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Review Article

Gingival Biotype : When Thin Is Not In

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ABSTRACT

Among the factors that may impede success in dental treatments, gingival biotype is the greatest cause of concern, particularly affecting the outcomes of periodontal therapy, root coverage procedures, and implant placement. Often neglected tissue biotype could be the difference between success and failure. Different tissue biotypes respond differently to inflammation and to surgical and restorative treatment; consequently, it is crucial to identify tissue biotype before treatment. This review article gives an overview of the classification characteristic features, methods of assessment and clinical significance of different types of gingival biotypes.

Key words : gingival , periodontal biotype, implants

INTRODUCTION

The gingival morphology of the maxillary anterior region plays an important role in determining the final esthetic outcome.[1] One of the important morphologic features is the determination of the biotype. The term “gingival or periodontal phenotype” was coined by Muller.[2] The term periodontal bio- type was used later by Seibert & Lindhe.[3] The term "periodontal biotype" was introduced to describe the thickness of the gingiva in a bucco-lingual dimension (thick or thin).[4] Gingival biotype is known to be dependent upon many factors such as age, gender, growth, tooth shape, tooth position, tooth size and genetically

determined factors.[5] Knowledge of the periodontal biotype or phenotype is of fundamental importance to an oral clinician because the anatomical characteristics of the periodontium, such as gingival thickness, gingival width and alveolar bone morphology, will determine the behaviour of periodontium when submitted to physical, chemical, or bacterial insult or during therapeutic procedures viz periodontal surgeries, implant, orthodontic treatment.[1,6-8] There is a considerable intra and inter-individual variation in both width and thickness of the facial gingiva, giving rise to the assumption that different gingival phenotypes might exist in any adult population.[5] Therefore, an accurate diagnosis of gingival tissue biotype is of the utmost importance in devising an appropriate treatment plan and achieving a predictable esthetic outcome.

CLASSIFICATION

Early, in the year 1923, Hirschfeld observed a thin alveolar contour and made the assumption that a thin bony contour was probably accompanied by thin gingival form.[9], In 1969 Ochsenbien and Ross indicated that, gingival biotypes are of two types - they are scalloped and thin or flat and thick gingiva. They proposed that the contour of the gingiva closely followed the contour of the underlying bone. The authors reported that flat gingiva was associated with a square tooth form, while scalloped gingiva was associated with a tapered tooth form.,[10] In 1977,Weissgold emphasized that the form and function are related and also observed that the gingival tissues in a scalloped periodontium are generally thinner than in a flat periodontium. Therefore the terms thin scalloped and thick flat type was introduced.[11], Later in 1986 Claffey and Shanley defined the thin tissue biotype as a gingival thickness of ≤1.5 mm, and the thick tissue biotype was referred to as having a tissue thickness ≥2 mm (measurements of 1.6 to 1.9 mm were not accounted for). [6] Seibert and Lindhe in 1989 categorized the gingiva into "thick-flat" and "thin-scalloped" biotypes.[3], In 1996, Kois suggested a classification system related to the periodontal biotype involving the relationship between cementoenamel junction and the crest of the bone. The three categories included (1) normal crest: alveolar crest is 3mm apical to the cementoenamel junction (85% of the population). (2) high crest: alveolar crest is < 3mm apical to the cementoenamel junction (2% of the population).(3) low crest: alveolar crest is >3mm apical to the cementoenamel junction (13% of the population). He described the treatment outcomes in each of the three crest positions and suggested that clinical outcomes were strongly related to the gingival/alveolar crest. He described how the crest position would affect the tooth preparation.[12] Becker et al in 1997 proposed three different periodontal biotypes: flat, scalloped and pronounced scalloped gingiva. Measuring from the height of the bone interproximally to the height at the direct midfacial, their findings are as follows: flat = 2.1 mm, scalloped = 2.8 mm, pronounced scalloped = 4.1 mm.[13] De Rouck et al in 2009, illustrated the presence of two distinct gingival biotypes. The first which occurred in one third of the study population and was prominent among females, was classified as having a thin gingival biotype, slender tooth form, narrow zone of keratinized tissue and a high gingival scallop. The second, which occurred in two thirds of the study

population and was prominent among males, was classified as having a thick gingival biotype, quadratic tooth form, broad zone of keratinized tissue and a flat gingival margin.[8]

CHARACTERISTICS OF THICK AND THIN BIOTYPE

Thin gingival tissue tends to be delicate and almost translucent in appearance. The tissue appears friable with a minimal zone of attached gingiva. The soft tissue is highly accentuated and often suggestive of thin or minimal bone over the labial roots. Surgical evaluation often reveals thin labial bone with the possible presence of fenestration and dehiscence. It reacts to insults and disease with gingival recession.

Thick gingival tissue is probably the image most associated with periodontal health. The tissue is dense in appearance with a fairly large zone of attachment. The gingival topography is relatively flat with the suggestion of a thick underlying bony architecture. Surgical evaluation of these areas often reveals relatively thick underlying osseous forms. This type of tissue is resistant to acute trauma and reacts to disease with pocket formation and infrabony defect formation.[14]

METHODS FOR DETERMINATION OF GINGIVAL BIOTYPE

Many methods (both invasive and non- invasive) have been used 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, probe transparency, ultrasonic devices, and CBCT.[6,15-26.]

Visual evaluation

It is a simple and non –invasive method that is routinely used in clinical practice. But it is not considered as a reliable method as it cannot assess the degree of gingival thickness.[10] Eghbali et al in their study concluded that simple visual examination cannot be relied as an effective method for assessment of biotype irrespective of the clinicians experience.[27]

Transgingival probing method

In this method tissue thickness is measured using a periodontal probe. When the thickness is >1.5mm, it was categorized as thick biotype and if less than 1.5 mm, it was considered as thin. This method although is 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.[19]

TRAN method

In this method the ginigival biotype is considered thin if the outline of the probe is shown through the gingival margin from the sulcus. This method was found to be highly reproducible with 85% of intraexaminer repeatability for gingival thickness assessment in a clinical trial of 100 periodontally healthy subjects. It was thus validated as a simple, rapid and minimally invasive method.[22]

Modified caliper

A tension-free caliper can only be used at the time of surgery and cannot be used for pretreatment 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.[28]

Cone beam computed tomography (CBCT) scans

These have been used extensively for hard tissue imaging because of their superior diagnostic ability. Fu et al measured the thickness of labial gingiva and bone and reported no statistically significant difference between the clinical measurements made with a caliper and radiographic measurements utilizing CBCT scans; however, CBCT measurements may be a more objective method than direct measurement. A plastic lip, tongue retractors, and wooden spatulas can be used to better visualize soft tissue margins.[1,26] Although his method is gaining popularity, it requires technical expertise and is expensive.

Ultrasonic devices

The emergence of ultrasonography as a diagnostic tool has steadily increased ever since it was first used in the field of Ophthalmology by Mundt and Hughes. [29] A 1971 study by Kydd et al was the first to measure the thickness of palatal mucosa using an ultrasonic device.[30] Ultrasonic devices appear to be the least invasive method, are inexpensive , rapid , convenient and offer excellent validity and reliability. [31] Ultrasonographic tissue depth measurement procedures are now accurate and reliable than direct gingival probing and since it is a dynamic procedure a real time evaluation for diagnosis is possible.

CLINICAL SIGNIFICANCE

The dimensions of different parts of the masticatory mucosa, especially gingival thickness , has become the subject of considerable interest in Periodontics from both an epidemiological and therapeutic point of view. [32] It was suggested that since the two tissue biotypes have different gingival and osseous architectures, they exhibit different pathological responses when subjected to inflammatory, traumatic, or surgical insults [33]. These different responses dictate different treatment modalities. Therefore an accurate diagnosis of gingival tissue biotype is of utmost importance in forming an appropriate treatment to acheieve a predictable treatment outcome.

Tissue response of different biotpes [14]

The demands for excellent esthetic outcomes requires the establishment of periodontium and its compatibility with the surrounding hard and soft tissues. For this purpose a thorough understanding of the gingival biotype form is mandatory for a clinician.

Response to thick biotype to inflammtion and healing

Soft tissue: Marginal inflammation; cyanosis; bleeding on probing; edema/ fibrotic changes

Hard tissue: here is bone loss with pocket formation/infrabony defects.Predicable soft and hard tissue contour after healing.

Response to thick biotype to inflammtion

Soft tissue: Thin marginal redness and gingival recession

Hard tissue: there is rapid bone loss associated with

soft tissue recession Difficult to predict where tissue will heal and stabilize.

Tissue Biotype and Extraction of teeth

Though extractions should always be atraumatic, teeth with thin gingival biotypes merit more attention due to their association with thin alveolar plates. Thick bony plates associated with thick biotypes and thin bony plates with thin biotypes respond differently to extraction. Also thick biotypes are associated with minimal ridge atrophy following extraction

Possible strategies that should be considered while extracting teeth with thin biotypes include:

- Minimizing leveraging forces toward the thin labial plate. Most of the manipulation should be focused on the interproximal area.
- Sectioning the root(s) from the tooth, when possible, to improve the likelihood for elevation.
- Using periotomes to expand and elevate the tooth with controlled force focused on the periodontal ligament space..
- Using a ratchet extraction device to apply reciprocating force on adjacent teeth while extruding the amputated root tip out the socket This may be the most effective and atraumatic approach for the broken tooth. [14]

Tissue Biotype and Implant Treatment Planning

If osseous and gingival tissues are different for thick and thin tissue biotypes, it seems logical that these distinctions would significantly influence implant site preparation and treatment planning. This is consistent with previous observations that the stability of the osseous crest and soft tissue is directly proportional to the thickness of the bone and gingival tissue. [34,45] Thick bony plates associated with thick biotypes and thin plates with potential fenestrations and dehiscence associated with thin biotypes respond differently to extraction and have a different pattern of osseous remodeling following this procedure. This underscores the importance of appreciating gingival tissue biotypes during implant treatment planning. Furthermore, when these tissue biotypes are carefully considered, various periodontal and surgical strategies can be employed to improve the treatment outcome either by minimizing alveolar resorption or by providing a better tissue environment for implant placement.

Tissue Biotype and Immediate Implants

A delayed implant approach might be taken when there is not enough thickness in periodontal tissues to predictably minimize alveolar resorption secondary to healing, or a lack of anchoring bone to ensure stabilization. For a thin biotype case, practitioners must be aware of the possibility of significant resorption, which may have an impact on esthetics. Furthermore, the loss of peri-implant structures may result in thin, translucent tissue over the implant, which appears grayish, especially if the facial plate is lost and implant threads are exposed. In a thick biotype environment, immediate placement of an implant can be completed with predictable results [36]

Tissue Biotype and root coverage procedures

An initial gingival thickness was found to be the most significant factor that influences the prognosis of a complete root coverage procedure.[18] Nisapakultorn et al repoted a significant association of thin biotype with increased risk of facial mucosal recession.[37]

Tissue Biotype and orthodontic treatment

Alteration of mucogingival dimensions may occur during orthodontic treatment. It was found that the buccolilngual thickness determines gingival recession and attachment loss at sites with gingivitis during orthodontic treatment. In cases with thin gingival caused by prominent postion of teeth there is no need for pre orthodontic gingival augmentation procedures the recession and bone dehiscence will decrease when the tooth is moved in a more proper position within the alveolar bone .

CONCLUSION

Periodontal biotype evaluation is an important parameter in establishing patient expectations in many complex esthetic procedures by allowing the clinician to predict therapeutic outcome. By understanding the nature of tissue biotypes, clinicians can employ appropriate periodontal management to minimize tissue resorption and provide more favorable results after dental treatment. 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. Therefore, to achieve the best clinical and esthetic success, a careful assessment of existing anatomic parameters, such as the amount of keratinized tissue, the periodontal biotype, and vestibule depth, is a vital part of the surgical decision-making process which will ultimately help in maintaining the balance of pink and white.

REFERENCES

1. Fu JH, Yeh CY, Chan HL, Tatarakis N, Leong DJ, Wang HL. Tissue biotype and its relation to the underlying bone morphology. J Periodontol 2010; 81:569-74.
2. Anand V, Govila V, Gulati M. Correlation of gingival tissue biotypes with gender and tooth morphology: A randomized clinical study. Indian J Dent 2012; 3:190-5.
3. Seibert JL, Lindhe J. Esthetics and periodontal therapy. In: Lindhe J, ed. Textbook of Clinical Periodontology, 2nd ed. Copenhangen, Denmark: Munksgaard; 1989: 477-514.
4. Khalid H. Zawawi, Shaimaa M. Al-Harthi, Mohammad S. Al-Zahrani. Prevalence of gingival biotype and its relationship to dental malocclusion Saudi Med J 2012; 33: 671-5.
5. Malhotra R, Grover V, Bhardwaj A, Mohindra K. Analysis of the gingival biotype based on the measurement of the dentopapillary complex. J Indian Soc Periodontol 2014; 18: 43-7.
6. Claffey N, Shanley D. Relationship of gingival thickness and bleeding to loss of probing attachment in shallow sites following nonsurgical periodontal therapy. J Clin Periodontol 1986; 13: 654-7.
7. Zigdon H, Machtei EE. The dimensions of keratinized mucosa around implants affect clinical and immunological parameters. Clin

Oral Implants Res 2008; 19: 387-92.

8. 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.
9. Hirschfeld I. Astudy of skulls in the American Museum of Natural Histort in relation to periodontal disease. J Dent Res 1923; 5: 251-65
10. Ochsenbien C, Ross S. A re-evaluation of osseous surgery. Dent Clin North Am 1969;13 :87–102
11. Weissgold AS.Contours of the full crown restoration.Alpha Omegan 1977; 70: 77-89.
12. Kois JC.The restorative –periodontal interface:biological parameters.Periodontal 20001996;11:29-38
13. BeckerW, Ochsenbien C, Tibbetts L, Becker BE. Alveolar bone anatomic profiles as measured from dry skulls Clinical ramifications J Clin Periodontol,1997; 24: 727–31
14. Kao RT , Fagan MC, Conte GJ. Thick vs. Thin gingival Biotypes: a key Determinant in Treatment Planning for Dental Implant. J Calif Dent Asooc 2008; 36: 193-8.
15. Olsson M, Lindhe J. Periodontal characteristics in indi- viduals with varying form of the upper central incisors. J Clin Periodontol. 1991;18(1):78-82.
16. Olsson M, Lindhe J, Marinello CP. On the relationship between crown form and clinical features of the gingi- va in adolescents. J Clin Periodontol. 1993;20(8):570-7.
17. Eger T, Muller HP, Heinecke A. Ultrasonic determination of gingival thickness. Subject variation and influence of tooth type and clinical features. J Clin Periodontol 1996; 23(9): 839-45.
18. Baldi C, Pini-Prato G, Pagliaro U et al. Coronally advanced flap procedure for root coverage. Is flap thick- ness a relevant predictor to achieve root coverage? A 19-case series. J Periodontol 1999; 70(9):1077-84.
19. Greenberg J, Laster L, Listgarten MA. Transgingival probing as a potential estimator of alveolar bone lev- el. J Periodontol 1976;47(9):514-17.
20. Goaslind GD, Robertson PB, Mahan CJ, Morrison WW, Olson JV. Thickness of facial gingiva. J Periodontol 1977;48(12):768-771.
21. Studer SP, Allen EP, Rees TC, Kouba A. The thickness of masticatory mucosa in the human hard palate and tuberosity as potential donor sites for ridge augmentation procedures. J Periodontol 1997;68(2):145-151.
22. Kan JY, Rungcharassaeng K, Umezu K, Kois JC. Dimensions of peri-implant

mucosa: an evaluation of maxillary anterior single implants in humans. J Periodontol 2003;74(4):557-62.

23. Daly CH, Wheeler JB 3rd. The use of ultrasonic thick- ness measurement in the clinical evaluation of the oral soft tissues. Int Dent J 1971; 21(4):418-29.
24. Uchida H, Kobayashi K, Nagao M. Measurement in vivo of masticatory mucosal thickness with 20 MHz B-mode ultrasonic diagnostic equipment. J Dent Res 1989;68(2):95-100.
25. Lawson RB, Jones ML. An evaluation of a noninvasive method of assessing alveolar bone levels in an experi- mental model of cleft lip and palate. Cleft Palate Craniofac J 1998;35(1):1-8.
26. Barriviera M, Duarte WR, Janua'rio AL, Faber J, Bezerra AC. A new method to assess and measure palatalmasticatory mucosa by cone-beam computerized tomography. J Clin Periodontol 2009; 36(7): 564-568.
27. Eghbali A, De Rouck T, Bruyn H, Cosyn J. The gingival biotype assessed by experienced and in experienced clinicians .J Clin Periodontol 2009;36:958-63.
28. Kan JY, Morimoto T, Rungcharassaeng K, Roe P, Smith DH. Gingival biotype assessment in the esthetic zone: visual versus direct measurement. Int J Periodontics Restorative Dent.2010;30:237-43.
29. Mundt GH, Hughes WE. Ultrasonics in ocular diagnostics. Am J Ophthalmol 1956;41: 488-98.
30. Kydd WL, Daly CH, Wheeler JB 3rd. The thickness measurement of masticatory mucosa in vivo. Int Dent J. 1971;21:430-441.
31. Muller HP, Schaller N, Eger T. Ultrasonic determination of thickness of masticatory mucosa: a methodological study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1999;88:248-53.
32. Vandana KL, Savitha B.Thickness off gingival in association with age, gender and dental arch location.J Clin Periodontol 2005;32:828-30.
33. Kao RT, Pasquinelli K, Thick vs. thin gingival tissue: a key determinant in tissue response to disease and restorative treatment. J Calif Dent Assoc 2002;30:521-6.
34. Tarnow DP, Magner AW, Fletcher P, The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. J Periodontol 1992;62:995-6.
35. Maynard JG Jr, Wilson RD, Physiologic dimensions of the periodontium significant to the restorative dentist. J Periodontol 1979;50:170-4.
36. Sammartino G, Marenzi G, et al, Aesthetics in oral implantology: biological, clinical, surgical, and prosthetic

aspects. Implant Dent Mar 16(1):24-65, 2007.

37. Nisapakultorn K , Suphanantachat S, Silkosessak O, Ratanamongkolgul S. Factors affecting soft tissues level around anterior maxillary single tooth implants.Clin Oral Implants Res 2010;21;662-70.

38. Wennsrtom JL, Lindhe J, Sinclair F, Thilander B. Some periodontal tissue reaction to orthodontic tooth movement in monkeys. J Clin Periodontol 1987;14:121-9.

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