**Advances in periodontal diagnosis**

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**Periodontitis:** is a dynamic disease process characterized by periods of disease progression, remission and exacerbation.

In **conventional diagnosis** and classification of periodontal disease for a given patient primarily we depend on clinical assessment with many factors as

1. Presence or absence of clinically detectable inflammation. (gingivitis)

2. Extent and pattern of clinical attachment loss. (periodontitis)

3. Patient age at onset.

4. Rate of progression.

5. Presence or absence of miscellaneous signs and symptoms including pain, ulceration and amount of observable plaque and calculus.

**To reach a good diagnosis we examine:**

1. Gingival tissue in health and compare with signs of inflammation. (gingival index, bleeding on probing…..etc)

2. Loss of attachment assessed by probing pocket depth with calibrated instrument. (Periodontal probes)

3. Radiographic evidence of alveolar bone loss.

4. Demographic data as: age, gender, etc…

5. Medical history and history of previous and current periodontal problem and miscellaneous clinical features or observation.

For most cases, the conventional diagnostic procedures are sufficient to design an effective treatment plan. But these methods have poor sensitivity in diagnosis sites or patients with active disease progression.

**It is hoped that improved diagnosis of periodontal disease will better:**

• Differentiate between periodontal diseases.

• Identify persons and teeth that are susceptible to disease initiation and progression.

• Monitor the response to treatment.

• Identify disease initiation and progression.

In medical diagnosis, **test sensitivity** is the ability of a test to correctly identify those with the disease (true positive rate), whereas test specificity is the ability of the test to correctly identify those without the disease (true negative rate).

The sensitivity of a test (also called the true positive rate) is defined as the proportion of people with the disease who will have a positive result. In other words, a highly sensitive test is one that correctly identifies patients with a disease. A test that is 100% sensitive will identify all patients who have the disease. It’s extremely rare that any clinical test is 100% sensitive. A test with 90% sensitivity will identify 90% of patients who have the disease, but will miss 10% of patients who have the disease.

**The specificity of a test** (also called the True Negative Rate) is the proportion of people without the disease who will have a negative result. In other words, the specificity of a test refers to how well a test identifies patients who do not have a disease. A test that has 100% specificity will identify 100% of patients who do not have the disease. A test that is 90% specific will identify 90% of patients who do not have the disease and will miss 10% of patients who do not have the disease.

**Clinical Diagnostic Methods**

**1-Gingival bleeding:** It's 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.

Presence of positive bleeding on probing is not an indicator but negative bleeding or absence of bleeding indicates health. (This is in non-smoker patients)

**2-Probing technique**

Controlled – force, standardized probes, the periodontal probe is the most widely used periodontal diagnostic tool for clinically assessing connective tissue destruction secondary to periodontitis.

**Problems associated with conventional probe are:**

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

**Advances in Clinical Diagnosis**

**1-Indicators of local physical metabolic changes (gingival temperature)**

Subgingival temperature: Like other signs of inflammation has good specificity but poor sensitivity when considered alone as a marker for progressive periodontitis.

It appears to be an anatomic temperature gradient in the oral cavity where mandibular periodontal sites are hotter than maxillary sites, posterior wormer than anterior site. Also, it appears that there is positive correlation between elevated subgingival temperature and:

•Severity of disease.(amount of attachment loss)

•Degree of subgingival inflammation.it increased at the diseased site due to increase in cellular and molecular activity

•Presence of putative pathogens.

•Smoking state. smokers have differences in sub gingival temperature and sub lingual temperature.

Sub gingival probe is the tool used for measuring subgingival temperature. It is also called the perioTemp. probe (Abiodent) which detect the difference in the temperature of 0.1c. The warm area signaled with red emitted diode.

**2-Periodontal Probes**

**A-Pressure sensitive probe (Constant Force Probe):** it has a standardized, controlled insertion pressure. It uses a fabricated stent for reproducibility.

-30 gm 🡪 tip with the junctional epithelium.

-50 gm 🡪 periodontal osseous defect.

**B- Automated Florida disc periodontal probe**: which give a certainty of 99% detect of loss of attachment level of less than 1mm. It utilizes a reproducible Occlusal landmark or a customized stent margin as a reference land mark. Its 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:** it applied constant force and no need for assistant.

**-Disadvantages:** lack of tactile sensitivity, under estimation of deep probing points and fixed probing force.

**C-Automated Foster-Miller probe:** it registers the C.E.J as its attachment level landmark. Some investigations reveal that this probe detect up to 0.2mm loss in attachment. It capable of coupling pocket depth with detection of C.E.J.

-The disadvantage of such probe is time consuming.

 N.B: Other electronic probes/inter probe, peri probe , Toronto Automatic

**Advances in radiographic assessment**

**Conventional radiograph:** it is a traditional method used to assess the destruction of alveolar bone. It is very specific but lacks sensitivity.

Problems 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.

For standardization and reproducibility:

• Use film holder

• Use template with impression material.

• Extension arm to both film holder and X-ray.

**Digital radiograph (D.R.):**

 It enables the use of computerized image which can be stored and manipulated.

Advantages: digital storage, image enhancement, and radiation dose reduction

Two D.R. systems: -Direct method -Indirect method

**Direct method:** used charged coupled device, sensor linked with fiber optic to computer system. It provides 1/3 -1/2 reduction in radiation 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.

Limitations for 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

**Cone Beam Computed Tomography (CBCT):**

Utilizes a cone shaped source of radiation and an area detector and that it 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.

**Advances in Microbiologic Analysis**

Although over 300 bacterial species make up the oral flora. It is currently thought that only a few either alone or in combination initiate periodontitis progression. Strong evidence related to Aa, Pg,and Tf .Other m.o are thought to have etiologic role are; comphylobactor rectus, Euobacterium nodatum, Fusobacterium nucleatum and Prevotella intermedia and nigrescens

Uses of microbiologic analysis;

* Support diagnosis
* Aid in treatment planning
* Good indicator of disease activity

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

* Characterizing subgingival flora [count (relative and absolute), and morphology].
* For speciation and antibiotic susceptibility testing.

Cultivation for plaque done under anaerobic condition using selective and non selective media together with several biochemical and physical tests, the different putative pathogens can be identified.

**•Limitation of cultures:**

1-Technical problems, Culture methods can only grow live bacteria; therefore, strict sampling and transport conditions are essential.

2-Cultivating micro-organisms can be both time consuming and costs.

3-Low sensitivity.

**Advances in characterizing host response**

Asses host response by studying mediators as a response to specific bacteria or local release of inflammatory mediators or enzymes as in response to infection. Source of the sample include blood serum, saliva and GCF (gingival crevicular fluid), gingival crevicular cells, blood cells and urine.

**Identification of host constituent in crevicular fluid**

These constituent in GCF may be harvested through:

• Filter paper or strips

• Capillary tube includes micropapillary tube, micropipettes, microsyringes

• Intrasulcus washing

The most widely method used for collection of GCF is paper strips. These strips are placed in the gingival sulcus for a standard period of time until the filter paper is saturated, the fluid volume collected on the strips can be then quantified in a number of ways. At present the most popular way with specific assay is using the Periotron® device.

The Periotron® measure the capacitance across the wet paper strip, which convert to digital reading. Periotron® readings have high correlation with clinical gingival indices and its quickest and easiest way to measure GCF.

The diagnostic markers in GCF are: three main groups: **host-derived enzymes, tissue breakdown products, and inflammatory mediators**. Concentration of these mediators in GCF from a disease sites may be higher than from a healthy sites.

**- Inflammatory Mediators and Products**

Cytokines are potent local mediators of inflammation that are produced by a variety of cells. Cytokines that are present in GCF and have been investigated as potential diagnostic markers include tumor necrosis factor alpha (TNF- a), interleukin-1 alpha (IL-la), interleukin-1 beta (IL-1ß), interleukin-6 (IL-6), and interleukin 8 (IL-8).

IL-1, IL-6, and TNF-a are cytokines produced by a variety of cells at inflamed sites. They are potent immunoregulatory molecules with a variety of biologic effects, including metalloproteinase stimulation and bone resorption; therefore, they seem good candidates for markers of disease progression. Prostaglandin E2 is a product of the cyclooxygenase pathway of the metabolism of arachidonic acid. It is a potent mediator of inflammation and induces bone resorption. In cases of untreated periodontitis, the concentration of prostaglandin E2 found in GCF increased during active phases of periodontal destruction.

-**Host-Derived Enzymes**

 Various enzymes are released from host cells during the initiation and progression of periodontal disease. The enzymes that have received the most attention as possible markers of active periodontal destruction are aspartate aminotransferase (AST), akaline phosphatase, ß-glucuronidase, elastase, cathepsins and matrix metalloproteinases. Some of these enzymes are released from dead and dying cells of the periodontium; some come from polymorphonuclear neutrophils; and others are produced by inflammatory, epithelial, and connective tissue cells at affected sites.

**-Tissue Breakdown Products**

 One of the major features of periodontitis is the destruction of collagen and extracellular matrices. Analysis of GCF obtained from sites with periodontitis clearly shows elevated levels of hydroxyproline from collagen breakdown and glycosaminoglycans from matrix degradation. Other bone and connective tissue proteins, including osteocalcin and type 1 collagen peptides, have been correlated with the progression of alveolar bone loss induced in beagle dogs. Both markers gave high positive predictive values and now need to be extended to longitudinal studies in humans.

**Don't judge each day by the harvest you reap but by the seeds that you plant."**

**-Robert Louis Stevenson**