactive or enzyme detection system

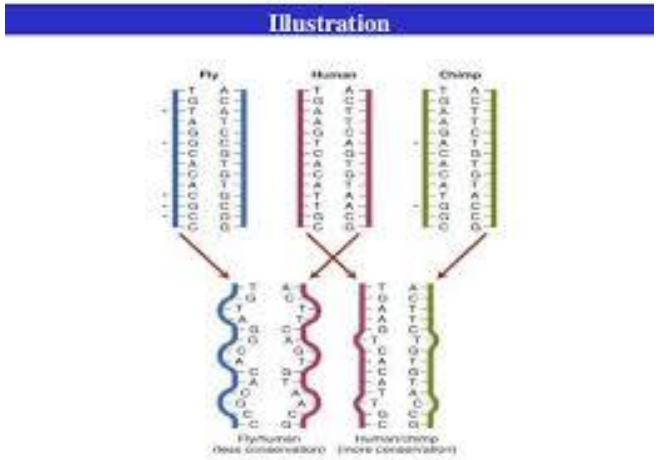
Second subgingival plaque are collected on a sterile paper points or dental curettes and enzymatic ally single, stranded, denaturized DNA fragments

Third the unknown fragments are then exposed to complementary labelled probe and allow to hybridization

Test response reflects both the presence and approximate number of tented pathogen up to 103
- Most often the DNA probe can test *p. gingivalis, prevottella intermedia, A.A. ,Eikenella corrodens*, etc.

2- Checkerboard DNA-DNA hybridisation technology is recently established technique that gives a simultaneous and quantitative analysis of up to 28 plaque samples against 40 microbial species (Socransky 1994)

- DNA checkerboard method offers the ability to include more potential periodontal pathogens in large scale studies with a single analysis than in usually practicable with cultural analysis
- By this method the associated pathogens related to periodontitis are set in clusters known as plaque complex each colour represents a cluster of associated periodontal pathogens



3- Polymerase chain reaction (PCR) this reaction is an in-vitro enzymatic reaction that involves the application of specific DNA sequences

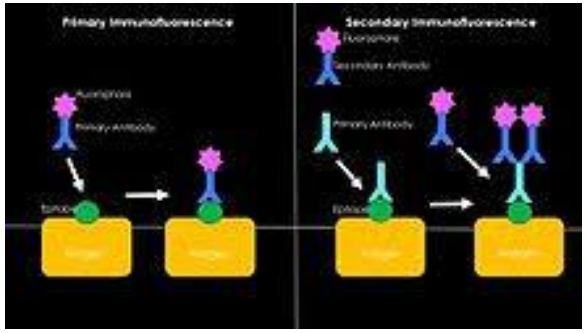
- The bases of PCR is the use DNA polymerase which is an enzyme that catalyses the formation and repair of DNA and can make a copy of the entire DNA in each chromosome

Immunologic-based tests for putative pathogens

Detecting subgingival pathogens using monoclonal antibodies specific antigens

- One technique for this immunofluorescent microscope
- The immunofluorescent assay can be done in two ways: direct and indirect

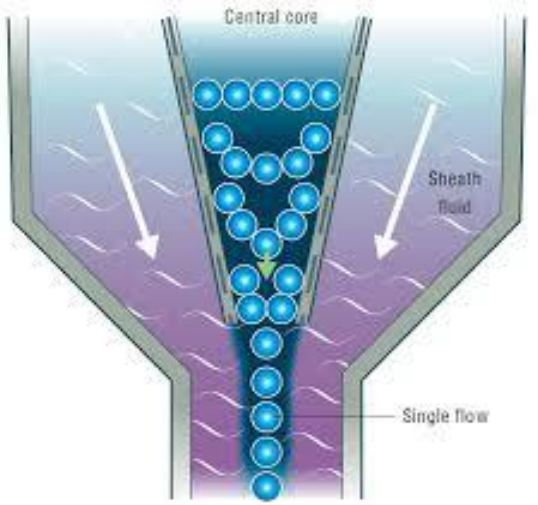
-**Direct method** include the interaction between antibody that conjugated with fluorescent marker of bacterial cells to make immune complex
- **Indirect method** include the interaction between immune complex (primary antibody + bacterial cells) with secondary fluorescent conjugated antibody



Enzyme linked immunofluorescent assay (ELISA) an enzymatic ally derived colour reaction, which can detect serum periodontal pathogens

Flow cytometry

A technique for identifying and sorting cells and their components as DNA by staining with fluorescent dye and detecting the fluorescence usually by laser beam illumination



Advances in characterising host response

Assessment of host response by studying mediators as a response to bacteria or local release of inflammatory mediators or enzymes as in response to infection
- The samples come from saliva, serum and gingival crevicular fluid (GCF)

Identification of host constituent in GCF

GCF is a serum like exudates which baths the gingival sulcus or periodontal pocket and follows an osmotic gradient with local tissue

- As this fluid traverse from the host microcirculation, through inflamed tissue and periodontal pocket, it captures mediators involved in the destructive host response and by products of local tissue metabolism

GCF can be collected by:

- Filter paper or strips
- Capillary tube include micropapillary tube, micropipette and microsyringe
- Intrasulcus washing

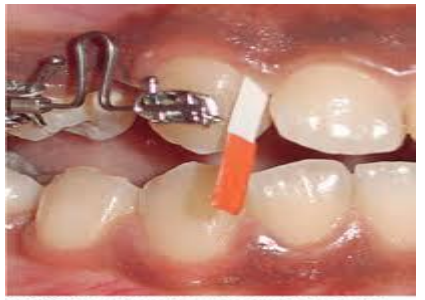


FIGURE 3 - Absorbent paper strip used for collection of gingival fluid.

The constituents of GCF can be quantified or qualified with a specific assay such as ELISA or periotron

Some of diagnostic markers in GCF are

- Arachidonic acid metabolites
- Cytokines such as interleukins (IL-1B, IL-8)
- Cathepsin like activities or mediators
- Proteases and collagenase and alkaline phosphatase enzymes

Saliva markers

Saliva is a transudation from serum, secreted from oral salivary glands

- It provides an easy method for collection which is either stimulated or unstimulated method

Saliva may contain locally and systemically derived markers of periodontal disease such as:

- Proteins and enzymes
- Hormones
- Bacteria and their products
- Ions
- Micro and macro elements
- Host cells

Advances in radiographic assessment

Conventional radiograph is a traditional method to assess the alveolar bone destruction. It is very specific but lacks sensitivity

Shortcomings associated with conventional radiograph

- Variations in the projection geometry
- Variations in contrast and density due to differences in film processing, voltage and exposure time
- Masking of osseous changes by other anatomic structures

Digital radiograph (DR) it enables the use of computerised image which can be stored and manipulated

Advantages: digital storage, image enhancement and radiation dose reduction

Two D.R. systems

Direct method: used charged coupled device, sensor linked with fiber optic to computer system

- It provides 1/3 – 1/2 reduction dose

Indirect method: used phosphor luminescence plate which is flexible, film like radiation energy sensor placed intraorally and exposed to conventional X-ray tube, a laser scanner read the exposed plate and produce digital image

Subtraction radiography

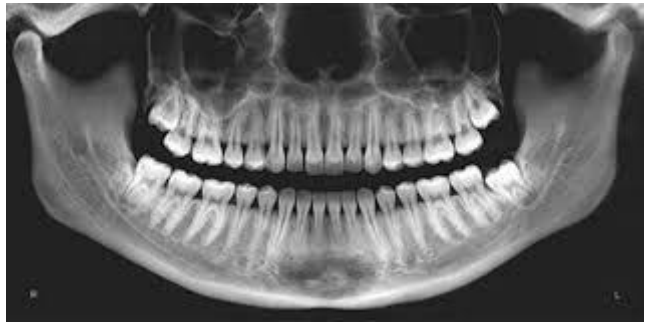
Conversion of serial radiographs into digital images. The image then superimposed and the resultant composite viewed on a video screen

Bone gain ⟶ lighter area

Bone loss ⟶ darker area

Limitation of this technique is the need to paralleling technique and accurate superimposition

Advantages



- Correlation between change in alveolar bone shown in subtraction radiograph and CAL change, post therapy
- Increased detect ability of small osseous lesions
- Both quantitative and qualitative visualization
- More sensitive

Disadvantages

Identical projection alignment during sequential radiographs

Computer-assisted densitometric-image analysis (CADIA)

3D quantification of bone volume change. The device includes camera, image processor and computer
- A video camera measures the light transmitted through a radiograph and the signals from camera are converted into gray-scale image

Advantages

- This method increases accuracy reproducibility and sensitivity
- Measure quantitative change in bone density overtime

Cone beam computed tomography (CBCT)

Utilised a cone shaped source of radiation and an area detector and that acquires a full volume of images in a single rotation with no need for patient movement

- CBCT system accompanying software any number of diagnostic images can be generated