

International Journal Of Medical Science And Clinical Inventions

Volume 2 issue 08 2015 page no. 1275-1278 ISSN: 2348-991X

Available Online At: <http://valleyinternational.net/index.php/our-jou/ijmsci>

Development Of Periodontium: A Star In The Making!!!

Dr. B. M. Bhusari<sup>1</sup>, Dr. Kunal Banavali<sup>2</sup>, Dr. Suvidha Dere<sup>3</sup>, Dr. Munaf Makhnoji<sup>4</sup>

<sup>1</sup>Professor & HOD

Email id: [bansibhusari@yahoo.in](mailto:bansibhusari@yahoo.in)

<sup>2</sup>Periodontist & Oral Implantologist

Email id: [kunalpericraze@gmail.com](mailto:kunalpericraze@gmail.com)

<sup>3</sup>III- Year PG Student

Email id: [dr.suvidha23@gmail.com](mailto:dr.suvidha23@gmail.com)

<sup>4</sup>III- Year PG Student

Email id: [dr.munafmaknoji@gmail.com](mailto:dr.munafmaknoji@gmail.com)

Corresponding Author:

Department of Periodontics, Y.M.T. Dental College & Hospital, Kharghar, Navi Mumbai.

*Abstract-The periodontium, defined as those tissues supporting and investing the tooth, comprises root cementum, periodontal ligament, bone lining the tooth socket (alveolar bone), and that part of the gingiva facing the tooth (dentogingival junction). The widespread occurrence of periodontal diseases and the realization that lost tissues can be repaired and, perhaps, regenerated has generated considerable interest in the factors and cells regulating their formation and maintenance. It is important to understand that each of the periodontal components has its very specialized structure and that these structural characteristics directly define function. Indeed, proper functioning of the periodontium is only achieved through structural integrity and interaction between its components. The following review article emphasizes on the development of the periodontium.*

**Key word:** Periodontal ligament, Cementum, Alveolar bone, dentogingival junction, periodontium.

**Introduction**

The term periodontium arises from the Greek word “Peri” meaning around and “odont” meaning tooth, thus it can be simply defined as the ‘tissue investing and supporting the teeth’. The periodontium is composed of the following tissue namely alveolar bone, root cementum, periodontal ligament and gingiva.

**Development of Periodontium**

**1. Cementum Development:**

Cementum is an avascular mineralised tissue covering the entire root surface. Following

completion of crown formation the cells of the outer and inner enamel epithelium begin to proliferate from the cervical loop of dental organ as a bilayer of cells known as the ‘Hertwig’s epithelial root sheath’. However Hertwig’s sheath is disintegrated and it does not cover much of the external surface of newly formed predentin. A fine layer of epithelial matrix(hyaline layer is 10µm thick) is deposited upon the newly formed dentin by overlying epithelial cells. This layer is also called the hyaline layer of Hopewell smith or intermediate cementum. Following the fragmentation of Hertwig’s epithelial root sheath, cells from the dental follicle can be seen to attach and align onto the matrix coating the dentin

surface and these subsequently differentiate into cementoblasts and form the root cementum.<sup>1</sup>

Thus, this advancing root edge in human remains accessible to cementum forming (dental follicle) cells from the beginning of root formation.

### Formation of fibers –

These cells first form compartments with cellular processes that demarcate intrinsic collagen fibers that are parallel to the long axis of the root surface and course in a circular fashion around the root. Extrinsic fibers are formed later. The extracellular compartment appears to regulate the architecture of the principal fibers and they are also necessary for the formation of intrinsic – extrinsic fiber structure. Once cementum is formed the cells retracts their processes and form intrinsic fibers around the principal fibers.<sup>2</sup>

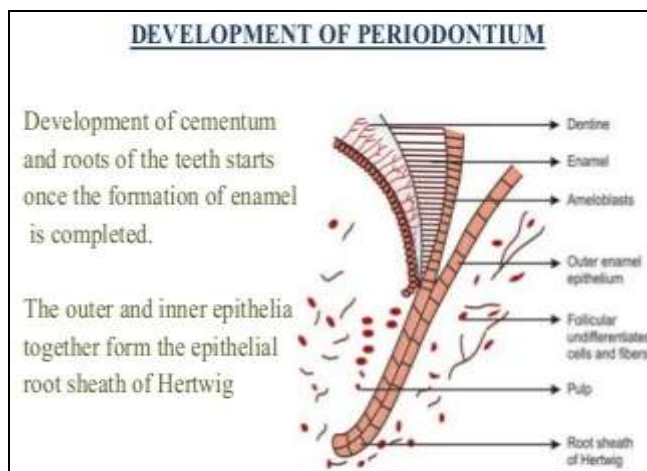


Fig: 1- Development of Periodontium

## 2. Periodontal ligament Development:

Periodontal ligament is a fibrous connective tissue that spans the space between root surface and alveolar bone produced mainly by fibroblasts, with minor contributions from vascular and neurologic components. While the gross developmental aspects of periodontal ligament are similar for most teeth, subtle differences do exist between primary teeth and teeth that do not have

precursors. Hertwig's sheath of epithelial cells grows apically between the dental papilla and dental follicle.<sup>3</sup>

### Development of the principal fibers and orientation-

Development of the major collagen bundles, the principal fibers of the periodontal ligament is closely correlated to root formation. Nascent fiber bundles (fringe fibers) originate at the surface of newly formed root dentin are tightly packed (bundled) by the action of cementoblasts during the initial development of acellular extrinsic fiber cementum.<sup>6</sup> During tooth eruption, as the periodontal ligament matures, the fringe fibers merge across the width of the ligament to form the principal fiber bundles. With continued development of the root, major collagen bundles, the principal fibers are established as continuous structures embedded as Sharpey's fibers in bone and cementum. In order to attach the tooth in the alveolus, the fibers must be embedded in mineralised bone and cementum.

The mature periodontal ligament can be subdivided into three regions:-

- a) a bone related region, rich in cells and blood vessels.
- b) a cementum related region characterized by dense well – ordered collagen bundles.
- c) middle zone containing fewer cells and thinner collagen fibrils

### Orientation of fibers –

The orientation of the early periodontal ligament formed prior to eruption is dramatically different from its final form. Initially the fibers become embedded in the cementum as sharpey's fibers and are laid down in a coronal direction, giving them an orientationalmost parallel to the root surface. Fiber formation and deposition occurs sequentially from the newly forming cemento -

enamel junction to the apex of the tooth root. The first fibers to be deposited ultimately become the dentogingival and transseptal fibers of the gingiva, while those fibers deposited apical to cemento– enamel junction ultimately forms the fibers of the periodontal ligament. Both the root surface derived and bone derived fibers ultimately coalesce in the middle third of the ligament space to form the intermediate plexus.

As the teeth begin to erupt, the orientation of the ligament fibers changes according to the stage of eruption. The dentogingival fibers continue to align from the cement – enamel junction in an occlusal direction terminating in the connective tissue of the gingiva. The transseptal fibers extend from the root surface in an oblique direction over the alveolar crest. Once the tooth is fully erupted and in functional occlusal contact, the ligament fibers adopt the final arrangements. The dentogingival, transseptal and alveolar crestal fibers emanate from cement – enamel junction. Below crestal fibers and within the coronal one third of the root surface the fibers have a horizontal orientation. In the middle third of the root, the fibers have an oblique orientation running in an occlusal direction from cementum surface to the alveolar bone. While the apical third, the fiber arrangement remains oblique but runs in an apical direction from the cementum surface to the alveolar bone.

### 3. Gingiva:

#### Development of gingival epithelium-

As an erupting tooth approaches the oral epithelium, the enamel epithelium rapidly proliferates forming the thick reduced enamel epithelium. As the crown erupts further, the reduced enamel epithelium overlying the enamel fuses with the oral epithelium, undergoes transformation and establishes the dentogingival junction forming the junctional epithelium cells.

The junctional epithelium maintains a direct attachment to the tooth surface.<sup>5</sup> During eruption contact is established between the reduced enamel epithelium and oral gingival epithelium. Epithelial cells of junctional epithelium contact with the tooth surface by internal basal lamina and separated from the connective tissue by the external basal lamina.

#### Development of gingival connective tissue-

Gingival connective tissue fibroblast originates from perifollicular mesenchyme, a derivative of the stomodeal mesoderm. New fibroblasts are derived from the proliferation of undifferentiated perivascular cells. The collagen matrix of gingival connective tissue is well organized into fiber bundles which constitute the gingival supra alveolar fiber apparatus. It is made up of transseptal, circular, semicircular, transgingival and intergingival fibers, which connect and link the adjacent teeth of one arch.<sup>4</sup>

### 4. Development of alveolar bone:

The major changes in the alveolar processes begin to occur with the development of the roots of teeth and tooth eruption. Tooth germs develop within bony structures in clearly outlined bony compartment. As the roots of the teeth develop, some cells in the dental follicle also differentiate into osteoblast and form alveolar bone proper.

#### Remodeling of alveolar processes during tooth eruption-

The tooth germs develop within the alveolar processes and where the root formation begins, the alveolar processes have already grown over the occlusal plane of the developing tooth. Thus, for successful tooth eruption there must be remodeling. In order for the developing tooth to escape from the alveolar bone, a gubernacular canal must be widened by osteoclastic bone resorption.<sup>7</sup> At the same time, new bone

formation at the base of the bony crypt is believed to be important in producing an outward eruption force directed against the erupting tooth.

- 7) Ten Cate AR, Mills C. The development of periodontium: the origin of alveolar bone. *Anat Rec* 1972; 170: 365-380.

### Conclusion

Indeed, knowledge of how tissue structure develops and how it relates to function is fundamental for understanding the disease process, and for devising effective therapeutic strategies, particularly in the case where tissue destruction, and hence a concomitant loss of function, ensues.

### References

- 1) Hammerstrom L. Enamel matrix, cementum development & regeneration. *J. Clin Periodontol* 1997; 24: 658-668.
- 2) Schroeder HE. Biological problems of regenerative cementogenesis: Synthesis and attachment of collagenous matrices on growing & established root surfaces. *Int Rev Cytol* 1992; 142: 1-59.
- 3) Jones SJ. Cement. In: Osborn JW, ed. *Dental anatomy and embryology*. Boston: Blackwell Scientific, 1981.
- 4) Schroeder HE. *Handbook of microscopic anatomy. The periodontium*. Berlin: Springer, 1986: vol.5: 22-119.
- 5) Ten Cate AR, Mills C. The development of periodontium. A transplantation and autoradiographic study. *Anat Rec* 1972; 170: 365-380.
- 6) Sloan P, Carter DH. Structural organization of the fibers of the periodontal ligament. In: Berkovitz BKB, Moxham BJ, Newman HN, ed. *The periodontal ligament in health & disease*. London: Mosby – Wolfe, 1995:35-53.