Review Article

Gingiva Tissue is the Issue: An Overview

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ABSTRACT

The healthy periodontium provides the support necessary to maintain teeth in adequate function. It comprises of gingiva, periodontal ligament, cementum and alveolar bone represent the supporting structures of the teeth. The gingiva, in health, normally covers the alveolar bone and tooth root to a level just coronal to the cementoenamel junction. Periodontal health maintenance is one of the keys for the longevity of teeth, as well as for the longevity of restorations in which the placement of restoration margin plays an important role. Deformities of the gingiva and alveolar mucosa, which are usually referred to as mucogingival problems, often has an impact on patients in terms of esthetics and function. Gingival recession, especially in the anterior teeth is a common concern due to esthetic reasons or root sensitivity. There are various mucogingival surgeries for root coverage procedures. Also esthetics demands often require hiding of restorative margins below the gingival margins i.e., pushing them down into the sulcus, which may cause biologic width violation. The esthetic rehabilitation of a patient involves a multidisciplinary approach. In this review, we have summarized the current literature regarding the concept of biologic width, importance of attached gingiva and also their management.

Keywords: Attached gingiva; biologic width; gingiva; gingival biotype

INTRODUCTION

Gingival tissues provide the framework for peripheral body defense. The tissues surrounding the teeth provide a seal around the teeth (via the junctional epithelium and the epithelial attachment), to withstand the frictional forces of mastication and to defend the potential space between the teeth and the soft tissues against foreign invaders, such as microorganisms.[1] The tissues collectively termed ‘gingiva’ serve a dual function: they belong to both the oral mucous membrane and the periodontium. The gingiva is the part of the oral mucosa that covers the alveolar processes of the jaws and the cervical portions of the teeth. The gingiva extends from the gingival margin and the tip of the interdental papillae to the mucogingival junction. Clinically, the gingival is regarded as a combination of epithelial and connective tissues. These make up the mucosa that is around the teeth of the complete deciduous or permanent dentition and is attached to both teeth and alveolar processes.[2]

Periodontal health maintenance is one of the keys for the longevity of teeth, as well as for the longevity of restorations in which the placement of restoration margin plays an important role. In this context, the recognition and knowledge of the biological width is essential. Deformities of the gingiva and alveolar mucosa, are usually referred to as mucogingival problems, often has an impact on patients in terms of esthetics and function.[3]

The term "mucogingival surgery" was introduced in the periodontal literature in the 1950’ and according to the Glossary of Periodontal Terms, it is defined as the "periodontal surgical procedures designed to correct defects in the morphology, position and/or amount of gingiva" surrounding the teeth. Lang and Loe[4] suggested

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that a width of at least 2 mm of keratinized gingiva, of which 1 mm of attached gingiva is adequate to maintain gingival health. The keratinized attached gingiva provides resistance to periodontium against external injury and helps patients to control plaque.

For the successful survival of the dental implant, soft tissue management is regarded as the foremost consideration. Peri-implant and periodontal tissues may differ in their resistance to bacterial infection. A zone of keratinized tissue adjacent to dental implants is essential as the implant supported restoration is located beneath the oral mucosa and the implant- mucosa interface differs from the interface between the mucosa and natural teeth, thus, rendering implants more susceptible to infection. Therefore, the aim of this review is to summarize the soft tissue management as a principal consideration in planning dental treatments to stabilize esthetic results, ensure periodontal health, and achieve patient satisfaction; or else, soft tissue will remain the issue!

METHODOLOY

A literature search Medline and PubMed databases were searched under the following key terms: "Attached gingiva," "biologic width," "gingiva," "gingival biotype," and "mucogingival problems." All keywords were restricted in title or abstract without the language limitation. Only highly relevant articles from manual and electronic databases were selected for the present review. The aim of this review is to highlight the soft tissue management as a principal consideration in planning dental treatments.

LITERATURE REVIEW

Gingival Biotype: The long term success of esthetic reconstructive dentistry, particularly affecting the dental implant placement, periodontal surgeries such as root coverage and ridge augmentation procedures depends on several factors like gingival biotype, architecture of the gingival tissue and shape of the anterior teeth.

Gingival biotype is defined as the thickness of the gingiva in the faciopalatal/ faciolingual dimension and it is a genetically determined trait.[5] In 1969 Ochsenbein and Ross[6] suggested the occurrence of two main variants of gingival morphology.

- Scalloped and thin gingiva- associated with a tapered tooth form
- Flat and thick gingiva- associated with a square tooth form

They also proposed that the contour of the gingiva closely mimics the contour of the underlying bone. The term 'periodontal biotype' was used later by Seibert and Lindhe[7] in 1989, who classified the gingiva as either thin-scalloped or thick-flat. A gingival thickness of ≥ 2 mm was considered as thick tissue biotype and a gingival thickness of <1.5 mm was referred as thin tissue biotype.[8] Thick biotype is quite dense in appearance with a broad zone of keratinized tissue and flat gingival contour; suggestive of thick bony architecture and also is more resistance to inflammation, trauma and subsequent recession. Thick biotype enables tissue manipulation, promotes creeping attachment, improves implant aesthetics, exhibits less clinical inflammation, and renders predictable surgical procedures.[9]

On the other hand, thin biotype as the name suggests, is characterized by thin band of the keratinized tissue with scalloped gingival contour making it delicate and almost translucent in appearance. Such a tissue appears friable, usually, having a minimal zone of attachment. The soft tissue is highly accentuated and often suggestive of thin or minimal bone over the roots labially, and also is less resistant to any inflammatory/traumatic/surgical insult and so usually exhibits pathological changes like gingival recession, osseous defects like fenestration and dehiscence.[10] In a study by De Rouck *et al*,[11] the thin gingival biotype occurred in one-third of the study population and was most prominent among women, while the thick gingival biotype occurred in two-thirds of the study population and occurred mainly among men.[12] In a healthy periodontium, the alveolar crest is positioned approximately 2 mm apical to the cementoenamel junction (CEJ) and mimics the scallop of CEJ. In the normal and high scalloped gingival form, there is more tissue coronal to the interproximal bone than the facial

bone. Supporting this in a 1994 article, Kois[13] examined crestal bone levels in patients with recession and classified them as :

- normal (crestal bone level is 3 mm apical to CEJ),
- high (crestal bone level is <3 mm apical to CEJ), and
- low (crestal bone level is >3 mm apical to CEJ)

Factors affecting gingival biotype and Gingval bioform

The different parameters which affect the two morphologic types (biotype and bioform) are gingival complex, tooth morphology, contact points, hard and soft tissue considerations, gingival bioform, and biotype. Gingival thickness affects the biotype of the gingiva, whereas, crown width (CL): Crown length (CW), papilla height, and gingival width are responsible for determining the gingival bioform. Chen *et al.*[14] suggested that the fidelity of the interproximal papilla increases as the tooth shape becomes more rectangular. Kois[13] further claimed that a rectangular tooth shape has a longer contact area and requires less of the interproximal papilla to fill up the embrasure space. Decrease in papilla height is also observed with thin biotype. Thicker tissue may resist collapse and contraction due to increased vascularity and extracellular matrix volume and is also more resistant to physical damage and bacterial ingress. Therefore, thick gingival biotype has been considered more favorable for achieving optimal aesthetics.[9] Sanavi *et al.*[15] claimed that the thick and flat periodontal tissues have a rectangular tooth shape, and the thin scalloped periodontal tissues have a triangular tooth shape.

Olsson and Lindhe[15] reported that long and narrow crowns have thin periodontal tissues, making them more susceptible and a high likelihood of having gingival recession compared to the thick gingival biotype. Weisgold *et al.*[9] considered long tapering teeth more susceptible to gingival recession while square teeth appeared to have a greater zone of gingiva that was more resistant to gingival recession. Vandana and Savitha[16] in their study on gingival thickness showed thicker gingiva in younger age group and stated that decrease in keratinization and changes in oral epithelium may be the contributing factors. Chang[16] in his study stated that an inverse relationship has been found to exist between papilla height and age. With age, the interdental papilla recedes; this explains the greater frequency of thin biotype seen with older age group.

Gingival Biotype Assessment

Various invasive and non-invasive methods were proposed to evaluate the thickness of facial gingival and other parts of the masticatory mucosa. These methods include conventional histology on cadaver jaws, injection needles, transgingival probing, histologic sections, cephalometric radiographs, modified calliper, probe transparency (TRAN) method, ultrasonic devices, and Cone beam computed tomography (CBCT).[17]

Width of Gingiva and its Clinical Relevance

The keratinized gingiva includes the free and the attached gingiva and extends from the gingival margin to the mucogingival junction. The width of the keratinized gingiva may vary between 1 and 9 mm.[4] Attached gingiva is a part of keratinized gingiva which aids the periodontium with increase resistance to external injury and stabilizes the gingival margin against frictional forces and also helps in dissipating physiological forces exerted by the muscular fibers of the alveolar mucosa on the gingival tissues. In the early 1980s, Wennstrom *et al.*[18] conducted a series of well-designed experiments to prove that the attached gingiva and its width, have little role in maintaining periodontal health. Few studies have proved that it is not the width but the volume of attached gingiva that is critical around restored or orthodontically moved teeth. Width of facial gingiva is different in different area of mouth; it is generally greatest in the incisor region and narrower in posterior tooth region i.e. 3.5-4.5 mm in maxilla anterior and 3.3-3.9 mm in mandible anterior; 1.9 mm in maxilla premolar and 1.8 mm in mandible premolar.[19] Ainamo *et al.*[20] 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. The width of attached gingiva increases with age and

in supra-erupted teeth. Earlier the thickness of the gingiva was measured using traumatic techniques like probes and injection needles. But now it can be measured without inducing trauma using new ultrasonic device called "KRUPP SDM". This device uses pulse echo principle. A pulse generator at a measurement frequency of 5 MHz allowed a piezoelectric crystal to oscillate. Ultrasonic pulses get transmitted at an interval through the sound permeable gingiva. When it reaches the bone or teeth surface, it starts reflected due to difference in acoustic impedance. A transducer probe of 4 mm diameter is moistened with saliva and applied to the measurement site with slight pressure to produce acoustic coupling. By timing the received echo with respect to transmission of pulse, thickness is determined within seconds and is digitally displayed with a resolution of 0.1 mm.[21] Lang and Loe[4] in 1972 reported a study on the relationship between the gingival width and inflammation, in an effort to determine the adequate amount.

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

Keratinized Attached Gingiva around Implants: The need for keratinized gingiva around dental implant is more controversial. Absence of keratinized mucosa increases the susceptibility 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 fiber run parallel to surface of the implant.[21] Schrodder and Listgartan[2] in 1997 suggested that mobile mucosa may disrupt the implant epithelial attachment zone and contribute to an increased risk of inflammation from plaque. Hygiene aids are more comfortable to use within the keratinized tissue as it's more resistant to abrasion.

Adibrad *et al.*[22] said that there is a significant influence of width of keratinized mucosa on health of the peri-implant tissues. 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. Schroeder and Listgartan [2] 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*.[23] said that attached mucosa is necessary to prevent movement of mucosa around an exposed cover screw from inflecting trauma upon marginal soft tissue. Meffert *et al.*[24] prefer to obtain keratinized tissue before implant placement.

Biological Width (Currently known as Supracrestal Attached Tissue)

The concept of biologic width was initiated by Gargiulo *et al.*[25] in 1961, who reported certain uniformity in the dimensions of some components of the periodontium which forms the biologic width. "Biologic Width" is defined as the junctional epithelium and supracrestal connective tissue attachment surrounding every tooth.[26] In 1977, Ingber *et al.* described biological width and credited D.Walter Cohen for first coining the term.[27] With the cadaveric studies, Gargiulo *et al.* concluded the following mean dimensions i.e., they measured the dentogingival components of 287 teeth from 30 cadavers and found that there is a definite proportion between the sulcus depth, the epithelial attachment, the connective tissue attachment and the alveolar crest. They established :

- the mean sulcular depth as 0.69 mm,
- junctional epithelium as 0.97 mm (range between 0.71 to 1.35 mm) and
- the mean of supraalveolar connective tissue attachment as 1.07 mm (1.06 - 1.08 mm).
- the total width of junctional epithelium and supraalveolar connective tissue attachment

which forms the biologic width is 0.97 + 1.07 = 2.04 mm.

- the dimensions of periodontium are not constant and it varies from tooth to tooth and with each aspect of a tooth. It depends on the location of tooth within the alveolus.
- the biologic width is essential for preservation of periodontal health and removal of irritation that might damage the periodontium.

Evaluation of Biological Width

Clinical method: If a patient experiences tissue discomfort when the restoration margin levels are being assessed with a periodontal probe, it is a good indication that the margin extends into the attachment and that a biologic width violation has occurred. The signs of biologic width violation are: Chronic progressive gingival inflammation around the restoration, bleeding on probing, localized gingival hyperplasia with minimal bone loss, gingival recession, pocket formation, clinical attachment loss and alveolar bone loss. Gingival hyperplasia is most frequently found in altered passive eruption and subgingivally placed restoration margins.[28]

Bone Sounding/Transgingival Probing: The most important diagnostic method is bone sounding, which is done by probing under local anesthesia to bone level. Biologic width is assessed by subtracting the sulcular depth from the resulting bone sounding measurement. If this distance is less than 2 mm, then a violation of biologic width can be diagnosed.[29] Kois in 1996, proposed three categories of biological width based on the total dimension of attachment and the sulcus depth following bone sounding measurements. These are normal crest, high crest and low crest.[30,31]

Normal Crest Patient: In the normal crest patients, the mid-facial measurement is 3 mm and the proximal measurement ranges from 3 mm to 4.5 mm. Normal crest occurs approximately 85% of time. In these cases gingiva tends to be stable for a long term.

High Crest Patient: This is an unusual finding in nature and occurs approximately 2% of the time. There is one area where high crest is seen more often, in a proximal surface adjacent to an edentulous site. In the high crest patient, the mid-facial measurement is less than 3 mm.

Low Crest Patient: In the low crest patient group, the mid-facial measurement is greater than 3 mm and the proximal measurement is greater than 4.5 mm. Low crest occur approximately 13% of the time. Traditionally a low crest patient has been described as more susceptible to recession secondary to the placement of an intracrevicular crown margin.

Radiographic Evaluation: Radiographic interpretation is also used to identify interproximal violations of biological width. However, on the mesiofacial and distofacial line angles of teeth, radiographs are not diagnostic because of tooth superimposition. A new radiographic technique called parallel profile radiographic technique (PPR) is used to measure the dimensions of the dental gingival unit (DGU). This technique could measure both the length and the thickness of the DGU with accuracy, as it is simple, concise, non-invasive, and a reproducible method.[27]

Violation of the Biological Width

The biological width forms a biologic seal around the neck of the tooth that acts as a barrier to help prevent migration of microorganisms and their products into the underlying gingival connective tissue and supporting alveolar bone. Each zone is approximately 1 mm wide and together they extend from the base of the gingival crevice to the osseous crest. The extension of restorative margin apical to the base of the histologic crevice will violate the biologic width resulting in inflammation, loss of connective tissue attachment and apical migration of the marginal attachment apparatus.[29,32]

Correction of Biologic Width Violation

Biologic width violation can be corrected surgically or orthodontically. Surgical correction is aimed at removing the bone away from the restorative margin while in orthodontic correction; the tooth is moved coronally away from the bone. Surgical correction is done by gingivectomy, apically repositioned flap with or without ostectomy. Orthodontic correction is

done either by slow eruption or forced eruption with supracrestal fibrotomy.[29]

Mucogingival Problems

Periodontal defects are becoming a great concern for patients. The main goal of periodontal therapy is to improve periodontal health and thereby to maintain a patient's functional dentition right through his/her life. However, aesthetics symbolize an inseparable part of today's oral therapy, and numerous procedures have been proposed to preserve or enhance patient aesthetics. The term mucogingival is defined as "a generic term used to describe the mucogingival junction and its relationship to the gingiva, alveolar mucosa, frenula, muscle attachments, vestibular fornices and floor of the mouth."[3]

Classification of Mucogingival deformities[33]

Mucogingival deformities can be divided into 3 main categories:

1. Soft tissue deformities associated with teeth

2. Soft tissue deformities associated with implants

3. Soft tissue deformities associated with edentulous ridges

Mucogingival surgery

The term "mucogingival surgery" was introduced in the periodontal literature in the 1950 by Friedman and was at that time defined as "surgical procedures designed to preserve gingiva, remove aberrant frenulum or muscle attachments, and increase the depth of the vestibule."[34] Later, it has been suggested that the term "periodontal plastic surgery", proposed by Miller[35] in 1993, may be more appropriate, since mucogingival surgery has moved beyond the traditional treatment of problems associated with the amount of gingiva and recession type defects to also include periodontal prosthetic corrections, crown lengthening, ridge augmentation, esthetic surgical corrections, coverage of the denuded root surface, reconstruction of papillae, esthetic surgical correction around implants and surgical exposure of unerupted teeth for orthodontics.

Periodontal plastic surgery would be defined as "surgical procedures performed to correct or eliminate anatomic, developmental, or traumatic deformities of the gingiva or alveolar mucosa."[35]

Goals of Mucogingival Therapy

An increased width of gingiva i.e., the distance between the soft tissue margin and the mucogingival line, independent of the number of millimetres, is considered as a successful outcome of augmentation procedures.[36]

- **Root coverage:** The assessment of amount of recession by measuring the distance between the cemento-enamel junction (CEJ) and the soft tissue margin (in mm) along with the reduction in root sensitivity gives the primary outcome variable for the therapeutic endpoint of success.
- **Vestibular sulcus extension**: creation of vestibular depth, i.e. distance from the gingival margin to the bottom of the vestibule, when it is lacking is another objective of mucogingival surgery. Gingival recession displaces gingival margin apically, thus reducing vestibular depth which jeopardizes proper oral hygiene maintenance and prosthesis retention.
- **Improved esthetics**: It is one of the major indications for mucogingival surgery. The recession of the facial, gingival margin which alters the proper gingival symmetry; presence of black triangle because of missing interdental papilla; gummy smile due to presence of excessive amount of gingiva, all results in esthetic problems.

Gingival Recession

Gingival recession is the apical migration of gingival margin to the cementoenamel junction (CEJ). The distance between the CEJ and gingival margin gives the level of recession. Since the soft tissue margin may not always be composed of gingiva, the terms "soft tissue recession" and "marginal tissue recession" are also commonly used. It can appear in its localized or generalized form. Although it rarely results in tooth loss, marginal tissue recession is associated with thermal and tactile sensitivity, esthetic complaints, and a tendency toward root caries. It is even frequent in developed countries with very effective dental plaque control. Regarding its

etiology, its causes can be divided into predisposing factors and precipitating factors.[37,38]

- Predisposing factors include: High Frenal Attachment, normal band of attached gingiva, Dentoskeletal disharmony, Bone dehiscences and fenestrations, Position of the Tooth, Periodontal biotype.
- Precipitating factors include: Calculus, Tooth Brushing, Tooth Movement by Orthodontic Forces, Improperly Designed Partial Dentures, Smoking, restorations, Chemicals.
- Predisposing factors affect the position and stability of the gingival or mucosal margin and precipitating factors affect predisposing factors causing periodontal or peri-implant recession.[37]

Periodontal Approach to Esthetic Dentistry

'Aesthetics' means "the science which treats the conditions of sensuous perception". Today cosmetic concerns as well as increased intra-oral awareness have created a demand for esthetics in periodontal practice. Esthetic improvements are the primary indication for performing periodontal plastic and soft tissue reconstruction surgery.[39] A sound periodontium provides a firm foundation for an esthetic and functional prosthesis.

The maxillary anterior area in a patient with a high lip line presents a visible area in which patients are concerned with the esthetic appearance of the gingival tissues. This area is addressed as the "esthetic zone," which requires special consideration in restorative, periodontal, and implant therapy. The symmetry of the facial gingival margin from canine to canine is altered with the recession of the gingival margin, the loss of the interdental papilla, or if there is excessive amount of gingival tissue creating a "gummy smile."[33]

Esthetic Smile

Any changes in the pre-existing "Lip-Gingival-tooth" relationship was thought to require orthodontic therapy in conjunction with orthognathic surgery or aggressive periodontal procedures.[40] However, with the advent of soft tissue plastic surgery, much of this has changed. The essentials of a smile involve: the teeth, the gingival scaffold, the lip framework.[41] Lip lines can be classified as high, medium or low, depending on relation of inferior border of lip with gingiva and teeth.[39]

1. High lip line: shows a large exposure of the gingiva extending from the inferior border of the upper lip to the free gingival margin.
2. Medium lip line: shows a nominal exposure of 1-3 mm of the gingiva from the apical extent of the free gingival margin to the inferior border of the upper lip.
3. Low lip line: only a portion of the teeth are exposed below the inferior border of the upper lip.

The Gummy Smile

Excessive gingival display (EGD) associated with incompetence of lips, increased incisal show and gummy smile is probably the greatest esthetic concern for patients (Table: 1). With the increase in patients' esthetic expectations, EGD could have an adverse emotional and psychosocial impact.[42]

Table 1 : Etiological factors of gummy smile[42]

Skeletal	Vertical maxillary excess Rotation of the maxilla
Dental	Short clinical crown Extruded incisors Loss of torque on the anteriors Normal compensation of class II malocclusion
Soft tissue	Morphologically short upper lip Hypermobile lip
Periodontal	Delay in the migration of the gingiva Gingival hyperplasia

Soft Tissue around Implants

Soft tissue management around dental implants is one of the foremost considerations for the long term survival of dental implants. The maintenance of stability and function of an implant is dependent on a well-functioning barrier mechanism established at the transmucosal passage of the implant.[43]

Restoration of lost function, aesthetics, and harmony of dentition is the primary intention of

implantology. It is achieved with a sound crestal bone stability and healthy periimplant soft tissue. The presence of an adequate zone of keratinized mucosa was thought to be necessary for the maintenance of gingival health and prevention of periodontal disease progression. The absence of keratinized gingiva may be a risk factor for developing recession or periimplantitis. Lang and Loe[4] suggested a width of atleast 2 mm of keratinized mucosa, of which 1mm was to be attached. However, there is still ambiguity in the need for keratinized gingiva around dental implants. Periimplant soft tissue acts as a transmucosal seal. It resists recession and enhances an ideal aesthetic blending, and provides a prosthetic-friendly environment to withstand the mechanical challenge and appropriate contours for a self-cleansing environment.

Factors Effecting Long Term Functional and Esthetic Stability around Teeth and Implants

1. Biotype, thickness of facial bone
2. Existence and shape of interdental papilla, level of proximal bone
3. Thickness and width of keratinized gingiva, maintained bone surrounding
4. Depth of the vestibule
5. Contour and proximal height of the periodontium of neighbouring teeth
6. Shape and positioning of the teeth: "emergence profile" There is an obvious need to achieve tooth-like harmonious pink and white esthetics via implant borne restorations.

Biology of Peri-implant Soft Tissue

The interface between the implant and the mucosa comprises an epithelial tissue component and a connective tissue component. The epithelial part is called barrier epithelium and resembles the junctional epithelium around the teeth. It was reported that basal lamina and hemidesmosomes occurred 2 weeks after implant placement.[44,45]

Functional similarities exist between the gingival mucosa and periimplant mucosa. Collagen type I is the main constituent part of the supracrestal connective tissue of the periimplant mucosa; type V is also found in higher amounts in periimplant tissues. Supracrestal fibers are oriented in a parallel rather than a perpendicular configuration. This creates much weaker mechanical attachment compared to natural teeth. In addition, Berglundh and Lindhe[43] suggested that the ability of the peri-implant mucosa to regenerate itself is limited by its compromised number of cells and poor vascularity.

The Peri-implant Soft Tissue Health: As compared to periodontal tissues, peri-implant tissues are vulnerable to mucosal inflammation and bone loss. The long-term success of the implant is strongly determined by the peri-implant soft tissue integrity. Soft tissue health around implants is primarily governed by the peri-implant marginal bone and the peri-implant papilla. A minimum of 3 mm of the interimplant distance should be maintained to avoid crestal bone loss and subsequent necrosis of the papilla. Marginal gingiva is influenced by: Periodontal biotype, width of the facial bone, microstructure/ macrostructure of the neck of the implant, microstructure of implant- abutment connection, abutment material and design, interimplant distance, implant abutment junction, abutment disconnection (one-stage or two-stage), and surgical technique adopted. The gingival biotype is a diagnostic key for the esthetic success of implants. According to Abraham *et al.*[46] thick gingival tissue (more than 2.5 mm) can significantly prevent crestal bone loss around implants. In 1996, Berglundh & Lindhe[43] stated that thin gingival tissue may lead to marginal bone loss during the formation of biologic width around implants.

Significance of Keratinized tissue around Implants

An adequately keratinized zone of masticatory mucosa for maintaining gingival health around implants supporting overdentures is defined as ≥2 mm of masticatory gingiva with ≥1 mm of attached gingiva.[47]

Lack of keratinized tissue and vestibular depth leads the periimplant mucosa in close proximity to the muscular attachment fibers. The contraction of muscle will pull these fibers away, resulting in a break in the seal. The transmucosal extensions of the implants may trap food boluses

since there is shallow vestibule and lead to inflammation of the tissues. Soft tissue remodeling occurs after implant placement. An apical displacement of the facial mucosa by 0.6 mm occurs within the first 6 months, with relatively little change thereafter.[48] Thus, in situations, which require an appropriate dimension of keratinized tissue, soft tissue augmentation should be contemplated.

CONCLUSION

The gingival tissues, with their specialized relationship to the tooth surface, constitute the major peripheral defence against microbial infections that may lead to periodontal disease. It can be concluded that the gingiva can act both as a protective barrier as well as harbinger of bad news by recruiting neutrophils to the site to help battle the accumulating bacteria and by producing cytokines and adhesion molecules, which upregulates the underlying developing inflammatory response, respectively. Gingival biotype is concerned with the particular pattern and thickness of gingival tissue around the teeth and is of greatest concern in aesthetic reconstructive dentistry, particularly affecting the successful outcome of dental implant placement, periodontal surgeries such as root coverage and ridge augmentation procedures.

The preservation and reconstruction of soft tissue around dental implants is an integral component of dental implantology. It has been proposed that a sufficient amount of gingival tissue is absolutely essential for maintaining a healthy and favourable periodontium.

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REFERENCES

1. Bartold PM, Walsh LJ, Narayanan AS. Molecular and cell biology of the gingiva. Periodontol 2000 2000; 24: 28-55.
2. Schroeder HE, Listgarten MA. The gingival tissues: the architecture of periodontal protection. Periodontol 2000. 1997; 13: 91–120.
3. The American Academy of Periodontology. Glossary of Periodontal Terms, 3rd ed. Chicago: The American Academy of Periodontology 1992; 32.
4. Lang NP, Loe H. The relationship between the width of keratinized gingiva and gingival health. J Periodontol 1972; 43: 623-7.
5. Manjunath RGS, Rana A, Sarkar A. Gingival Biotype assessment in a healthy periodontium: Transgingival Probing Method. J Clin Diagn Res 2015; 9: 66-9.
6. Ochsenbein C, Ross S. A reevaluation of osseous surgery. Dent Clin North Am 1969; 13: 87-102.
7. Seibert JL, Lindhe J. Esthetics and periodontal therapy. In: Lindhe J, ed. Textbook of Clinical Periodontology, 2nd ed. Copenhangen, Denmark: Munksgaard; 1989:477-514.
8. Claffey N, Shanley D. Relationship of gingival thickness and bleeding to loss of probing attachment in shallow sites following non-surgical periodontal therapy. J Clin Periodontol 1986; 13: 654–7.
9. Joshi N, Agarwal MC, Madan E, Gupta S, Law A. Gingival Biotype and Gingival Bioform: Determining Factors for Periodontal Disease Progression and Treatment Outcome. Int J Sci Stud 2016; 4: 220-5.
10. Abraham S, Deepak KT, Ambilli R, Preeja C, Archana V. Gingival biotype and its clinical significance –A Review. The Saudi J Dent Res 2014; 5: 3–7.
11. De Rouck T, Eghbali R, Collys K, De Bruyn H, Cosyn J. The gingival biotype revisited: transparency of the periodontal probe through the gingival margin as a method to discriminate thin from thick gingiva. J Clin Periodontol 2009; 36: 428-33.
12. Becker W, Ochsenbien C, Tibbetts L, Becker BE. Alveolar bone anatomic profiles as measured from dry skulls Clinical ramifications. J Clin Periodontol 1997; 24: 727–31.
13. Kois JC. Altering gingival levels: The restorative connection. Part. 1: Biologic variables. J Esthet Dent 1994; 6: 3-7.
14. Chen MC, Liao YF, Chan CP, Ku YC, Pan WL, Tu YK. Factors influencing the presence of interproximal dental papillae between maxillary anterior teeth. J Periodontol 2010; 81: 318-24.
15. Olsson M, Lindhe J. Periodontal characteristics in individuals with varying form of the upper central incisors. J Clin Periodontol 1991; 18: 78-82.
16. Chang LC. The association between embrasure morphology and central papilla recession. J Clin Periodontol 2007; 34: 432-6.
17. Esfahrood ZR, Kadkhodazadeh M, Ardakani MRT. Gingival biotype: A Review. Gen Dent 2013; 14-7.
18. Wennstrom J.L. Lindhe J, Sinclair F, Thilander B. Some periodontal tissue reactions to orthodontic

tooth movement in monkeys. J Clin Periodontol 1987; 14:121–9.
19. Bowers. G, M. A study of the width of attached gingiva. J Periodontol 1963; 47: 412-4.
20. Ainamo A: Influence of age on the location of the maxillary Mucogingival Junction. J Periodontal Res 1978; 13:189.
21. Malthi K, Arjun S, Blaisie RM, Dhanesh S. Attached Gingiva: a review. IJSRR 2013; 3: 188 - 98.
22. Adibrad M, Shahabu M, Sahabi M. Significance of the Width of Keratinized mucosa on the health status of the supporting tissue around implants Supporting overdentures. J Oral Implantol 2009; 35(5):232-7.
23. Adell R, Lekholm U, Rockler B, Branemark PI, Lindhe J, Eriksson B, Sbordone L. Marginal tissue recession at osseointegrated titanium fixture (I).A 3-year longitudinal prospective study. Int J Oral Maxillofacial Surgery 1986; 15: 53-61.
24. Fiorellini JP, Kim DM, Uzel NZ. Anatomy of the Periodontium. In: Carranza's Clinical Periodontology (11th ed.) Philadephia: Saunders, Elsevier Publishing; 2012:12-27.
25. Gargiulo AW: Dimensions and relations of the dento-gingival junction in humans. J Periodontol 1961; 32: 264.
26. Schmidt JC, Sahrmann P, Weiger R, Schmidlin PR, Walter C. Biologic width dimensions – A Systematic Review. J Clin Periodontol 2013; 40: 493–504.
27. Rajendran M, Rao GU, Logarani A, Sudagaran M, Badgujar SR. Biologic Width - Critical Zone for a Healthy Restoration. IOSR- JDMS 2014; 13: 93-8.
28. Jorgic-Srdjak K, Plancak D, Maricevic T, Dragoo MR, Bosnjak A. Periodontal and prosthetic aspect of biological width part I: Violation of biologic width. Acta Stomatol Croat 2000; 34: 195-7.
29. Nugala B, Santosh Kumar BB, Sahitya S, Krishna PM. Biologic width and its importance in periodontal and restorative dentistry. J Conserv Dent 2012; 15: 12-7.
30. Kois JC. The restorative-periodontal interface: Biological parameters. Periodontol 2000 1996; 11: 29-38.
31. Robinson PJ, Vitek RM. The relationship between gingival inflammation and the probe resistance. J Periodontal Res 1975; 14: 239-43.
32. Aishwarya M, Sivaram G. Biologic width: Concept and violation. SRM J Res Dent Sci 2015; 6: 250-6.
33. Takei HH, Scheyer ET, Azzi RR, Allen EP, Han TJ. Periodontal plastic and esthetic surgery. In: Newman MG, Takei HH, Klokkevold PR, Carraza FA, eds. Carranza's Clinical Periodontology, 11 ed. Saunders: St. Louis; 2011.910-29.
34. Friedman N. Mucogingival surgery. Texas Dent J 1957; 75: 358-62.
35. Miller PD. Root coverage grafting for regeneration and aesthetics. Periodontol 2000 1993; 1: 118-27.
36. Wennstrom JL. Mucogingival therapy. Ann Periodontol 1996; 1: 671-701.
37. Srivastava R, Siddiqui ZR, Jhingran R, Bains VK. Double papilla graft with amnion membrane for root coverage of isolated recession. World Journal of Dentistry 2016;7:213-16.
38. Rossy B, Luis, Ferrari R, Shibli J. Treatment of recession and mucogingival defects using connective tissue grafts on teeth and implants. Odontoestomatology 2015; 17: 35-46.
39. Babu S, Adhikari K. Periodontal Approach to Esthetic Dentistry. Pak Oral Dent J 2015; 35: 91-5.
40. Spear FM, Kokich VG, Mathews DP. Interdisciplinary management of anterior dental esthetics. J Am Dent Assoc 2006; 137: 160-9.
41. Garber DA and Salama MA. The aesthetic smile: diagnosis and treatment. Periodontol 2000 1996; 11:18–28.
42. Ambrosio F, Gadalla H, Kapoor N, Neely AL, Kinaia BM. Lip repositioning procedure to correct excessive gingival display: A case report of identical twins. Clin Adv Periodontics 2017; 1-21.
43. Berglundh T, Lindhe J, Ericsson I, Marinello CP, Liljenberg B, Thomsen P. The soft tissue barrier at implants and teeth. Clin Oral Implants Res 1991; 2: 81-90.
44. George JP, Dhir S. Soft tissue and esthetic considerations around implants. J Int Clin Dent Res Organ 2015; 7: 119-31.
45. Listgarten MA, Lai CH. Ultrastructure of the intact interface between an endosseous epoxy resin dental implant and the host tissues. J Biol Buccale 1975; 3: 13-28.
46. Abraham S, Deepak KT, Ambilli R, Preeja C, Archana V. Gingival biotype and its clinical significance –A review. Saudi J Dent Res 2014; 5: 3–7.
47. Chung DM, Oh TJ, Shotwell JL, Misch CE, Wang HL. Signifcance of keratinized mucosa in

maintenance of dental implants with different surfaces. J Periodontol 2006; 77: 1410-20.
48. Cardaropoli G, Lekholm U, Wennström JL. Tissue alterations at implant-supported single-tooth replacements: A 1-year prospective clinical study. Clin Oral Implants Res 2006; 17: 165-71.

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