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Research Paper

Gingival Biotypes

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ABSTRACT:- Gingival biotype is the thickness of the gingiva in the facio-palatal dimension. It has a significant impact on the outcome of restorative, regenerative and implant therapy. Since tissue biotypes have different gingival and osseous architectures, they exhibit different pathological responses when subjected to inflammatory, traumatic or surgical insults. These different responses, dictate different treatment modalities. Hence in clinical practice, identification of the gingival biotype is important. This review article highlights the general aspects of gingival biotypes, methods to assess gingival thickness and its clinical significance.

Keywords:- gingival biotype, gingival thickness, osseous architecture

I. INTRODUCTION

Gingival biotype is one of the factors that influence successful dental treatment by its effects on the outcomes of periodontal therapy, root coverage procedures, and implant placement. Different tissue biotypes respond differently to inflammation and to surgical and restorative treatment; thus, it is crucial to identify tissue biotype before treatment.

This article reviews the characteristics and significance of various gingival biotypes and the many ways to determine them.

II. TYPES

In 1969, Oschenbein and Ross indicated that there were two main types of gingival anatomy— flat gingiva, that was associated with a square tooth form; and highly scalloped gingiva, that was associated with a tapered tooth form.[1]It was also proposed that the gingival contour closely mimics the contour of the underlying alveolar bone. The term periodontal biotype was used later by Seibert and Lindhe, who classified the gingiva as either thin-scalloped or thick-flat.[2] In a study by De Rouck et al, 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.[3]Studies have confirmed that central incisors with a narrow crown form are at greater risk of recession than incisors with a wide, square form.[4,5] According to the literature, the alveolar bone and the gingival margin surrounding a tooth with pronounced cervical convexity are located more apically than they would be in teeth with flat surfaces, suggesting that the gingival margin is affected by the cervical convexity of the crown.[6,7]

Kois introduced in 1994 a classification system for the periodontal biotype in relation to the restorative margin. He took the cemento–enamel junction (CEJ) and the bone crest into consideration and defined three categories (high, normal and low crest). The restorative treatment outcome in each of these three crest positions is suggested to be strongly related to the gingival and alveolar crest form.[8]

Characteristics of Gingival Biotypes:

The following characteristics have been assigned to each biotype. (Oschenbein and Ross, 1969)

THIN AND SCALLOPED	THICK AND FLAT
Delicate thin periodontium	Thick heavy periodontium
Highly scalloped gingival tissue	Flat gingival contour
Usually slight gingival recession	Gingival margins usually coronal to the cementoenamel junction
Highly scalloped osseous contours	Thick, flat osseous contour
Minimum zones of keratinized gingiva	Wide zone of keratinized gingiva
Small incisal contact areas	Broad apical contact areas
Triangular anatomic crowns	Square anatomic crowns
Insult results in recession	Insult results in pocket depth or rebundant tissue
Subtle diminutive convexities in cervical third of the facial surface	Bulbous convexities in cervical third of the facial surface

Thin and scalloped

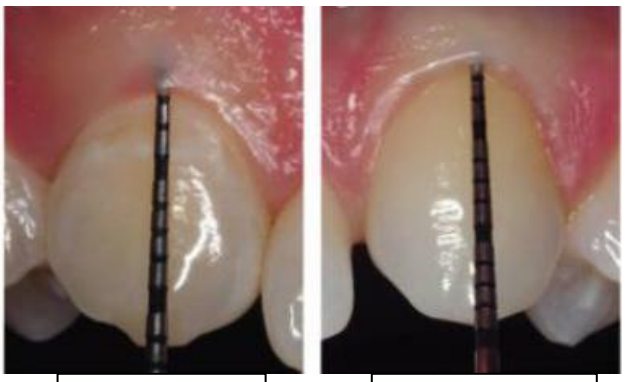
Thick and flat

Gingival Biotype Assessment:

Many methods (both invasive and non-invasive) have been used to evaluate the thickness of the gingiva. These methods include conventional histology on cadaver jaws, injection needles, transgingival probing, histologic sections, cephalometric radiographs, probe transparency, ultrasonic devices and CBCT.

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.[1,2,5]

Probe transparency- The gingival tissue's ability to cover any underlying material's colour is necessary for achieving esthetic results, especially in cases of implant and restorative dentistry. The most commonly used method for determining biotype is placement of a probe within the gingival sulcus and evaluating for probe visibility. If the probe can be seen through the gingival tissue, the biotype is classified as thin. Conversely, if the probe cannot be seen through the gingival tissue, the biotype is classified as thick.



Thin biotype

Thick biotype

Modified caliper- A tension-free caliper can only be used at the time of surgery and cannot be used for pre-treatment evaluation.

Transgingival probing- In this method tissue thickness is measured using a periodontal probe. When the thickness is greater than 1.5mm, it was categorized as thick biotype and if less than 1.5 mm, it was considered as thin. This method although simple and non–invasive, has inherent limitations such as precision of the probe during probing, which is to the nearest 0.5mm, the angulation of the probe during probing and distortion of tissue during probing.[9]

Ultrasonic devices- A 1971 study by Kydd et al was the first to measure the thickness of palatal mucosa using an ultrasonic device.[10]These devices appear to offer excellent validity and reliability.

Cone beam computed tomography- CBCT scans have been used extensively for hard tissue imaging because of their superior diagnostic ability. In contrast to transgingival probing and the ultrasonic device, CBCT method provides an image of the tooth, gingiva and other periodontal structures. Moreover, measurements can be repeatedly taken at different times with the same image obtained by soft tissue CBCT which is not feasible by other methods.

Advantages and disadvantages of various techniques

Technique	Advantages	Disadvantages
Visual inspection	Simple, straightforward, noninvasive, and inexpensive	Subjective and highly variable
Transgingival probing	Simple, straightforward, and inexpensive	Invasive; requires local anesthesia; and affected by probe diameter, angulation, probing force, and distortion of gingival tissues
Probe transparency	Simple, straightforward, and inexpensive	Subjective and invasive
Ultrasonic device	Simple, straightforward, and noninvasive	Additional cost involved, large probe diameter may hinder its use in areas of limited access, accuracy might be affected by moisture
CBCT imaging	Noninvasive, can provide quantitative measurements, images can be manipulated for better visualization of the hard and soft tissues	Expensive, requires technical expertise, and higher radiation exposure compared to conventional radiographs

III. CLINICAL SIGNIFICANCE

Periodontal biotype assessment is an important element in the diagnostic and prognostic phases of treatment. The influence of gingival thickness has been documented in various applications, including non-surgical periodontal therapy, mucogingival therapy, guided tissue regeneration (GTR), crown lengthening, and implant dentistry.

- Patients with gingiva <1.5 mm thick, lost attachment after non-surgical periodontal therapy, whereas sites with gingiva ≥2 mm thick demonstrated no attachment loss.[11]
- In root coverage procedures, a thicker flap was associated with a more predictable prognosis. Gingival thickness ≥0.8 mm was associated with 100% root coverage with a coronally advanced flap.[12]
- Less post-treatment recession was observed after GTR procedures with tissue thickness >1 mm compared with sites <1 mm.[13] A systematic review and meta-analysis suggested a correlation between a critical gingival thickness threshold of >1.1 mm and complete root coverage after connective tissue grafting and GTR procedures.[14]
- A thicker biotype has been correlated with greater tissue rebound after surgical crown lengthening as compared to a thin gingival biotype.[15,16]
- Thin periodontal biotypes are associated with slightly greater buccal marginal tissue recession around implants compared with thick biotypes.[17,18]Spray et al documented that, as buccal bone thickness approached 1.8 to 2.0 mm, bone loss decreased significantly and evidence of bone gain after implant placement was seen.[19]Huang et al (2005) reported that implant sites with thin mucosa were prone to angular bone defects, while stable crestal bone was maintained in implants surrounded by thick mucosa. Gingival recession is one of the most common complications resulting from single anterior tooth implant placement.[20] Hence gingival biotype is a diagnostic key for predicting the esthetic success of an implant.
- Mucogingival problems may result from orthodontic movement of teeth away from the alveolar process, particularly among patients with thin periodontium. It was found that the bucco-lingual thickness determines gingival recession and attachment loss at sites with gingivitis during orthodontic treatment.

- For patients with a thin gingival biotype, extreme care should be taken during extraction to prevent labial plate fracture. According to Fu et al, the thickness of the labial gingival tissue has a moderate association with the underlying bone.[21] Preservation of alveolar dimensions (such as socket preservation or ridge preservation techniques after tooth extraction) is critical for achieving optimal esthetic results in thin biotypes; atraumatic extraction also may be necessary.

IV. CONCLUSION

Since tissue biotypes have different gingival and osseous architectures, they exhibit different pathological responses when subjected to inflammatory, traumatic or surgical insults. These different responses, dictate different treatment modalities. Also new technologies, for assessment of periodontal biotype have opened new avenues to clinicians for accurate and predictable diagnosis, planning and treatment in a multidisciplinary patient based approach. The clinician has to carefully weigh the pros and cons of each modality and choose particular technique accordingly.

The morphologic characteristics of the gingiva depends on several factors, like the dimension of the alveolar process, the form of the teeth, events that occur during tooth eruption, and the position of the fully erupted teeth. The current periodontal surgical techniques have the potential to improve the tissue quality, thereby enhancing the restorative environment. So by understanding the nature of tissue biotypes, clinicians can employ appropriate periodontal management to minimize alveolar resorption and provide more favourable results after dental treatment.

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