

A GENERAL OVERVIEW OF GINGIVA

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ABSTRACT

The gingiva (gum) is the protective type of skin that is closely adapted to the necks of the teeth and covers the bone holding the roots of the teeth. Healthy gingiva is usually coral pink, but may contain physiologic pigmentation. Changes in color, particularly increased redness, together with edema and an increased tendency to bleed, suggest an inflammation that is possibly due to the accumulation of bacterial plaque. This article throws light on the types of gingiva, different cells present in gingiva, gingival disease etc. A review of some patents on gingiva is also provided that summarizes the recent advancements taken place in this area.

KEY WORDS: Gingiva, Marginal Gingiva, Characteristics, Patents

1. INTRODUCTION

Gingiva is the soft tissue around the teeth which is continuous with the mucosa of the oral cavity; this junction is called the mucogingival junction. Gingiva shows stippling, which is its typical appearance and is known as stippled gingiva. Compared with the soft tissue linings of the lips and cheeks, most of the gingiva are tightly bound to the underlying bone which helps resist the friction of food passing over them^{1,2}.

The gingiva is a type of masticatory mucosa. Healthy gingiva is usually coral pink, but may contain physiologic pigmentation. Changes in color, particularly increased redness, together with edema and an increased tendency to bleed, suggest an inflammation that is possibly due to the accumulation of bacterial plaque³. It is differentiated by the line which demarcates it by the dark color of the mucosa (due to high vasculature) and the light color of the gingiva (due to presence of more fibers) comparatively^{4,5}.

Gingival sulcus is also present which extends from the gingival margin apically to the cemento-enamel junction, which acts as a seal against the tooth and acts as a barrier against the sub-gingival plaque, bacteria and prevents fluid loss from underlying tissue^{6,7}.

2. TYPES OF GINGIVA

The gingiva is divided anatomically into marginal, attached and interdental areas.

2.1 Marginal gingiva: The marginal gingiva

is the terminal edge of gingiva surrounding the teeth in collar like fashion. It is demarcated from the adjacent, attached gingiva by a shallow linear depression, the free gingival groove. Usually about 1 mm wide, it forms the soft tissue wall of the gingival sulcus. The marginal gingiva is supported and stabilized by the gingival fibers^{8,9}.

2.2 Attached gingiva: The attached gingiva is continuous with the marginal gingiva. It is firm, resilient, and tightly bound to the underlying periosteum of alveolar bone. The facial aspect of the attached gingiva extends to the relatively loose and movable alveolar mucosa, from which it is demarcated by the mucogingival junction. Attached gingiva may present with surface stippling^{10,11}.

2.3 Interdental gingiva: The interdental gingiva occupies the gingival embrasure, which is the interproximal space beneath the area of tooth contact. The interdental gingiva can be pyramidal or have a "col" shape. Attached gingiva is resistant to masticatory forces and is always keratinized^{12,13}.

3. TYPES OF EPITHELIUM

3.1 Oral Epithelium: It is a stratified squamous keratinizing epithelium that lines the vestibular and oral surfaces of the gingiva. It extends from the mucogingival junction to the gingival epithelium except for the palatal epithelium where it blends with the palatal epithelium¹⁴.

3.2 Sulcular Epithelium: This is the epithelium which covers the gingiva present in the sulcus depths¹⁵.

3.3 Junctional Epithelium: The portion of the gingival tissue that is attached the gingival connective tissue on one side and the tooth surface on the other. And its coronal end lines the end of gingival sulcus¹⁶.

4. HISTOLOGY OF GINGIVA

4.1 Epithelium^{17,18}: The gingiva is covered with keratinized stratified squamous epithelium (the outer most layer of gingiva). This epithelial layer shows projections into the underlying connective tissue which are known as "Rete Pegs". There is the connective tissue underneath the Epithelium which contains fibers, Blood vessels etc. The outer layers of the epithelium are keratinized and are stratified so the size of the cells increases as we go into the gingiva. The epithelium has 4 layers:

4.1.1 Stratum Corneum: The cells are flattened, outermost layer.

4.1.2 Stratum Granulosum: The cells contain granules and are relatively bigger in size

4.1.3 Stratum Spinosum: The cells are spinous in appearance.

4.1.4 Stratum Basale: The cells are rounded and these are the proliferative cells which give rise to new cells.

4.2 Cells^{19,20}: The different types of cells which are present in the gingiva apart from the normal epithelial cells and they are:

4.2.1 Melanocytes: They are the cells which give the darkish color of gingiva in some individuals which are dark skinned.

4.2.2 Langerhan Cell: These are the modified macrophages which help in producing antigens.

4.2.3 Merkel cell: these are present in the deep layers and act as tactile proprioceptive cells.

4.3 Fibers^{21,22}: The different types of fibers seen in gingiva are:

4.3.1 Collagen Fibers: Type VII collagen fibers are predominant which are present in intimate contact with basal lamina. Type IV collagen fibers present in basal linings of epithelial walls and blood vessels.

4.3.2 Elastin Fibers: Rare in lamina propria and common in lining mucosa, the elastic fibers are made up of elastin (provide elastic nature) and Fibrillin.

4.3.3 Oxytalin Fibers: These resemble immature elastic fibers.

5. CHARACTERISTICS OF HEALTHY GINGIVA

5.1 Color: Healthy gingiva usually has a coral pink appearance. Other colors like red, white, and blue shows inflammations (gingivitis) or other pathology of the gingiva. Normal racial pigmentation makes the gingiva appear darker. Because the color of gingiva varies due to racial pigmentation, uniformity of color is more important than the underlying color itself²³.

5.2 Contour: Healthy gingiva has a smooth arcuate or scalloped appearance around each tooth. Healthy gingiva fills and fits each interdental space, unlike the swollen gingiva papilla seen in gingivitis or the empty interdental embrasure seen in periodontal disease. Healthy gums hold tight to each tooth in that the gingival surface narrows to "knife-edge" thin at the free gingival margin while the inflamed gums have a "puffy" or "rolled" margin²⁴.

5.3 Texture: Healthy gingiva has a firm texture that is resistant to movement, and the surface texture often exhibits surface stippling. Unhealthy gingiva, on the other hand, is often swollen and mushy²⁵.

5.4 Reaction to disturbance: Healthy gums usually have no reaction to normal disturbance such as brushing or periodontal probing. Unhealthy gums on the other hand will show bleeding on probing (BOP) and/or purulent exudate²⁶.

6. DISEASES OF THE GINGIVA

Improper or insufficient oral hygiene can thus lead to many gingival and periodontal disorders including gingivitis or pyorrhea which are major causes for tooth failure. Gingival recession is when there is an apical movement of the gingival margin away from the occlusal surface. It may indicate an underlying inflammation such as periodontitis or pyorrhea, a pocket formation, dry mouth or displacement of the marginal gingiva away from the tooth by mechanical (such as brushing), chemical, or surgical means. Gingival retraction, in turn, may expose the dental neck and leave it vulnerable to the action of external stimuli, and may cause root sensitivity²⁷.

In a mouth that is not kept clean by regular oral hygiene practice, a thin, soft, sticky colorless layer is constantly formed on the surface of teeth and it is called dental plaque. Dental plaque is layers of growing mass of various types of bacteria that are present in the mouth. Dental plaque in small quantities is almost invisible, but in large quantities it can be felt with a tongue as a fuzzy unclean coating. If plaque is not completely removed everyday by tooth brushing and flossing, the remaining plaque becomes a stony crust called calculus/tartar. Calculus clings to the teeth with such force that only a dentist or a hygienist with the help of special instruments can remove it²⁸.

As gum disease progresses the gum margin becomes detached from the tooth surface and the sulcus becomes progressively deeper. This sulcus that has been deepened by disease is called periodontal pocket. In the early stages there are usually no symptoms and patients are unaware of the progressing disease, but as the inflammation spreads there is bleeding from the pockets²⁹.

The inflammation of gingiva is known as gingivitis and is which is of 2 types acute and chronic. Acute can be due to acute infections or due to poor oral hygiene and accumulation of plaque and calculus while chronic is mainly caused due to hormonal imbalance, poor oral hygiene and vitamin deficiency³⁰.

7. SOME PATENTS ON GINGIVA

7.1 Gingiva modeling: Embodiments are provided for modeling gingiva. One method embodiment includes scanning a patient's teeth and gums, or a physical model thereof, to obtain location data, developing a digital model via a computing device, where the model represents a dentition and gingiva from the location data, defining in the model a gingival line at an intersection between at least one tooth and at least a portion of its surrounding gums, measuring a gingival pocket depth at a number of reference locations, and establishing in the model one or more gingival attachment points at the pocket depth from the gingival line³¹.

7.2 Gingival breath deodorizer and bite guard: The invention relates to an intraoral dispensing apparatus for rendering the breath of a person aromatically pleasant. A vesicle is disposed about and in contact with the gingiva or dental gums and contains a supply of breath

deodorizing or sweetening solution, which may include medications. A valve is provided for selectively dispensing solution as desired by the user, and is activated by finger pressure on the outside of the cheek. The dispensing valve operates only selectively to release solution to avoid flavor contamination of food when eating. Filling means are provided to recharge the vesicle. An alternative model is adaptable for use with dentures and can comprise a vesicle formed from a single layer of material attached about its periphery on the gingival surface³².

7.3 Gingiva former: The invention relates to a gingiva former which can be connected to a dental implant and has a head portion which is located in the region of the gingiva. The gingiva former should be developed such that the formation of the soft tissue is improved. Thus it is suggested that the head portion have at least one opening for gingival fastening devices and that the opening lead into a central bore of the head portion³³.

7.4 Systems and methods for removing gingiva from computer tooth models: A computer-implemented method separates gingiva from a model of a tooth by defining a cutting surface along the gingiva; and applying the cutting surface to the tooth to separate the gingiva from the tooth³⁴.

7.5 Automatic crown and gingiva detection from three-dimensional virtual model of teeth

In this technique, the inventors Markus K, Peer S and Phillip G show a method for automatically separating tooth crowns and gingival tissue in a virtual three-dimensional model of teeth and associated anatomical structures. The method determines saddle points between the local maxima in the model, the saddle points corresponding to boundaries between teeth. It further positions the saddle points along a dental arch form. For each tooth, the method automatically identifies a line or path along the surface of the model linking the saddle points to each other, the path marking a transition between teeth and gingival tissue and between adjacent teeth in the model³⁵.

8. CONCLUSION

The gingiva not only protects type of skin that is closely adapted to the necks of the teeth and but also covers the bone holding the roots of the teeth. Gingiva is of three main types with

different types of cells present in it like melanocytes, langerhan cell, merkel cell, etc and fibers like collagen fibers, elastin fibers, oxytalin fibers, etc. A healthy gingiva which is stippled and pink in color not only enhances in the esthetics of a person and but also maintains proper oral hygiene of a person. Any damage to gingiva can cause its diseases and changes in its lining and cells so proper care should be taken of the gingiva. Hope this review will be useful for dental students in knowing about the gingiva.

REFERENCES

1. Shay K. Denture adhesives. Choosing the right powders and pastes. *J Am Dent Assoc* 1991; 122:70-6.
2. <http://mexicodentaldirectory.com/>
3. Levin EI. Dental esthetics and the golden proportion. *J of Pros Dent* 1978; 40(3): 244-52.
4. Gingival Recession - Causes and treatment JADA. American Dental Association, Vol 138, 2007.
5. <http://www..anaesthesia.com/>
6. Epidemiology of Dental Disease, hosted on the University of Illinois at Chicago website. Page accessed January 9, 2007.
7. <http://newsvote.bbc.co.uk/1/hi/health/7175306.stm>
8. Executive Summary of U.S. Surgeon General's report titled, The Health Consequences of Smoking: A Report of the Surgeon General, hosted on the CDC website. Page accessed January 9, 2007.
9. <http://www.toothtalk.com/>
10. Dental Health, hosted on the British Nutrition Foundation website; 2004. Page accessed August 13, 2006.
11. Rogers, Anthony H. Molecular Oral Microbiology Caister Academic Press; 2008. ISBN 978-1-904455-24-0
12. Neville, B.W., Damm D, Allen C, Bouquot J. Oral & Maxillofacial Pathology. 2nd edition; 2002. ISBN 0-7216-9003-3.
13. Esposito SJ. Esthetics for denture patients. *J of Pros Dent* 1980; 44(6): 608-15.
14. <http://jada.ada.org/>
15. Fejerskov, Ole Gingiva: The Disease and Its Clinical Management. Oxford: Blackwell Munksgaard; 2008. ISBN 1405138890.
16. Kidd, E.A.M. Essentials of Dental Gingiva. Oxford: Oxford University Press; 2005 ISBN 0198529783.
17. Dental Health, hosted on the British Nutrition Foundation website; 2004. Page accessed August 13, 2006.
18. Frequently Asked Questions, hosted on the American Dental Hygiene Association website. Page accessed August 15, 2006.
19. Health Promotion Board: Dental Gingiva, affiliated with the Singapore government. Page accessed August 14, 2006.
20. Gerabek WE. The tooth-worm: historical aspects of a popular medical belief. *Clin Oral Investing*; 1999. 3 (1): 1-6.
21. Epidemiology of Dental Disease, hosted on the University of Illinois at Chicago website. Page accessed January 9, 2007.
22. Sonis, Stephen T. Dental Secrets: Questions and Answers Reveal the Secrets to the Principles and Practice of Dentistry. 3rd edition. Hanley & Belfus, Inc.; 2003. ISBN 1-56053-573-3.
23. Oral Health Topics: Anesthesia Frequently Asked Questions, hosted on the American Dental Association website. Page accessed August 16, 2006.
24. <http://www.toothtalk.com/>
25. Oral Health Resources - Gingiva Fact Sheet. Hosted on the Centers for Disease Control and Prevention website. Page accessed August 13, 2006.
26. Health Strategy Oral Health Toolkit, hosted by the New Zealand's Ministry of Health. Page accessed August 15, 2006.
27. Guideline on Infant Oral Health Care, hosted on the American Academy of Pediatric Dentistry website. Page accessed January 13, 2007.
28. <http://jama.amaassn.org/cgi/content/full/295/15/1835?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=Needleman&searchid=1&FIRSTINDEX=0&resourcetype=HWCIT>.
29. American Society of Dental Surgeons. American Journal of Dental Science. Harvard University. p. 170.
30. <http://www.gingiva.com/>
31. Kuo, Eric E in-ventors. Gingiva modeling. Align Technology, Inc. (San Jose, CA), US patent 7,942,672; 2011 May 17.
32. Lefkowitz J in-ventor. Gingival Breath Deodorizer And Bite Guard. US patent 4,676,752; 1987 Jun 30.
33. Fouad K, Joerg N in-ventors. Gingiva former. Friadent GmbH (Mannheim, DE), US patent 6,257,890; 1999 Mar 18.
34. Pavlovskajaia, Sarva E, Venkata S, Carmen C in-ventors. US patent 7,040,896; 2006 May 9.
35. Markus K, Peer S, Phillip G in-ventors. Automatic crown and gingiva detection from three-dimensional virtual model of teeth. US patent 7,004,754; 2006 Feb 28.