Gingival and periodontal pocket

Tooth gingival interface

The interface between a tooth and the surrounding gingival tissue is a dynamic structure. The gingival tissue forms a crevice surrounding the tooth, resembling a fluid-filled moat, wherein food debris, endogenous and exogenous cells, and chemicals float. The depth of this crevice, known as a sulcus, is in a constant state of flux due to microbial invasion and subsequent immune response. Located at the depth of the sulcus is the epithelial attachment, consisting of approximately 1 mm of junctional epithelium and another 1 mm of gingival fiber attachment, comprising the 2 mm of biologic width naturally found in the oral cavity. The sulcus is literally the area of separation between the surrounding epithelium and the surface of the encompassed tooth.

Gingival sulcus

A healthy sulcular depth is 3 millimeters or less. Through much investigation and research, it has been determined that sulcular depths of 3 millimeters or less are readily self-cleansable with a properly used toothbrush or the supplemental use of other oral hygiene aids. When the sulcular depth is chronically in excess of three millimeters, regular home care may be insufficient to properly cleanse the full depth of the sulcus, allowing food debris and microbes to accumulate, forming dental biofilm. This poses a danger to the periodontal ligament (PDL) fibers that attach the gingiva to the tooth. If accumulated microbes remain undisturbed in a sulcus for an extended period of time, they will penetrate and ultimately destroy the delicate soft tissue and periodontal attachment fibers. If left untreated, this process may lead to a deepening of the sulcus, recession, destruction of the periodontium, including the bony tooth socket, tooth mobility, and tooth loss.
Both the gingival and periodontal pocket are extensions of the gingival sulcus, which exists in health. Gingival and periodontal pockets are dental terms indicating the presence of an abnormal depth of the gingival sulcus near the point at which the gingival tissue contacts the tooth.

**Periodontal pocket**

- It’s an inflammatory changes and apical migration of junctional epithelium; it is also defined as a pathological deepening of gingival sulcus, which occurs by coronal movement of gingival margin, apical displacement of gingival attachment, or both.

**Classification:**

1. **According to the involved tooth surface:**
   a) Simple pocket: involve one surface  
   b) Compound pocket: involve more than one surface  
   c) Complex or spiral pocket: originating on one surface and twisting around the tooth to involve one or more additional surface (but it opens into the oral cavity on the surface of its origin).

2. **According to its location:**
   a) Gingival pocket: which is formed by gingival enlargement without destruction of underlying periodontal tissue. The sulcus is deepened because of increased bulk of the gingiva  
   b) Periodontal pocket: associated with destruction of underlying supportive tissues.

**Gingival pocket**

A gingival pocket presents when the marginal gingiva experiences an edematous reaction, whether due to localized irritation and subsequent inflammation, systemic issues, or drug induced gingival hyperplasia. Regardless of the etiology, when gingival hyperplasia occurs, greater than normal (the measurement in a pre-pathological state) periodontal probing measurements can be read, creating the illusion that periodontal pockets have developed. This phenomenon is also referred to as a false pocket or pseudopocket. The epithelial attachment does not migrate, it simply remains at the same attachment level found in pre-pathological health. The only anatomical landmark experiencing migration is the gingival margin in a coronal direction.

In a gingival pocket, no destruction of the connective tissue fibers (gingival fibers) or alveolar bone occurs. This early sign of disease in the mouth is completely reversible when the etiology of the edematous reaction is eliminated and frequently occurs without dental surgical therapy. However, in
certain situations, a **gingivectomy** is necessary to reduce the gingival pocket depths to a healthy 1–3 mm.

3. **According to its relation to alveolar crest:**

   a) Suprabony pocket: also called supra crestal or supra alveolar. The base of the pocket is coronal to the level of underlying bone. The bone loss is horizontal
   
   b) Infrabony pocket: also known as sub crestal or intra alveolar pocket. The base of the pocket is apical to the level of adjacent bone. The bone loss is vertical.

**Diagnosis/ detection of pockets**

1. Careful exploration with periodontal probe. (this method is accurate).
2. Radiographic: pockets are not detected by the radiographic examination because pockets are soft tissue changes.

   A calibrated silver points or gutta percha points can be used with radiographic to assist in determining the level of attachment of periodontal pocket.

**Probing techniques**

i. Occlusal view: six surfaces measured in periodontal probing

ii. In multirooted teeth, the possibility of furcation involvement should be carefully explored with specially designed probe (eg. Nabers probe).

   The probe should be inserted parallel to the vertical axis of the tooth and walked circumferentially around each tooth to detect the area of deepest penetration.
To detect internal crater: the probe should be placed obliquely from both facial and lingual surfaces, so as to explore the deepest point of the pocket located beneath the contact point.

**Pathogenesis**

- Accumulation of microorganisms on the supragingival tooth surface and its extension into gingival sulcus.
- Inflammatory changes in the connective tissue wall of the gingival sulcus.
- Cellular and fluid inflammatory exudate causes degeneration of the connective tissue including the gingival fibers.
- Collagen fibers gets destroyed apical to the junctional epithelium and the area becomes occupied by the inflammatory cells and edema.
- The coronal portion of the junctional epithelium detaches from the root as the apical portion migrates.
- Polymorphonuclear neutrophils invade the coronal end of the junctional epithelium in increasing number.
- With continued inflammation the gingiva increase in bulk and the crest of the gingival margin extends coronally.
- The junctional epithelium continues to migrate along the root and separate from the root.

**Mechanisms of collagen loss:**

Two mechanisms involved:

- **First mechanism:**
  
  Collagenases and other enzymes secreted by fibroblast, PMNs and macrophages. These enzymes degrade the collagen and other matrix macromolecules into small peptides which are called as matrix metalloproteinase.

- **Second mechanism**
  
  Fibroblast phagocytize collagen fibers by extending cytoplasmic processes to the ligament-cementum interface and degrade the inserted collagen fibrils and the fibrils of cementum matrix.

**Histopathology:**

**A. Epithelial changes**

- Epithelium becomes degenerated and atrophied
- Inner aspect of the pocket walls becomes ulcerated.
- Pus occurs in the pocket with suppurative inflammation of the inner wall.

**B. Connective tissue changes**
The connective tissue is edematous and densely infiltrated with plasma cells, lymphocytes and PMNs.

Blood vessels are increased in number, dilated and engorged in sub epithelial connective tissue layer.

Single or multiple necrotic foci are present in the connective tissue.

Proliferation of endothelial cells with newly formed capillaries, fibroblasts, and collagen fibers.

**C- Root surface wall of the pocket**

Root surface forms the medial wall of the pocket. The root surface that get expose to the oral environment as a result of periodontal attachment loss, undergoes following changes (structural, chemical, cytological).

- **Structural changes:**
  Exposure of cementum to the oral environment minerals present in saliva tend to get deposited on cementum surface (Ca, F,...) area of hypermineralization root surface is exposed to oral fluids and bacterial plaque proteolysis of embedded remnants of Sharpey’s fibers Area of demineralization root caries (yellowish or brown patch) soft and lethargy on probing patient feels hypersensitivity to the thermal changes and sweets pulp exposure may occur in sever forms.

- **Chemical changes**
  Cementum exposed to saliva may absorb calcium, phosphorus, magnesium and fluoride. This increase in mineral content of the root surface alters the chemical composition of the cementum, making it resistant to dental caries.

- **Cytotoxic changes:**
  Histologic studies of periodontally involved cementum have shown the presence of bacteria in the cementum or endotoxins in the cementum.

**Content of the pocket:**

1) Microorganisms
2) Bacterial products (enzymes and endotoxins).
3) GCF.
4) Remnants of food
5) Salivary mucin.
6) Desquamated epithelial cells.
7) Leukocytes
8) Purulent exudates may be present and this is a secondary feature because deep pocket may have little or no pus and shallow pocket may have extensive pus formation so pus is not an indicator of the depth of pocket.
Pocket probing:

We have two different pocket depths:

1) **Biologic or histologic depth**: distance between gingival margin and base of the pocket, measured histologically (accurate measurement but not used routinely)
2) **Clinical or probing depth**: distance to which a probe penetrates into the pocket.

   The standardized force used for penetration of probe is 25 pounds or 23 grams (0.75 N).

   - **Pocket depth PPD**: Distance between base of pocket and gingival margin.
   - **Level of attachment loss CAL**: Distance between base of pocket and a fixed point on the tooth such as CEJ.

Periodontal pocket as healing lesions:

Periodontal pockets are inflammatory lesions and constantly undergoing repair. Complete healing does not occur because of persistence of bacterial attack which continues to stimulate an inflammatory response causing degeneration of new tissues.

- **Edematous pocket walls**: when the inflammatory component predominates, the lateral wall appears soft, edematous friable, with smooth shiny surface and bluish red discoloration.
- **Fibrotic pocket wall**: when reparative changes predominates, the gingiva appears fibrotic and pink.
- In some cases both lesions present in the same pocket as outer surface of a pocket wall fibrotic, the inner surface of soft tissue wall is inflamed and ulcerated.

Clinical features:

A. 1- bluish red discoloration of the gingival wall of pocket, this caused due to circulatory stagnation.
   2- flaccidity of tissue: due to destruction of gingival fibers.
   3- smooth shiny surface: due to atrophy of the epithelium and edema.,
   4- pitting on pressure: due to edema and degeneration.
B. Gingival wall may be pink or firm when fibrotic changes predominates over exudation and regeneration.
C. Bleeding on probing: due to
   a. Increased vascularity.
   b. Thinning and degeneration of epithelium.
   c. Proximity of engorged vessels to inner surface.
D. Probing is generally painful: due to ulceration of the inner aspect of the pocket wall.
E. Pus may be present: due to suppurative inflammation.
F. Other clinical features
   a. Thickened marginal gingiva.
   b. Loss of stippling.
   c. Tooth mobility and diastema formation.

**Periodontal disease activity**
1--- Period of quiescence or inactivity this period characterized by reduced inflammatory response and little or no loss of bone and connective tissues.
A buildup of unattached plaque with its gram negative and anaerobic bacteria
2----period of exacerbation or activity bone and connective tissue attachment are lost and the pocket deepens
This period may last for days, weeks, months and eventually followed by period of remission and quiescence in which G+ve bacteria proliferate and more stable condition is established
Clinical feature shows bleeding spontaneous or on probing and greater amount of gingival exudates
Histological features, pocket appear thin and ulcerated, infiltrate composed of plasma cells and PMNs leukocytes

**Treatment:**

*Non surgical treatment:*

1) Oral hygiene instruction.
2) Scaling and root planning
   ✓ Use curettes for subgingival scaling, root planing and removal of the soft tissue lining the pocket.
   ✓ Root planing stock should be moderate to light.
   ✓ Pull stock for final smoothing and planing of root surface.
   ✓ Continuous series of long, overlapping shaving stock is achieved.
   ✓ To avoid over instrumentation, a delicate transition from short, powerful scaling strock to longer, lighter root planning strokes must be made as soon as calculus and initial roughness have been eliminated.
   ✓ Periodontal medication as application of tetracyclines

*Surgical treatment-----*

Pocket depth reduction through different surgical procedures
1-gingival curettage
2-gingivectomy
3-periodontal flap procedures
4-osseous surgery
Periodontal regeneration procedures