

Original Article

A comparative evaluation of the reliability of three methods of assessing gingival biotype in dentate subjects in different age groups: An *in vivo* study

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Abstract

Introduction: In the modern competitive society, a pleasing appearance often dictates the difference between success and failure in both our personal and professional lives. Evaluation of gingival biotype is very important from the start of treatment plan to the final restorative placement to provide excellent esthetics.

Materials and Methodology: For the study, subjects were divided into 4 groups of different ages, from 20-30, 31-40, 41-50 and 51-60 years. 30 subjects (15 men and 15 women) were selected in each group for the study. Examination of the thickness of Gingival Biotype was done in 3 different ways; - Direct visual, William's Graduated Probe and Using modified wax caliper.

Results: The McNemar test showed statistically significant differences in the way gingival biotype was identified when comparing visual assessment with assessment using direct measurement ($P < 0.001$). And there was no statistically significant difference when assessment using a periodontal probe was compared to direct measurement ($P < 0.676$). There is no correlation for the Biotype among the different age groups.

Conclusion: Gingival biotype identification by visual assessment is statistically significantly different from assessment with direct measurement. Gingival biotype identification by assessment with a periodontal probe is not statistically significantly different from direct measurement.

Key Words: Direct measurement, gingival biotype, visual measurements

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INTRODUCTION

In the modern competitive society, a pleasant appearance often dictates the difference between success and failure in both our personal and professional lives. The gingival perspective of esthetics is concerned with the soft tissue

covering surrounding the teeth. The term gingival biotype has been used to describe the thickness of the gingiva in the labiolingual dimension.^[1-4]

Thus, gingival biotypes are classified into thick and thin type of gingiva, surrounding the teeth. Thick gingival biotype is also called as flat-thick gingiva, corresponded to a tooth with squared facial form; distinct cervical convexity; and relatively large, more apically located contact areas^[5] is fibrotic and resistant to surgical procedures with a tendency for pocket formation. Thick biotype has a large amount of attached gingiva and a thick underlying osseous form; thick tissue is resistant to acute trauma.

Thin gingival tissue which is also called as scalloped-thin gingiva has been suggested to be associated with tapered crown form;

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subtle cervical convexity; and minute proximal contact areas located near the incisal edge of the tooth.^[5] Thin gingival tissue tends to be delicate and almost translucent in appearance; the tissue appears friable with a minimal zone of attached gingiva which escalates the risk of recession following the crown preparation and periodontal or implant surgery. Thin gingival margins also allow visibility of a metal substructure, thereby compromising esthetics in the anterior region of the mouth.^[2]

Today, with the high survival and success rates of implant therapy, the focus has shifted toward creating an esthetic restoration that is indistinguishable from natural teeth and is stable over time. This is particularly important in the anterior maxilla also known as the “esthetic zone” of the oral environment. Therefore, although tissue biotype is an inherent trait that varies from patient to patient, it can be transformed through precise management of the implant position, implant design, and prosthetic design triad such that a desired esthetic outcome is achieved.

Thus, evaluation of gingival tissue as a thick or thin type is important in treatment planning as it has been suggested that a direct correlation exists between gingival biotype and the susceptibility to gingival recession following surgical or restorative procedures. Since thick and thin gingival biotypes are associated with thick and thin osseous patterns respectively, the two tissue types respond differently to the inflammation and trauma and have different patterns of osseous remodeling. In fixed prosthodontics, care to be taken in finish line placement and retraction and type of restoration selection in the esthetic zone.^[6]

Hence, it is necessary to understand the pattern of the surrounding gingiva as it varies from patient to patient characterizing thick or thin gingiva helping in better outcome of implant healing and the prosthesis in esthetic harmony to soft tissues. Therefore, there exists a need to investigate the reliability of different methods used to assess gingival biotypes are having either thick or thin gingiva.

The null hypothesis stated as:

- There is no correlation between the different age group and gingival biotype
- There is no significant difference in the techniques obtained for measuring gingival thickness.

MATERIALS AND METHODS

The study was approved by the Ethical Committee of the Sumandeep Vidyapeeth and was conducted at the K. M. Shah Dental College and Hospital. Subjects were selected on the basis of the inclusion and exclusion criteria. Subjects were included in a gingival index score of 0, having adequate and

harmonious gingival architecture with surrounding dentition and subject having free gingival margin to underlying bone dimension of 2–3 mm as measured by periodontal probe. If there was any infection present, inflammation around the free gingival margin and those who were under medications, which can alter gingival architecture were excluded, and were not a part of the study.

For the study, subjects were divided into 4 groups of different ages, from 20 to 30, 31–40, 41–50, and 51–60 years. Totally, 30 subjects (15 men and 15 women) were selected in each group of the study. The subjects involved in this study were evaluated for the thickness of the gingival thickness by three different techniques visual assessment, periodontal probe, and direct measurement.

Three different examiners were calibrated before the start of the study and evaluated the thickness of the gingiva so as to achieve accurate results. Two co-examiners evaluated thickness by visual assessment and periodontal probe and direct measurement by the principal examiner.

For the visual examination, the subject was clinically evaluated by the visual appearance of gingiva [Figure 1]. The gingival biotype was considered thick if the gingiva was dense and fibrotic in appearance with flat gingival contour suggestive of thick bony architecture and thin if the gingival was scalloped gingival contour, delicate, friable, and almost translucent.^[1,5,7] For the periodontal assessment, the gingival biotype of the selected tooth was evaluated clinically by sulcus probing of the midfacial aspect of the selected tooth till the 0.5–1 mm into the sulcus [Figure 2]. The gingival biotype was categorized as either thin or thick according to the visibility of the underlying periodontal probe through the gingival tissue (visible = thin, not visible = thick).^[1,8] Moreover, for the direct measurement, gingival biotype was evaluated by using modified gauge having calibration of 1/10 mm with two extended arms from its head [Figure 3]. The extended arms were kept dulled so that it does not injure the soft-tissue, and extensions were desired as sulcus would be very slender in which very thin projections can insert without much problem. One extension was fixed parallel to long axis of the tooth so that it can be inserted with ease and both the arms were arranged in such a way that beaks of the wax caliper and extended arms were closing at same time for its homogeneity. It was made tension free after breaking the spring of the wax gauge. The thickness of the gingiva was measured on the midfacial aspect of the labial surface of the maxillary anterior teeth, as it is the most esthetic area and the area of fretful. The first arm was inserted into the free gingival margin again 0.5–1 mm into the sulcus for proper measurements and the second arm coming from the



Figure 1: Visual assessment for gingival thickness



Figure 2: Periodontal Probe for assessing gingival thickness



Figure 3: Modified wax gauge for measuring gingival thickness

labial aspect of the gingiva placed on the gingiva without pressure. The gingival biotype was considered thick if it is measured >1 mm and thin if measured ≤ 1 mm.^[1]

Data collection and analysis

Data were collected and subjected to statistical analysis. Means and standard deviations (SDs) were calculated for the gingival tissue thickness. The assessments for the difference in the age group were analyzed by ANOVA. The assessment methods were compared using the McNemar test at a significance level of $\alpha = 0.05$.

RESULTS

For the age group of 20–30 thick biotypes was seen in 10 patients (33%) and for thin biotype it was 20 (67%). Similarly, for the age group of 31–40, 15 (50%) cases of thick biotype were seen and for thin biotype again 15 (50%) cases. However, for the age group of 41–50 and 51–60, the results were found to be similar which were 17 (57%) for thick and 13 (43%) for thin in each age group, respectively [Table 1].

Mean for the gingival thickness for the age group of 20–30 was 0.88 ± 0.26 mm. Furthermore, for the age group of 31–40 mean for the gingival thickness was 0.93 ± 0.27 mm. For the age group of 41–50 mean was 0.97 ± 0.24 mm. Mean for the gingival thickness of the age group for 51–60 was 0.98 mm with the SD of 0.23 mm [Table 2].

The analysis of variance test showed that there was no statistically significant difference was identified when comparing different age group for the thick biotype and thin biotype ($P = 0.39$).

Assessing visual assessment with direct measurement showed that 35 subjects were having thick biotype whereas it was thin for direct measurement and 61 subjects had similar results. Moreover, for thin biotype it was 11 subjects showing thick biotype for direct measurement with 13 results in similarity. Henceforth, the McNemar test showed statistically significant differences in the way gingival biotype was identified when comparing visual assessment with assessment using direct measurement [$P = 0.001$, Table 3]. For the assessment of gingival biotype with a periodontal probe with direct measurement showed that 10 subjects were having thick biotype whereas it was thin for direct measurement and 60 subjects had similar results. Moreover, for thin biotype it was 13 subjects showing thick biotype for direct measurement with 25 subjects fallout in similarity. However, there was no statistically significant difference when assessment using a periodontal probe was compared to direct measurement [$P = 0.676$, Table 4].

DISCUSSION

Tissue biotypes are associated with the outcomes of periodontal therapy, root coverage procedures, implant esthetics, and also

Table 1: Percentage of biotype in different age groups

Age group/biotype	Thick (%)	Thin (%)
20-30	10 (33)	20 (66.6)
31-40	15 (50)	15 (50)
41-50	17 (56.6)	13 (43.3)
51-60	17 (56.6)	13 (43.3)

Table 2: Mean with standard deviation of different age groups

Age group	Mean±SD
20-30	0.88±0.26
31-40	0.93±0.27
41-50	0.97±0.24
51-60	0.98±0.23

SD: Standard deviation

Table 3: Comparison of frequency distribution of gingival biotype recorded using direct measurement against visual assessment

Gingival biotype (direct measurement)	Gingival biotype (visual assessment)	
	Thick	Thin
Thick	61	11
Thin	35	13

Table 4: Comparison of frequency distribution of gingival biotype recorded using direct measurement against periodontal probe assessment

Gingival biotype (direct measurement)	Gingival biotype (periodontal probe)	
	Thick	Thin
Thick	60	13
Thin	10	25

for the restorations going subgingivally. Thus, understanding the gingival morphology of the maxillary anterior region plays an important role in determining the final esthetic outcome.

In 1969, Ochsenbein and Ross^[9] indicated that there were two main types of gingiva morphology, namely the scalloped and thin or flat and thick gingiva. They proposed that the contour of the gingiva closely followed the contour of the underlying alveolar bone. The term “periodontal biotype” was later introduced by Seibert and Lindhe to categorize the gingiva into thick flat and thin-scalloped biotypes.^[5]

As evaluating the thickness of the gingiva, requires the skill and precision it becomes the important aspect to choose the appropriate method. The methods of gingival biotype identification in these studies were a primarily visual assessment, assessment with a periodontal probe and direct measurement with modified wax caliper.

There is no universal standardization of visual assessment, and it relies heavily on the clinical experience of the examiner and is, therefore, subjective. Assessment with a periodontal probe, on the other hand, provides some objectivity with the

visibility during the evaluation. However, the degree of gingival thickness cannot be expressed with this assessment and can only be verified with a direct measurement.^[1]

There are various methods used for the direct measurement such as endodontic file/reamer, transgingival probing, which are invasive methods. The use of ultrasonic devices would be the most noninvasive method, but is deemed practically impossible since they are no longer available commercially. In this study, tension free modified wax gauge was used as direct measurement as a noninvasive method. As the extended arms were kept dull so that it would not injure the soft-tissue while having measurements. Two extended arms were modified in such a way that the closure of both the beaks would give the same results as of the original beak. The modification was done in a way to use it without much difficulty and to produce accurate results with ease.

The mean for the gingival thickness of different age groups came out to be unlikely. Thus, there exists no correlation for the thick and thin biotype for the different age group. Henceforth, here it rejects the research hypothesis and accepts the null hypothesis that there exists no correlation between the different age groups and the gingival thickness.

The results of this study show that gingival biotype identification by the visual assessment was highly statistically significantly different from assessment with direct measurement [$P = 0.001$, Table 3]. The results of this study are in agreement with Kan *et al.*,^[1] in which gingival biotype identification was statistically significant for the direct measurement against the visual assessment. Furthermore, the results of the study go in conformity with the study conducted by Olsson *et al.*,^[10] in which a lack of association between the visually scalloped-thin/flat-thick periodontal biotype and the measured thin/thick gingiva was observed.

Frequency distribution for the direct measurement against periodontal probe was not statistically significant [$P = 0.67$, Table 3] as results obtained from the periodontal probe were similar for direct measurement also. These results suggest that assessment using a periodontal probe is an adequately reliable and objective method for evaluating gingival biotype. Again it was in agreement with Kan *et al.*,^[1] where the assessment of the direct measurement was not statistically significantly different with a periodontal probe.

Furthermore, even though the most commonly used dimension to separate thick and thin gingival biotypes is 1.0 mm, this numerical assignment is at best arbitrary. Regardless, it is worthwhile to note that the mean gingival thickness in this study was 0.98 mm with a range (0.6–1.5 mm) that is comparable to

that reported in the study conducted by (0.7–1.5 mm) Olsson *et al.*^[10] and also by Eger *et al.*^[11]

Classification of periodontal biotype may assist practitioners in a multitude of clinical situations including esthetic crown lengthening, crown/veneer preparations, implant placement in the esthetic zone, extraction site wound healing, and mucogingival therapy. This study provides evidence to support the commonly held opinion that patients with a clinically thick/average biotype have a thicker labial plate and a smaller distance from the cemento-enamel junction to the alveolar crest than subjects with a thin clinical biotype.

CONCLUSION

Within the limitations of the study, we conclude that:

- There is no significant difference in the gingival biotype between the different age groups
- Gingival biotype identification (thick versus thin) by visual assessment is statistically significantly different from assessment with a periodontal probe and direct measurement
- Gingival biotype identification by assessment with a periodontal probe is not statistically significantly different from direct measurement and is an adequately reliable and objective method in evaluating gingival biotype
- Visual assessment of gingival biotype by itself is not sufficient as a predictor for proper diagnosis and treatment planning of gingival esthetics prior to surgical and restorative procedures.

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