Gingival Biotype- It's Significance in Dentistry

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Abstract

This review provides an overview about gingival biotype, its characteristics and various methods available for its determination. In recent years, gingival biotype has become a subject of considerable interest in the era of esthetic-driven dentistry. Gingival biotype is a genetically determined trait that describes the faciopalatal thickness of gingiva. Various methods for measuring biotype have been suggested. Routine dental procedures subject the gingiva to various insults and the biotypes behave differently to it. Therefore, gingival biotype can provide clinicians with an insight into the precautions that are necessary during tissue handling to avoid undesirable treatment outcomes.

Keywords- *Biotype, Gingiva, Probe, TRAN, CBCT, Thick, Thin.*

Introduction

The gingiva is the part of oral mucosa that covers the alveolar processes of jaws and surrounds the neck of teeth. [1] One of the pillars of a beautiful smile is a well scalloped margin at the cemento-enamel junction (CEJ). Most dental procedures inevitably result in handling of gingival tissue. Hence, it is of utmost importance in the era of esthetic-oriented dentistry that clinicians be aware of factors that can influence the esthetic consequence of a procedure. The long term success of esthetic restorations and other dental procedures depend on a number of factors such as gingival biotype, gingival tissue architecture and anterior teeth shape. With the increase in literature on the topic, it is now recognized that under similar clinical conditions different gingival biotypes behave differently. In addition, treatment considerations differ for individuals with different biotypes.

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GINGIVAL BIOTYPES AND THEIR CHARACTERISTICS-

Gingival biotype, a genetically determined trait [2] describes the thickness of gingiva faciopalatally. Several terms such as "gingival" or "periodontal biotype", "morphotype" or "phenotype" have been used by various authors. [3] In the most recent literature, [4] it was referred to as periodontal biotype and overall distinction among different biotypes was said to be based upon anatomic characteristics of components of the masticatory complex, including gingival biotype (which included in its definition gingival thickness and keratinized tissue width), bone morphotype (BM); and tooth dimension.

Thick gingival tissue characterizes thick biotype and is generally related with good periodontal health. It is dense in appearance and has sufficient zone of attached gingiva. Ample evidence indicates that thick tissues withstand trauma and subsequent recession, enable

manipulation of tissue, encourage creeping attachment, enhance esthetics of implants, exhibit less clinical inflammation and also provide predictable surgical outcomes. [5,6,7]

Thin biotype characterizes thin gingival tissues. They are almost translucent and delicate with minimal zone of attached gingiva. Such tissues are highly accentuated suggesting the presence of thin or minimal bone. Evidence suggests that thin gingiva is less resistant to insults that are inflammatory or surgical in nature and more predisposed to gingival recession. [8,9]

Methods to Assess Gingival Biotype-

Many methods for measuring gingival biotype such as direct approach, probe transparency method (TRAN), ultrasonic method, and cone beam computed tomography (CBCT) have been suggested. [3,10] A simple and reliable method in clinical practice would be advantageous to help clinicians modify the treatment plan and produce more predictable results.

i) VISUAL EXAMINATION

A routinely used simple and non-invasive method in clinical practice. Here the tissues are examined visually and evaluated on the basis of the general appearance of gingiva. However, the degree of gingival thickness cannot be assessed by this method. Also the accuracy was found to be low with high inter examiner variation. [11]

ii) DIRECT METHODS

a) TRANSGINGIVAL PROBING-

The thickness of the tissue is determined using a periodontal probe and the biotype is categorized as thick and thin, thick being more tshan 1.5 mm and thin less than 1.5 mm. This method has the advantages of being simple and inexpensive. Disadvantage includes its invasive nature as the procedure requires administration of local anesthesia. [12]

b) ENDODONTIC REAMERS, FILES-

After the gingiva is anesthetized, it is pierced perpendicular to a point lying in the center of gingival margin and mucogingival junction with an endodontic reamer/file with a rubber stop. The measurement is then recorded against a digital caliper. It yields a precise measurement but is invasive in nature. Ronay et al. [13] 2011 stated that such techniques could lead to an increase in local volume and potential patient discomfort due to local anesthesia administration.

c) MODIFIED CALIPER TECHNIQUE-

In 2010 Kan et al. [14] first used a tension-free caliper to measure the gingival thickness of maxillary anterior teeth on the facial aspects. He compared the results with that obtained using a probe and concluded that the two methods did not show any statistically significant difference. Disadvantage of using this caliper is that it cannot be used for pretreatment evaluation and can be used only at the time of surgery.

d) PROBE TRANSPARENCY METHOD-

Sulcus sampling is performed on the midfacial aspect of the tooth. Based on the visibility of the underlying periodontal probe through the gingival tissue, the biotype is defined as thick or thin (probe visible indicates thin biotype and probe not visible indicates thick biotype). (Figures i & ii)

This method was found to be highly reproducible with about 85% intra examiner repeatability for assessment of gingival thickness in a clinical trial of 100 periodontally healthy subjects. The advantages of this method include good accuracy, simple, rapid and minimal invasiveness. [3]

More recently, a color-coded probe (Colorvue® Biotype Probe, Hu-Friedy) has also been used for the purpose of determination of gingival biotype. [15]

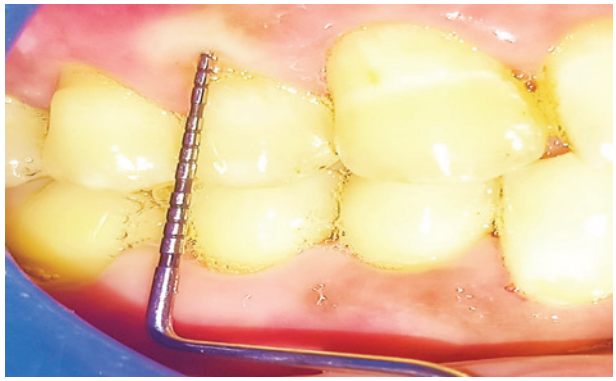

Figure i : A thick gingival biotype

Figure ii : A thin gingival biotype

iii) MODIFIED IWANSON'S WAX GAUGE WITH ATTAsCHED WILLIAM'S PERIODONTAL PROBE CALIBRATED TIP -

A Modified Iwanson's wax gauge with attached William's periodontal probe calibrated tip have also been used for gingival biotype measurement. [16] The method was a combination of TRAN technique and direct measurement. The technique proved to be highly reproducible. The benefits of this method include assessment, biotype categorization, and simultaneous measurement of gingival thickness.

iv) ULTRASONIC METHOD-

This method uses an ultrasonic device to which is attached a sensitive thin probe. It utilizes the concept of pulse echo to determine the thickness of biotype. This method offers precise measurement, digital display, eliminates inter examiner variability and is non-invasive, but it is less feasible due to high cost of equipment and limited availability.[17]

v) CONE BEAM COMPUTED TOMOGRAPHY-

The thickness of both hard and soft tissues can be visualized and measured using CBCT. Highly accurate results can be achieved using this method. Also there is no inter examiner variability. Limitations include exposure to radiation and increased costs for patients. [18]

CLINICAL IMPLICATIONS OF GINGIVAL BIOTYPE-

The two biotypes respond differently when subjected to clinical/surgical insults. In an event of inflammation or any other type of insult, soft tissues in a thick biotype responds by more fibrotic changes and pocket formation, however in thin biotype, more inflammatory changes and recession of gingiva are observed. [19]

Gingival biotype and periodontal reconstructive surgeries-

The effectiveness of esthetic reconstructive surgery showed a strong correlation with gingival biotype. At the surgical site, thickness of gingival tissue acts as a primary determinant of the effectiveness of treating mucogingival defects. A flap thickness of 0.8-1.2 mm was found to be associated with a more predictable prognosis. Also, flap margins can be inadvertently thinned, thus increasing the risk of post-operative recession, especially in thinner tissues. [20] Therefore, clinicians must handle flaps carefully in such situations to avoid unesthetic or undesirable results. Patients with thinner biotype can ideally be treated with connective tissue graft technique combined with a coronally advanced flap that will produce a pseudo-thick biotype. [21]

Crown lengthening procedures –

Determination of biotype is an important factor to be considered during crown lengthening procedures. Following full thickness flap procedures, there is bone resorption of 0.5-0.8 mm. [12] Hence, it is difficult to predict the final hard and soft tissue position. This could cause undue chances of gingival recession after the completion of procedure specially in thin biotype. Permanent restorations are recommended after a healing period of 6 months specially in anterior esthetic region. Tissue thickness may be improved by soft tissue grafting 6-8 weeks prior to crown lengthening procedures. [22]

Prosthodontic perspective-

Thin periodontal biotypes being friable, the possibility of recession increases after crown preparation. Over contoured restorations particularly lead to gingival recession. It is advisable to position the margins of prepared restorations supragingivally in thin biotype cases. Failing to do so especially in PFM restorations may cause a grayish hue of the restorative margin to be visible through the thin and translucent gingival tissues,

ultimately compromising esthetics specially in anterior esthetic regions. Thicker biotype has greater resistance to tissue recession and can better mask the margins of restorations that are even placed subgingivally. [6]

Care must be taken in thin biotypes to prevent soft tissue injury during placement of retraction cords. Thin cords are usually advised for retraction. More chances of recession exist if cord is kept for more than 15 minutes. Gingival retraction can be carried out more easily in a thick biotype. [6]

Implant dentistry-

Thick tissues are preferred around dental implants as they conceal titanium of implants better and also are more accommodating to different implant positions. [23,24] Significantly less bone resorption is seen in thick biotypes after implant placement compared to thin biotypes. Hence, an immediate implant placement can be considered in thick biotype with predictable outcomes as it can help to preserve the osseous structures. [25,26] However, a delayed implant placement is preferable when thickness of surrounding tissue is not sufficient. Additional hard tissue augmentation using various bone grafts and soft tissue augmentation using modified roll technique, split finger technique and acellular dermal matrix may be required in such cases to achieve the best esthetic outcomes. [27-29]

Preventing alveolar bone loss after teeth extraction is equally important in ensuring success of implants. Thin biotype is associated with thin alveolar plate and hence undergoes more ridge remodeling in contrast to thick biotype associated with thick alveolar plate. [30] Therefore, the placement of grafts and membranes in the socket can minimize alveolar bone loss after tooth extraction.

Orthodontic Perspective-

Understanding gingival biotype is also important in the field of orthodontics. Perforation of cortical plate may occur during orthodontic treatment especially in thin biotype leading to soft tissue recession and exposure of root. [31]

Therefore, non- surgical periodontal therapy and/ or surgical correction of soft or hard tissue defects using membranes and grafts may be required to prevent breakdown of periodontal tissues during orthodontic phase. These procedures can be carried out before or during orthodontic therapy to modify thin periodontal tissues to pseudo thick type thereby avoiding tissue collapse. In cases of malaligned tooth leading to thin gingiva, pre orthodontic soft tissue augmentation procedures are not needed. [32]

Oral surgery-

In comparison to thin biotypes, thick biotypes are associated with minimal ridge atrophy after extraction. Excessive force can lead to fracture of buccal alveolar plate in thin biotype resulting in bone resorption and unpredictable bone healing. [33]

METHODS TO ENHANCE GINGIVAL BIOTYPE-

A thin gingival biotype can inhibit desired esthetic outcome of many therapies. In such scenarios, gingival biotype can be enhanced. When a thin biotype is surgically converted to a thick one, it is termed as "pseudo-thick gingiva". This can be done to achieve more stable results that is functionally and esthetically acceptable. Procedures that can be performed to enhance gingival biotype include-

1) Connective tissue grafts [34] that is harvested from palate or tuberosity and then placed subepithelially at the thin biotype site. It is the most reliable and frequently documented method of enhancing gingival biotype.

2) As an alternate to connective tissue, acellular dermal matrix can also be used. The procedure of matrix placement and healing mechanism is similar to that of connective tissue grafts.

3) Placement of platelet rich fibrin membrane (PRF)- Platelets release several growth factors such as platelet-derived growth factors and endothelial growth factor. [35]

4) Recently, fetal membranes such as amnion and chorion membranes have been used to enhance gingival biotype. [36] These membranes are allografts derived from human placenta. They can be placed under a tunnel/ pouch/coronally advanced flap and sutured.

Conclusion

Gingival biotype can dictate the diagnosis and treatment planning in patients as they behave differently when exposed to inflammation, trauma or surgical insults. Present day periodontal surgical techniques have provided the scope of improving tissue quality that can augment the restorative environment. Therefore, biotype assessment in routine examination of patients can provide clinicians with an insight into the precautions necessary during tissue handling. Also, biotype when considered during inter- and multi-disciplinary treatment approaches can aid in avoiding undesirable treatment outcomes.

Ethical Clearance- Individual consent was taken from patients for the photographs.

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