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'Gingival/Soft Tissue Biotype'- Its Entreaty in Prosthodontics- A Narrative Review.

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INTRODUCTION:

Gingival biotype refers to the thickness and morphology of the gingival tissue surrounding the teeth. The normal scalloped gingival line at the cemento-enamel junction is part of an esthetic smile.[1] When planning treatment, the soft tissue biotype should be considered because it affects the final treatment outcome. Gingival biotype, also known as soft tissue biotype, has been used to describe the thickness of the gingiva in the palatal dimension.[2].

Gingival biotype is one of the important factors influencing the indications and outcomes of various periodontal, restorative, surgical, and implant treatments. Thin gingival biotypes respond differently to thick gingival biotypes. The term periodontal biotype was later introduced by Seibert and Lindhe in 1989 to divide gingiva into "thick and flat" and "thin and scalloped" biotypes. Soft tissue thickness and contour are important diagnostic factors influencing the esthetic outcome of implant restorations.[4].

Types of tissue biotype:

The Gingival Biotype are A).Thick and B).Thin types.

1).In 1986, Claffey N and Shanley D, and in 1989, Seibert JL and Lindhe J, suggested classifications, basing on the thickness of gingiva. if the gingival thickness is ≥2 mm, as thick gingival type and the thickness of gingiva is <1.5 mm as thin type of biotype.[5]

2). In 2010, Fu JH et al., basing on the relationship of tissue biotype and underlying bone in to thick and thin types. Thick biotype, if probe not seen through gingiva, whereas if the probe seen through gingiva is thin type of biotype. [6]

A. Thick Gingival Biotype Characteristics: [2, 7]

1. Flat soft tissue and relatively thick bone structure, 2. Thick and heavy periodontium, 3. Gingival margin usually located above ECJ, 4. Large keratinized gingival area with flat gingival margin, 5. 6. Large apical contact area in anatomically square teeth and crowns. 7. Mainly related to periodontal health. 8. Dense tissue with large area of attached gingiva. 9. The underlying bone shape is thick.

Tissue response to thick biotype:

* Inflammation:

a). Soft tissues: This results in marginal inflammation, cyanosis, bleeding on probing, and edema/fibrotic changes.

b).Hard tissues: bone loss with pocket/defect formation in the bone is observed.

*Surgery: soft and hard tissue contours can be predicted after healing.

*Extraction: minimal atrophy has been reported. In dense biotype environments, immediate implant placement may be considered with predictable results.[8] Immediate implant placement may help preserve bone structure.[9]To achieve the best aesthetic results, soft and hard tissue augmentation should be performed simultaneously in addition to immediate implant placement. Data suggest that the success rate of immediate anterior implant placement is higher in individuals with dense biotypes.[10].

Thick biotypes exhibit greater dimensional stability during remodelling than thin biotypes. It has been hypothesized that in thick biotypes, the presence of laminar bone adjacent to the outer cortical plate provides the basis for metabolic support of the cortical bone and thus its stability and strength.[11]

B. Thin Gingival Biotype Characteristics: [12,13]

1. Severely sloughed gingival tissue may often have mild gingival recession. 2. Firm scalloped bone contour, 3. Thin and thin periodontal tissue, 4. Small incisor contact areas in triangular anatomical teeth and crowns, 5. Tissue appears friable with very little attached gingival area, 6. The soft tissue is prominent and often suggests thin or scanty bone at the labial roots, 7. Demonstrates thin labial bone with increased incidence of fenestrations and fissures.

Tissue response to thin biotype:

* Inflammation:

a. Soft tissue: They have a slight red border and receding gums

b. Hard tissue: This leads to rapid bone loss and soft tissue deterioration.

*Surgery: It is difficult to predict where the tissue will heal and stabilize.

* Tooth extraction: bone loss in the apical and lingual directions. [1,14]

1.Periodontal health: Patients with a thin biotype are more susceptible to gingival recession and periodontitis. Careful management and preventive measures are necessary to maintain periodontal health.

2. Esthetic outcome: Biotype affects the esthetic outcome of dental procedures such as implants, crowns, and veneers. A thin biotype may result in more visible metal margins and less favourable soft tissue contours.

3. Surgical procedure: In periodontal and implant surgery, the biologic type influences the choice of surgical technique and materials. For example, a thick biologic type is more favourable for flapless implant surgery, whereas a thin biologic type may require tissue augmentation procedures.

4. Orthodontics: The biologic type may influence the stability and position of teeth after orthodontic treatment. Thin biotypes may require additional care to avoid recession during and after treatment.[15]

However, in patients with thin biotypes, the frequency of gingival recession after implant restoration is high.[2] In thin biotypes, where stratum bone is scarce or absent, cortical bone may be rapidly resorbed. The long-term stability of the gingival margin around the implant and adjacent teeth will depend on adequate height and thickness of the facial bone.[16].

How to Assess Gingival Biotype:

Very commonly used popular methods include:[11]

A. Bone sounding method

B. Periodontal Probe transparency method

C. Visual examination method

D. Ultrasonic device method

E. CBCT method

A. Bone sounding also known as Direct measurements method:

The gingiva is anesthetized with a topical local anaesthetic gel. A rubber-tipped retractor/probe/endodontic needle is inserted at a point midway between the gingival margin and the mucogingival junction in a perpendicular direction and measurements are recorded with a digital caliper.[17] This method is easy to perform, practical, inexpensive, and accurate. However, it is an invasive technique, requires local anesthesia, is dependent on the angle and accuracy of the probe, and has poor accuracy in assessing tissue thickness.[18].

B. Periodontal Probe transparency method (TRAN):

The periodontal probe is placed in the groove on the middle surface of the tooth and the gingival biotype is classified based on the visibility of the periodontal probe underneath through the gingival tissue. It is considered thick if it is not visible and thin if it is visible. This technique is minimally invasive and highly accurate.[19]

C. Visual examination method:

Visual assessment is a commonly used technique to determine the gingival biotype. In this technique, no instruments are required, and it is quite simple and straightforward as each genotype has its own typical characteristics. In this method, the gingival biotype is clinically assessed based on the general appearance of the gingiva surrounding the teeth. The gingival biotype is considered thick if the gingiva is dense and fibrous, and thin if the gingiva is fragile, friable, and nearly translucent. The advantage of this method is that it is non-invasive.[20]

D. Ultrasonic Device Method:

Ultrasound is a non-invasive diagnostic tool based on the phenomenon of ultrasonic wave distribution, dispersion, and reflection at an interface. Using an ultrasonic device, a cross-section of the measured tissue can be obtained, and the desired length can be estimated. A thin, sensitive probe attached to the ultrasonic device measures the gingival biotype. Advantages include accurate measurement, digital display, avoidance of inter-examiner variability, and non-invasiveness. [21]

E. CBCT method:

This technique is used to measure and visualize hard and soft tissues. With this technique, the results obtained are very accurate without inter-examiner variation. However, radiation exposure, high cost, and the need for expertise make this technique not clinically feasible.[22]

Strategies for Managing Thick Gingival Biotype: [11,23-26]

1. Preoperative assessment and planning:

Comprehensive assessment: Perform a thorough assessment of the periodontal tissues and underlying bone structures. Use diagnostic tools such as CBCT scans for accurate assessment. Patient education: Inform the patient about the characteristics of thick biotypes and the risk of pseudo pockets as well as aesthetic concerns.

2. Surgical Techniques:

Controlled Tissue Reduction: In some cases, controlled tissue reduction may be required to control excess tissue and improve esthetics. Techniques such as gingivectomy or flap surgery may be used. Accuracy in Flap Design: Ensure accurate flap design and management to accommodate thicker tissue without compromising wound healing.

3. Implant Considerations

Accurate Implant Placement: Ensure accurate implant placement to maintain gingival structure and prevent esthetic complications.

Profile management: Carefully manage the implant's appearance profile to achieve a natural-looking result, taking into account thicker tissues.

4. Prosthetic planning:

Prosthetic profile design: Design the prosthetic with an appropriate prosthetic profile to avoid excessive pressure on thick gingival tissues.

Contour adjustment: Adjust the contour of the prosthetic to harmonize with thicker gingival tissues, ensuring a natural appearance.

5. Maintenance and monitoring:

Regular monitoring: Schedule regular check-ups to monitor gum health and ensure that the thickened tissues remain healthy and free of inflammation.

Professional cleanings: Regular professional cleanings are recommended to maintain periodontal health and effectively manage the thickened tissues.

In case of thin biotype, it can be converted or enhanced into thick biotype by following procedures:

1. The use of connective tissue grafts.[27]

2. Acellular dermal matrix can also be used to improve biopattern.

3. The use of platelet-rich fibrin (PRF) membranes. Shetty et al., demonstrated in 2014 that placement of a PRF membrane over the retracted root surface combined with a coronally advanced flap improved gingival thickness.[28]

4. Recently, the use of foetal membranes such as amnion and chorion has been shown to improve gingival biotype.[29]

Strategies for Managing Thin Gingival Biotype:

1. Preoperative assessment and planning:

Comprehensive assessment: perform a thorough examination of the periodontal tissues and bone structure. Use diagnostic tools such as CBCT scans to assess bone and tissue size.

Patient education: Inform patients of the risks associated with thin biotypes, such as increased likelihood of gingival recession and the need for meticulous oral hygiene.

2. Surgical Techniques:

Minimally invasive surgery: Use minimally invasive surgical techniques to reduce trauma to the gingival tissue.

Flap management: Perform specific flap management techniques to minimize tissue damage and ensure better wound healing.

Soft tissue grafting: Consider soft tissue grafting procedures, such as connective tissue grafting or free gingival grafting, to increase tissue thickness and improve stability.

3. Implant considerations:

Implant positioning: Ensure proper implant placement to minimize the risk of recession. Sub crest placement may be beneficial in some cases.

Provisional restorations: Use provisional restorations to shape and contour the gingival tissues prior to placement of the permanent prosthesis.

4. Restoration planning:

Profile design: Carefully design the profile of the restoration to avoid excessive pressure on delicate gingival tissues.

Material selection: Use biocompatible and tissue-friendly materials. Consider using a softer covering material for removable dentures.

5. Post-operative care and maintenance:

Regular follow-up: Schedule regular follow-up visits to monitor the health of the gum tissues and make adjust as needed.

Meticulous oral hygiene: Emphasize the importance of practicing excellent oral hygiene to the patient, including proper brushing and flossing techniques to prevent infection and deterioration.

Professional cleanings: Encourage regular professional cleanings to maintain periodontal health and prevent disease progression.

DISCUSSION:

Kan JYK et al., [1] reported that individuals with a thicker biotype had a lower risk of recession and that there was a possibility for greater gingival recession in a population with a thin biotype following an initial single tooth implant restoration. Different people have varied gingival thicknesses, as do different parts of the same person's mouth.[35] Additionally, in maxillary anterior teeth, there was a positive association between gingival thickness and the width of keratinised tissue. According to Lee A and his colleagues, maxillary lateral incisors have the largest keratinised tissue width, followed by canines and central incisors. Similarly, maxillary lateral incisors exhibited the highest mean gingival thickness.[4] Over the course of five years, it has been observed that, in thin biotypes compared to thick biotypes, there is a much greater increase in gingival recession following prosthesis insertion in respect to metal ceramic prosthesis. After implant insertion, thick biotypes exhibit noticeably less bone loss than thin biotypes.[36]

According to Kois JC, gingival biotype is one of the diagnostic keys for implant success, along with tooth position, periodontium type, periodontium biotype, tooth form, and osseous peak location.[13] Assessing the soft tissue gingival biotype is crucial for achieving a visually pleasing implant restoration, enhancing immediate implant success, and preventing future mucosal recession.[4] Patients with a thin tissue biotype tended towards more recession, but a thick biotype was substantially related with retaining the existence of the gingiva papilla in the immediate dental implants replaced with a fixed single-crown prosthesis.[2]

I. Significance of gingival biotype in Fixed prosthodontics:

The gingival biotype has a major effect on fixed prosthodontics, affecting prosthetic treatment outcomes that are both aesthetically pleasing and long-lasting. The contour and emergence profile of prosthetic restorations, the possibility of gingival recession, and the gingival reaction to restorative operations are all influenced by the biotype. The following particulars and their ramifications are listed:

Visual Results:

Thin Biotype: More vulnerable to recession, which may expose restorative margins and impair aesthetics, particularly in the anterior area.

Thick Biotype: More recession-resistant, better able to support prosthetic restorations, and yielding more consistent cosmetic outcomes.[37]

Marginal Fit and Contour:

a) Crown Margins: The crown margins' fit and position are very important. Whereas a thick biotype allows for greater flexibility, a thin biotype needs to be placed more carefully to prevent recession.

b) Emergence Profile: To preserve gingival health and beauty, the emergence profile must be properly managed. While thin biotypes need to be carefully contoured to prevent tissue irritation, thick biotypes support a wider emergence profile.[37]

Periodontal Health:

a) Gingival Inflammation: Individuals with thin biotypes are more likely to experience inflammation and periodontal disease, which calls for frequent maintenance and attentive oral hygiene.

b) Surgical Considerations: Gingival biotype affects the surgical approaches used for procedures like soft tissue grafting and crown lengthening, which may be required to get the best results possible with a prosthesis. [38]

Prosthodontic Implants:

a) Implant implantation: The prosthetic restoration's design and implant implantation methods are influenced by the biotype. Thin biotypes might need extra treatments to thicken their soft tissues, which would improve the stability and appearance of their implants.

b). Soft Tissue care: Preserving the health of the peri-implant area and attaining results that look natural require effective soft tissue care. [1,39]

Prosthodontists can customise their approach to fixed prosthodontics by knowing the significance of gingival biotype. This ensures that periodontal health is maintained while meeting both functional and aesthetic goals.

II. Significance of gingival biotype in Implantology:

In implantology, the gingival biotype is an important factor that affects the design, implementation, and results of dental implant procedures. Clinicians can better anticipate problems and achieve both aesthetically pleasing and functional outcomes by having a thorough understanding of the biotype. The following are some salient features about the importance of gingival biotype in implantology:

Visual Results/Esthetic outcomes:

a) Thin Biotype: More prone to gingival recession, which can expose the implant or abutment and have a detrimental effect on appearance, particularly in the front.

b) Thick Biotype: Usually offers superior peri-implant soft tissue support, leading to more stable and consistent aesthetic results.

Implant Placement:

a). Surgical technique: To improve tissue thickness and stability surrounding the implant, thin biotypes may need a more conservative surgical technique, as well as perhaps soft tissue augmentation.

b) Implant location: Especially in patients with a thin biotype, proper implant location is essential to preventing recession and guaranteeing a natural emerging profile.[40]

Peri-Implant Health:

a) Tissue Stability: Tissue stability and recession risk are both lower in thick biotypes, which contributes to better long-term peri-implant health.

b). Maintenance: To avoid peri-implantitis and other problems, thin biotypes need to be carefully maintained and monitored.[1]

Management of Bone and Soft Tissue: a) Grafting: To increase the volume and quality of the peri-implant tissue, bone and soft tissue grafting may be required in situations of thin biotypes.

b) Healing: Biotype affects implant integration and the healing process; thick biotypes typically exhibit more advantageous healing dynamics.[6].

Prosthetic Considerations:

a) Restoration Design: To guarantee a smooth transition between the implant and the native tissues, the prosthetic restoration's design should take the biotype into account.

b) Emergence Profile: In thin biotypes, achieving an ideal emergence profile is more difficult and requires careful planning and implementation.[41]

III. Significance of gingival biotype in removable prosthodontics:

In the field of removable prosthodontics, gingival biotype is important because it affects the long-term viability, comfort, fit, and design of prosthetic appliances.

Importance:

Stability and Retention:

Thin Biotype: Frequently more prone to ulceration and irritation from detachable prosthesis. The thin biotype's delicate nature might cause discomfort and increase the chance of pressure points, which can impair stability and retention.

Thick Biotype: Offers a stronger tissue foundation that can withstand the strain and friction of detachable prosthesis, improving stability and retention.

Tissue Response:

Gingival Health: Because thin biotypes' gingiva are so sensitive, they are more vulnerable to recession and inflammation. To reduce these hazards, the prosthesis must be carefully designed and maintained on a regular basis.

Thick Biotype: Provides a more favourable tissue response by being more resilient to mechanical damage and less prone to pressure-induced ulcerations.

Aesthetic Points to Remember:

Tissue Thickness: A thicker biotype will help the detachable prosthesis look more natural by providing better support for its contours.

Gingival Recession:

Biotypes with thinner profiles are more likely to experience recession, which may affect the detachable prosthesis's aesthetics.

Design and Fit: Custom Adaptations: Depending on the biotype, prostheses may need to be specially fitted and made with certain modifications. More soft tissue relief and cautious contouring can be required for thin biotypes.

Material Options: To relieve pressure points and enhance comfort, individuals with thin biotypes can benefit from prostheses made of softer liners and more flexible materials.

Extended Upkeep:

Frequent Check-ups: Individuals with thin biotypes should have their prosthesis adjusted more frequently to avoid issues by monitoring tissue health.

Cleanliness: To avoid tissue irritation and recession, all patients—but particularly those with thin biotypes—need to practise meticulous oral cleanliness. [42–46].

CONCLUSION:

The ultimate result of aesthetic treatment is determined by gingival thickness. The clinician must therefore determine the tissue biotype and change the thin biotype to a thick biotype.

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