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Attached Gingiva: A Review

Malathi K.*, Singh Arjun, Rajula M Prem Blaisie and Sabale Dhanesh

Dept. of Periodontics, Tamil Nadu Govt. Dental College & Hospital, Chennai-03TamilNadu

ABSTRACT:

In a healthy and intact periodontium the length of keratinized attached gingiva include coronally from the bottom of gingival sulcus to the mucogingival junction apically. The width of attached gingiva varies with the age. The keratinized attached gingiva provides the periodontium with increase resistance to external injury and stabilized the gingival margin against physical forces and helps patients plaque control measurements. In patients with inadequate width of attached gingiva mucogingival surgeries like connective tissue grafts, free gingival grafts are used with other surgical procedure to widen the zones of attached gingiva. This article reviews the biology of Attached gingiva and its importance for healthy periodontium and smile.

KEYWORDS: Keratinization, Width of attached gingiva, Mucogingival junction, External injury.

Corresponding Author:

Dr. K. Malathi

Dept. of Periodontics, Tamil Nadu Govt. Dental College & Hospital,
Chennai-03TamilNadu
E Mail - malsmoni@gmail.com

INTRODUCTION:

According to orban and sicher oral cavity is lined by three different kind of mucosa.Masticatory mucosa which includes covering of hard palate and gingiva of alveolar process, lining mucosa which include covering of lips, cheeks and vestibular fornix and specialized mucosa covering the dorsum of tongue. Each of this oral mucosa has its own clinical significances. Anatomically gingiva is divided into free, attached and interdental gingiva. Attached gingiva is a part of keratinized gingiva which aids in periodontium to increase resistance to external injury and contribute in stabilization of gingival margin against frictional forces and also aids in dissipating physiological forces exerted by the muscular fibers of the alveolar mucosa on the gingival tissues.For many years the presence of an "adequate" zone of gingiva was considered critical for the maintenance of marginal tissue health & for the prevention of continuous loss of connective tissue attachment. In the early 1980s, Wennstrom et al. conducted a series of well-designed experiments to prove that the attached gingiva and its width, have little role in maintaining periodontal health[1].4–6 Successive studies went on to prove that it is not the width but the volume of attached gingiva that is critical around restored or orthodontically moved teeth[2].

ANATOMY:

According to glossary of periodontal term (1972) Attached gingiva is that portion of gingiva that extends from the base of gingival crevice to mucogingival junction. Orban(1948) appear to be the first to describe attached gingiva, he divided gingiva into free and attached gingiva demarcated by free gingival groove (FGG) according to him, FGG is at appropriate level of the bottom of gingival sulcus. Ainamo and loe (1966) published a study to show that FGG was present only in one-third of cases examined so it was unreasonable to assume that FGG represent the dividing line between free gingiva and attached gingiva.[3] They suggested a better parameter "an imaginary horizontal plane which can be drawn from the bottom of sulcus to surface of gingiva". According to glossary of periodontal term Attached gingiva is firm, resilient and tightly bound to underlying periosteum, tooth of alveolarbone through connective tissue. Facialaspects of attached gingiva extend to relatively loose and movable alveolar mucosa is demarcated by mucogingival junction. On the lingual aspect of mandible, the attached gingiva terminates at the junction of lingual alveolar mucosa, which is continuous with mucous membrane lining the floor of the mouth. The palatal surface of gingiva in maxilla blends imperceptibly with firm and resilient palatal mucosa.

MICROSCOPIC AND MACROSCOPIC FEATURE:

Histologically, the attached gingiva is better suited than non-keratinized mucosa to withstand mechanical irritations. The epithelium of attached gingiva is keratinized and has thin, prominent epithelial ridges. The connective tissue contains no elastic fibers. These characteristics are exactly the opposite of the histology of alveolar mucosa.

Attached gingiva is lined by four layers.

1. Stratum Basale.
2. Stratum spinosum.
3. Stratum granulosm
4. Stratum corneum.

Connective tissue of gingiva, also known as lamina propria and it consists of:

1. Papillary layers subjacent to epithelium consisting of papillary projection between epithelial rete pegs.
2. Reticular layers contiguous with periosteum of alveolar bone.

Coral pink color of attached gingiva is governed by factor like thickness of epithelium, vascular supply and degree of keratinization and presence of pigmentation.

Feature which are specific to attached gingiva include are:

- Deep rete begs.
- Thick lamina propria.
- Abundant collagen with elastic fibers.
- Indistinct sub mucosa.

Attached gingiva is tough, inflexible and resistant to abrasion. Collagenous nature of connective tissue and its adherence to underlying muco-periosteum determine the firmness of attached gingiva. Elongated papilla provides good mechanical attachment and prevents epithelium being striped under shear forces. Thick network of closely packed collagen fibers resist the loading[4]. Thus attached gingiva can bear the compressive and shear forces. Attached gingiva presents a surface texture similar to orange peel which is referred as a stippled.It varies among different individual and different areas of mouth .It is less prominent on the lingual surface then on the facial surface. It is absent in infancy and appear around 5 year of age. Attached gingiva is a form of adaptive specialization. It is produced by elevation and depression in surface of gingival tissue.

NORMAL WIDTH OF ATTACHED GINGIVA:

It is the distance between mucogingival junction and projection on external surface of bottom of sulcus. Width of facial gingiva is different in different area of mouth; it is generally greatest in the incisor region.

3.5-4.5 mm in maxilla anterior.

3.3-3.9 mm in mandible anterior.

It is narrower in posterior tooth region:

1.9mm in maxilla premolar

1.8 mm in mandible premolar

Width of attached gingiva is minimal in newly erupted permanent teeth and increase with permanent teeth eruption. Bower measured the width of facial attached gingiva in both primary and permanent dentition[5]. The width of gingiva varies from 1-9mm, being greatest at the incisor region especially in the lateral incisor and smallest in the canine and first premolar region. Voigt et.al measured the width of attached gingiva in clinically normal subjects[6]. The first and second molar demonstrated the greatest width (4.7mm) and decrease at premolar and third molar sites. The incisor and canine demonstrated the smallest width (1.9mm).With the progression from primary to permanent dentition the width of lingual attached gingiva is decreased. Ainamo et.al in different studies said that, mucogingival junction remains stationary throughout life and changes in width of attached gingiva are caused by modification in position of coronal gingival.[7] The width of attached gingiva increases with age and in supra-erupted teeth[8,9]. Maze land et.al said that, width depends on height of alveolar process and vertical dimension of lower face. Andin-sobocki and bodin[10] in a series of studies over 2 year used longitudinal observational to confirm the pattern of Facial keratinized tissue in children. Over a 2year period both primary and permanent teeth demonstrated an increase in both facial attached and keratinized tissue .It was noted that if primary tooth had less than 1 mm of attached gingiva at base line, the permanent tooth displayed a wider zone of attached gingiva on second examination. Zone of attached gingiva was narrower on facially positioned teeth then on well-aligned or lingually positioned teeth.

MEASUREMENT OF WIDTH OF ATTACHED GINGIVA:

HALL[11] said that the width of attached gingiva is determined by subtracting the sulcus or pocket depth from total width of gingiva.

Methods to determine mucogingival junction:

1. Visual method.
2. Functional method.
3. Visual methods after histochemistry staining.

I. Mucogingival junction assessed as a scalloped line separating attached gingiva from the alveolar mucosa.

II. Assessed as a borderline between movable and immovable tissue. Tissue mobility was assessed by running a horizontally positioned probe from the vestibule toward the gingival margin using light force.

III. Assessed visually after staining the mucogingival junction with iodine solution.

- If Mucogingival junction is distinct this is done by stretching the lip or cheek to demarcate Mucogingival junction while pocket is being probed.
- If Mucogingival junction is indistinct its position can be gauged by placing a probe horizontally flat against the mucosal surface and sliding it coronally.

INADEQUATE WIDTH OF ATTACHED GINGIVA:

Friedman stated that ‘‘inadequate’’ zone of gingiva would facilitate Subgingival plaque Formation because of improper pocket closure resulting from the movability of the Marginal tissue.[12]The amount of attached gingiva is generally considered to be insufficient when stretching of the lips or cheeks to induce movement of free gingival margin.

It may be due to:

- Some people are born without sufficient attached gingiva, resulting in the muscles in alveolar mucosa to pull the gingiva down. Gingival recession as well as bone loss is seen.
- Abnormal free attachment, which exaggerates the pull on gingival margin.
- Vigorous brushing in people with naturally thin tissue or when the tissues have been stretched during orthodontic treatment.
- Deep pockets that reaches the level of mucogingival junction.

Lang and loe: Reported a study on the relationship between the gingival width and inflammation, in an effort to determine the adequate amount.[13]

- In 100% of teeth with less than 2mm of keratinized tissue, inflammation and exudates was present.
- 76% of cases with greater than 2mm of keratinized tissue there was no exudates and was considered as clinically healthy.
- They concluded that 2mm of keratinized gingiva, with less than 1mm of attached gingiva is adequate to maintain gingival health.

Hall mentioned few critical factors to be considered for determination adequate attached gingiva.[14]

- Patients age,
- Level of oral hygiene practice,
- Teeth involved any
- Potential or existing esthetic problem.
- Existing recession with esthetics or sensitivity problem
- Patients' dental needs.

An adequate band of attached gingiva could be defined as that amount which is sufficient to prevent recession in opinion of individual practioners[15]. Thus No minimum width of attached gingiva has been established as standard necessary for gingival health. Another paper by miyasato et al concluded that there is no relationship between inflammation and amount of attached gingiva whether or not plaque is present.[16] De tray and bernimoulin concluded in a study that the adequacy of attached gingiva cannot be determined by measurement of its width alone.

INDICATION TO INCREASE WIDTH OF ATTACHED GINGIVA:

- Patient experiencing discomfort during tooth brushing and chewing.
- In cases where orthodontic treatment planned and final position is expected to result in recession.
- To improve aesthetic-the coverage of denuded root surface for aesthetic which increase the attached gingiva.
- For teeth that serve as an abutment for fixed or removable partial denture, as well area in relation to denture.

KERATINIZED ATTACHED GINGIVA AROUND IMPLANTS:

The needs for keratinized gingiva around dental implant are more controversial, the color, contour and texture of soft tissue drape should be similar around implants. Absence of keratinized mucosa increases the suscipility of peri-implant lesions and plaque induced destruction. Keratinized gingiva around implant has more hemidesmosomes and orientation of collagen fiber in the connective tissue zone of an implant often appear perpendicular to implant surface, but in mobile non keratinized tissue these fibre run parallel to surface of the implant[17]. Schrodder et al. suggested that mobile mucosa may disrupt the implant epithelial attachment zone and contribute to an increased risk of inflammation from plaque[18] .keratinized non mobile tissue and keratinized mobile tissue are the type of mucosa that may be found around implants. Hygiene aids are more comfortable to use within the keratinized tissue as it's more resistant to abrasion. Mehdi Adibrad et al said that there is a significant influence of width of keratinized mucosa on health of the peri-implant tissues.[19] the absence of adequate keratinized mucosa around implants supporting over dentures was associated with higher plaque accumulation, gingival inflammation, bleeding on probing, and mucosal recession. Listgartan and Schroeder stated that it is preferable to locate the implants in masticatory mucosa. Hence if there is inadequate gingiva present it is better to augment the gingiva before placement of fixture. Adell et al. said that attached mucosa is necessary to prevent movement of mucosa around an exposed cover screw from inflecting trauma upon marginal soft tissue.[20] Meffert et al. prefer to obtain keratinized tissue before implant placement.[21]

CLINICAL SIGNIFICANCE OF ATTACHED GINGIVA AROUND IMPLANTS:

- Prevent spread of inflammation.
- Prevents recession of marginal tissue.
- Provides tight collar around implants.
- Enable patients to maintain good oral hygiene.

CLASSIFICATION OF ATTACHED GINGIVA AROUND IMPLANTS:

Ono et al. have proposed a classification of attached gingiva and surgical alternative to improve soft tissue type in edentulous sites for implant placement.[22]

METHODS OF MEASURING THICKNESS OF ATTACHED GINGIVA:

Gosalind et al said that average thickness of attached gingiva is 1.25mm[23.] Earlier method of measuring the thickness of attached gingiva includes traumatic technique like probing and injection needles. Now a day's new methods include measuring atraumatically with the help of newer device called "KRUPP SDM".This device uses pulse echo principle with aids of pulse generator and at a measurement frequency of 5MHz, a piezoelectric crystal is allowed to oscillate. Ultrasonic pulses are transmitted through the sound permeable gingiva .on reaching bone or teeth surface, it is reflected. A transducer probe of 4mm diameter moistened with saliva is applied to measure site with slight pressure to produce acoustic coupling. By timing received echo with respect to transmission of pulse, thickness is digitally displayed.

Eager divided attached gingiva based on periodontal type:

- Shallow thin gingiva with slender crown formation.
- Wide thick gingiva with quadrant crown formation.
- Unknown combination

CLINICAL IMPLICATION OF THICKNESS OF ATTACHED GINGIVA:

Gingiva thickness is genetically determined and associated with tooth form. Therefore surrounding soft tissue should carefully be considered when tooth form or size has to be altered. The successful clinical outcome of both regenerative and periodontal surgical procedures, highly rely on the thickness of attached gingiva covering it. Claffey et al said that in case of thin gingiva, there is increased amount of recession following non-surgical periodontal treatment.[24]

Method of increasing the width of attached gingiva (gingival augmentation)

The earliest of these techniques are the vestibular extension operations

1. Denudation techniques. (Ochsenbein 1960, Corn 1962, Wilderman 1964[25])

2. Periosteal retention procedure or Split flap procedure (Staffileno et al. 1962, 1966, Wilderman 1963, Pfeifer 1965)

3. Free grafts have been used for gingival augmentation (Haggerty 1966[26], Nabers 1966, Sullivan & Atkins 1968, Hawley &Staffileno 1970, Edel 1974).

Periodontists, historically, have indicated gingival augmentation to recreate this zone of attached gingiva. The early concept was that attached gingiva is important to dissipate the force of muscle pull and unattached mucosa, due to its mobility collects more plaque. Surgical technique to provide a functionally adequate zone of keratinized attached gingiva is known as mucogingival surgeries (friedman).[27] The apically positioned flap, free gingival graft, and Sub epithelial connective tissue graft are the most common surgical procedures used for augmenting the zone of attached gingiva effectively and predictably. These procedure may be combined with other procedure to obtain a healthy periodontal complex-a complex capable of withstanding the stress of mastication, tooth brushing, trauma from foreign bodies, tooth preparation associated with a crown and bridge[28] , Subgingival restoration, orthodontics, inflammation and frenum pull.

TISSUE BARRIER CONCEPT:

Goldman and Cohen outlined a "tissue barrier" concept for mucogingival surgery.[29] They postulated that a dense Collagenous band of connective tissue retard or obstruct the spread of inflammation better than does the loose fiber arrangement of the alveolar mucosa. They recommended increasing the zone of keratinized tissue to achieve an adequate tissue barrier.

GENERAL PRINCIPLES FOR MUCOGINGIVAL SURGERY[30]:

1. Existing keratinized gingiva should always be maintained.
2. Exposing bone to increasing the zone of keratinized gingiva is contraindicated (wilderman1964).
3. When an adequate zone of keratinized gingiva exists, vestibular depth is not a factor.

CONCLUSION:

The adequate width attached gingiva cover the essential component for Maintaining Healthy Periodontium .Adequate keratinized gingiva provides a firm and stable Base for maintaining good oral hygiene, restorative and esthetic procedure. Restoring dentist should be aware of the biology of keratinized Gingiva and methods for increasing the attached gingiva for a successful treatment Outcome.

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