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Role of Gingival Tissue Biotype in Periodontal Management

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Abstract: *Surgical outcome is largely dependent on the anatomy of the involved area. Gingival architecture whether thin or thick has an influence on the disease progression as well as treatment outcome. This important and yet often neglected anatomical factor needs an emphasizedduring treatment planning as they respond differently to different periodontal and restorative procedures.*
Keywords: *gingival biotype, treatment outcome, periodontal therapy.*

I. Introduction:

Gingival biotype refers to the quality of the soft tissue profile surrounding the teeth. From the factors that may determine successfultreatment, gingival biotype is a great cause of concern, as it has significant impact on the outcome of periodontal surgery and implant placement. Different types of biotypes respond differently to disease process and to surgical and restorative treatments.

Ochsenbein & Ross in 1969 divided gingival anatomy into"*pronounced scalloped*" and the "*flat*" biotype. [1] The teeth associated with flat gingiva are of square shaped with pronounced cervical convexity. The gingiva of such individuals is wide with more volume, the contact areas between the teeth are large and more apically located, and the interdental papillae are short. Teeth associated with scalloped gingiva have slender teeth, tapered crown form, delicate cervical convexity and minute interdental contact areas that are located close to the incisal edge.Subjects with pronounced scalloped gingiva often exhibited more advanced soft tissue recession in the anterior maxilla than subjects with a flat gingiva.[2]The gingival contour closely resembles the contour of the underlying osseous crest. The term periodontal '*biotype*' was used by Seibert & Lindhe, who classified the gingiva as either thin or thick, where thin corresponds to scalloped type and thick to the flat.


1 (a)


1 (b)

Figure 1(a): Thick gingival bio square tooth form and Figure 1(gingival biotype with conical :m andincreased chances of rece

II. Prevalence:

The thicker biotype was observed to be more prevalent in male population with short, wider forms of maxillary central incisors while the females had thinner biotypes and narrow, long form of maxillary central incisors. Among the different age groups, young group had a thicker biotype compared to older group. The mean papillary height was less in subjects with thicker biotypes. [4]

III. Gingival Biotype And Underlying Alveolar Bone:

Kan et al. in 2003 measured the dimensions of the gingiva by bone sounding at the mesio-buccal and disto-buccal aspects of maxillary anterior teeth. Bone sounding determines the distance between the soft tissue margin and the crest of the bone and, hence, provides an estimate that is about 1 mm greater than that obtained in a regular probing pocket depth measurement. The authors reported that thethickness of the gingiva varied between subjects of different gingival biotypes. Thus, the height of the gingiva at the buccal-approximal surfaces in subjects who belonged to the flat biotype was, on average, 4.5 mm, while in subjects belonging to the pronounced scalloped biotype, the corresponding dimension on an average of 3.8 mm was significantly smaller. This indicates that subjects who belong to the flat biotype have more voluminous soft approximal tissues than subjects who belong to the pronounced scalloped biotype.[4]Dehiscence and fenestrations are usual findings in thin underlying bone

Pontoriero and Carnevale in 2001 performed evaluations of the reformation of the gingival unit at the buccal aspect of teeth exposed to crown lengthening procedures using a denudation technique. At the 1-year follow-up examination after surgery the regain of soft tissue – measured from the level of the denuded osseous crest – was greater in patients with a thick biotype than in those with a thin biotype (3.1 mm versus 2.5 mm). No assessment was made of the bone level change that had occurred between the baseline and the follow-up examination. It must, however, be anticipated that some bone resorption had taken place during healing and that the biologic width of the new connective tissue attachment had been re-established coronal to the level of the resected osseous crest.[6]

Gingival Biotype And Position Of Teeth:

The dimensions of the buccal gingiva may also be affected by the bucco–lingual position of the tooth withinthe alveolar process. A change of the tooth position in buccal direction results in reduced dimensions of the buccal gingiva, while an increase is observed following a lingual tooth movement. [7] Müller and Könönen in 2005 demonstrated that most of the variation in gingival thickness was due to the tooth position and that the contribution of subject variability was minimal. [8]

Gingival Biotype And Periodontal Treatment Planning:

The gingival morphology plays an important role in determining the final esthetic outcome. Therefore during treatment planning, it is important to recognize differences in gingival tissue. Different gingival biotypes respond differently to inflammation, restorative, trauma and parafunctional habits.[9]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.[10]The initial gingival thickness is significant as it may predict the outcome of root coverage procedures and restorative treatments.

Gingival Biotype And Treatment Outcome:

The gingival thickness affects the treatment outcome possibly because of the difference in the amount of blood supply to the underlying bone and susceptibility to resorption. [11]Periodontal surgical techniques can significantly improve the tissue quality and treatment outcome. Periodontal surgical techniques can enhance tissue quality resulting in a more favourable treatment outcome. Soft tissuegrafting in areas of thin biotypes can enhance the quality ofthe gingival tissue. The best way to convert a thin soft tissueto a thick biotype is through subepithelial connective tissue grafting. [12] Various other soft tissue augmentation proceduresinclude modified roll technique and use of acellular dermalmatrix.Tissuekeratinization can be improved by oral physiotherapy. Understanding Periodontal biotype is also of importance in orthodontic treatment. Alteration of mucogingival dimensions may occur during orthodontic treatment resulting from proper tooth position within the alveolar bone. It has been demonstrated that the gingival tissue with a little horizontal diameter in the presence of a dental plaque, is more susceptible to apical migration of connective tissue attachment with marginal gingiva especially near teeth under the influenceof orthodontic force. However, in cases with thin gingiva caused by the prominent position of the teeth, there is no need for pre-orthodontic gingival augmentation procedures. The recession and bone dehiscence will decrease when the tooth is moved in amore proper position within the alveolar bone. [13]

Gingival Biotype And Root Coverage:

Thickness of tissues in the recipient site and the donor site are key factors in treating mucogingival defects. In cases involving root coverage procedures, a flap thickness of 0.8-1.2 mm produced more predictable outcomes. An initial gingival thickness was found to be the most predictable factor for predicting the success of complete root coverage procedures.There is a correlation between flap thickness and complete root coverage. [14]A thick tissue has an increased blood supply that will enhance the revascularization of grafts, leading to increased healing and graft incorporation and hence there are more chances of complete root coverage in thick biotype.

Gingival Biotype And Crown Lengthening Procedures:

Thick gingival tissues are more resistant to mucosal recession or mechanical irritation and are capable of creating a barricade to conceal restorative margins. With crown lengthening procedures, it is often difficult to predict the final position of the soft and hard tissues, due to the fact that each time when a flap is reflected, there is at least 0.5–0.8 mm of bone loss. There could be undue gingival recession following surgery. So before placement of permanent restoration in the anterior region a healing period of at least six months is desirable. In an extremely thin gingival tissue, soft tissue grafting is recommended 6–8 weeks prior to surgical crown lengthening to improve the thickness of the keratanized tissue. [15]

IV. Gingival Biotype And Ridge Preservation:

Thick biotypes show greater dimensional stability during remodeling compared to thin biotypes. A thin gingival biotype is associated with a thin alveolar plate. More ridge remodeling has been found in thin biotype when compared with thick periodontal biotype. Ridge preservation should be considered for most thin biotype cases. Preservation of alveolar dimensions such as atraumatic extraction, socket preservation or ridge preservation techniques after tooth extraction is critical for achieving optimal esthetic results in thin biotypes.

Gingival Biotype And Implant Therapy:

Evidence suggests that the percentage of the success rate of immediate implants in anteriors is more inindividuals with thick biotypes. However in patients with thin biotypes the frequency of gingival recession is high following implant restoration. [16] The thicknesses of the crestal bone on the buccal aspect significantly influence remodeling during the initial four month healing period after immediate implant placement. A delayed implant must be considered when there is not enough soft and hard tissue thickness. However immediate implants can be considered with predictable results in thick biotypes.

V. Gingival Biotype And Maxillary Sinus Lining:

Aimetti et al in 2008 took maxillary mucosal biopsies from the sinus floor during otorhinolaringologic surgical interventions, and measured gingivalthickness in the area of the maxillary anterior teeth. The authors reported that the average thickness of the Schneiderian membrane was 0.97 ± 0.36 mm. Patients with thick gingiva had a sinus mucosa that was 1.26 ± 0.14 mm thick, compared to 0.61 ± 0.15 mm thickness among patients with thin gingiva. The results showed that gingival thickness is a reliable factor for predicting sinus membrane thickness. However research on this is still in its infancy. [17]

Methods To Measure Gingival Biotype:

Many Invasive and non-invasive methods have been used to evaluate the thickness of facial gingival and other parts of the masticatory mucosa. The method of assessment of gingival biotype ranges from assessment with periodontal probe, probe transparency visual examination, ultrasonic devices or radiographic methods to conventional histology on cadaver jaws, injection needles, transgingival probing, histologic sections, cephalometric radiographs and Cone beam computed tomography.

Visual Evaluation: Simple visual evaluation is used in clinical practice to identify the gingival biotype; however, it may not be considered a reliable method, as it cannot be used to assess the degree of gingival thickness.

Probe Transparency: The gingival tissue's ability to cover any underlying material's color is necessary for achieving esthetic results, especially in cases of implant and restorative dentistry, where subgingival metal restorations are used widely. Using a metal periodontal probe in the sulcus to evaluate gingival tissue thickness is the simplest way to determine gingival biotype; with a thin biotype, the tip of the probe is visible through the gingiva. This method is minimally invasive and can be performed routinely during periodontalprobing procedures.

Modified Caliper: A tension-free caliper can only be used at the time of surgery and cannot be used for pre-treatment evaluation. A 2010 study by Kan et al of the facial gingival biotype in maxillary anterior teeth compared visual evaluations, the use of a periodontal probe, and direct measurements with a tension-free caliper. The authors reported a statistically significant difference between visual assessment and both the periodontal probe and the tension-free caliper; however, there was no statistically significant difference when comparing the periodontal probe assessment and the tension-free caliper. Based on these results, a periodontal probe in the sulcus is an adequately reliable and objective way to evaluate tissue thickness, whereas visual evaluation of the gingival biotype by itself is not as reliable as the periodontal probe or the tension-free caliper. [18]

Transgingival Probing: Gingival thickness can be measured by using a periodontal probe; however, such measurements can be affected by the precision of the probe, the angulation of the probe, and the distortion of the tissue during probing. [11]

Ultrasonic Devices: A 1971 study by Kydd et al was the first to measure the thickness of palatal mucosa using an ultrasonic device. Ultrasonic devices appear to be the least invasive method and offer excellent validity and reliability. However, such devices are no longer available commercially; in addition, they make it difficult to both determine the correct position for accurate measurement and successfully reproduce measurements.

Cone Beam Computed Tomography (Cbct): CBCT scans have been used extensively for hard tissue imaging because of their superior diagnostic ability. CBCT measurements may be a more objective method than direct measurement. Thickness of alveolar bone plate surrounding the tooth is associated with the type of

biotype. Thick buccal bony plate usually corresponds to thick gingival biotype. Measuring the thickness of bony plate by CBCT can be a non-invasive method for assessing type of gingival biotype.

VI. Conclusion

Different tissue biotypes exhibit different pathological responses when subjected to inflammatory, traumatic or surgical insults as they have different gingival and osseous structures. These different responses, dictate different treatment modalities. The current periodontal surgical techniques have the potential to improve the tissue quality, thereby enhancing the restorative environment. With the knowledge of the nature of tissue biotypes, clinicians can employ appropriate periodontal management to minimize tissue resorption and provide more favourable results after treatment. So by taking into consideration the gingival tissue biotypes during treatment planning, more appropriate strategies for periodontal management may be developed, resulting in more predictable treatment outcomes.

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