Correlation of gingival thickness with gingival width, probing depth, and papillary fill in maxillary anterior teeth in students of a dental college in Navi Mumbai

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Abstract

Context: The gingival biotype is of utmost importance for esthetics and biologic function. Anatomical characteristic of periodontium such as gingival thickness (GT), width of keratinized gingiva, and alveolar bone morphology will determine the behavior of periodontium when subjected to physical, chemical, or bacterial insult or during therapeutic procedure. **Aims:** The aim of this study was to correlate the GT with gingival width (GW), probing depth (PD), and papillary fill (PF) in relation to maxillary anterior region. **Settings and Design:** Undergraduate dental students and interns from a dental college in Navi Mumbai were enrolled in the study according to the inclusion criteria. Six teeth per subject were assessed; a total of 2178 maxillary anterior teeth were examined. **Subjects and Methods:** Subjects were examined clinically for GT, width of keratinized gingiva, pocket depth, and interdental PF. The data obtained was tabulated and subjected to statistical analysis. **Statistical Analysis Used:** Spearman's correlation analysis test was performed to find the correlation of GT with GW, PD, and PF. **Results:** Positive correlation was found between GT and GW ($r = 0.241$). No significant correlation could be found between GT and PD; and between GT and PF. **Conclusions:** The present study confirmed a positive correlation between GT and GW. A weak negative correlation was found between GT and PD.

Keywords: Gingival biotype, gingival width, papillary fill, probing depth

Introduction

Gingival biotype plays a major role in maintaining periodontal health, as anatomy of the periodontium determines its behavior in response to various physical, chemical, or bacterial insults. Therapeutic modalities such as periodontal surgeries implant surgeries or orthodontic treatment also requires the biotype to be assessed before treatment planning.

The gingival biotype in humans has been classified as thin or thick. The thick biotype is dense and fibrotic with a wide zone of attachment, thus making it more resistant to recession. Thin gingival biotype is a delicate, highly scalloped soft tissue and is more prone to recession, bleeding, and inflammation.[1] Clinical identification of the biotype helps in better determination of treatment outcomes; thinner biotype needs more attention.

Thick and flat gingiva is more resistant and tends to revert to its original form and dimension in the healing phase after periodontal therapy.[2] Thick gingival biotype responds to inflammation, surgery, and tooth extraction with marginal inflammation, edema, fibrotic changes and increase in probing depth (PD) and pocket formation with bone loss.[3]

The adequate width of attached gingiva is an essential component in maintaining healthy periodontium. Adequate keratinized gingiva provides a firm and stable base for maintaining good oral hygiene and during restorative and esthetic procedure.[4]

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Papillary fill (PF)/regeneration is an important consideration in the esthetic zone. Limited blood circulation at the papillary tip is a major reason why papilla regeneration is not predictable.[5]

Not only does the gingival biotype vary from person to person, but also being a genetically determined characteristic, it may influence other gingival features such as width of keratinized gingiva, PD, and PF. Hence, the aim of this study was is to correlate gingival thickness (GT) with gingival width (GW), PD, and PF in the maxillary anterior teeth.

Subjects and Methods

The study was conducted after the approval from the Scientific Review Committee and the Institutional Ethical Committee of Dental College. Undergraduate dental students and interns were enrolled for this study. Students were selected based on inclusion and exclusion criteria, as stated below. Maxillary anterior teeth were assessed; six teeth per subject were examined. Subjects above the age of 18 years with all maxillary anterior teeth present were included in the study. Subjects having a high frenal attachment, masochistic habits, restorations, and prostheses in the maxillary anterior region, subjects receiving medications know to have effects on the periodontal soft tissue, subjects undergoing orthodontic treatment or having had any periodontal surgery in the maxillary anterior region, and subjects who were smokers were all excluded from this study.

GT was evaluated for every tooth and categorized into thick or thin based on the probe transparency method. The University of North Carolina 15 periodontal probe was inserted into the sulcus at the midfacial aspect of maxillary anteriors. If the outline of the underlying probe could be seen through the gingiva, it was categorized as thin (score 0). If not, it was categorized as thick (score 1).

GW was measured midfacially with a periodontal probe to the nearest millimeter. This parameter was defined as the distance from the free gingival margin to the mucogingival junction.

PD was measured to the nearest millimeter at the midfacial aspect of maxillary anteriors. This parameter was defined as the distance from the free gingival margin to the base of the gingival sulcus.

PF was evaluated by examining the embrasure area between two adjacent teeth. Score 1 was assigned for complete fill of the embrasure area. Score 0 was assigned for incomplete fill of the embrasure area.

Correlation of GT with GW, PD, and PF was assessed using the Spearman's correlation analysis test.

Results

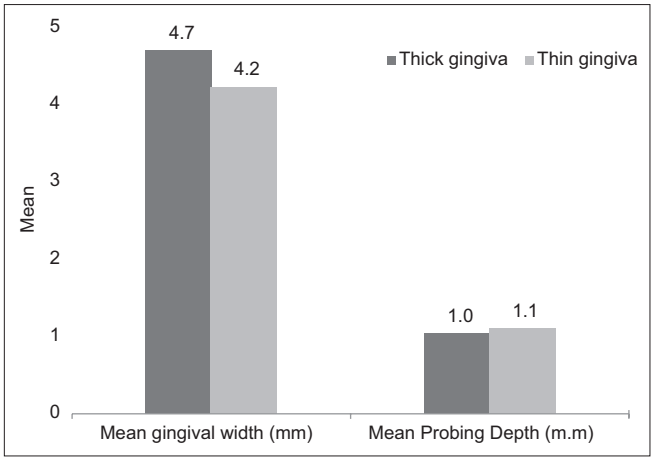
The number of teeth examined were 2178. Out of these, 1359 teeth showed the presence of thin gingival biotype and 819 had thick biotype.

Correlation between gingival thickness and gingival width

The mean GW in the thin gingival biotype was 4.2284 mm, whereas the mean width in the thick gingival biotype was 4.6964 mm. The Spearman's coefficient of rank correlation (rho) analysis showed a positive correlation between GT and GW ($r = 0.241$). This correlation was statistically significant [Table 1 and Graph 1].

Correlation between gingival thickness and probing depth

The mean PD for teeth with thin gingival biotype was 1.1014 mm. For teeth having thick gingival biotype, the mean PD was 1.0409 mm. A weak negative correlation was observed between GT and PD ($r = -0.0580$) which was not statistically significant [Table 1 and Graph 1].



Graph 1: Mean gingival width and probing depth in thick and thin gingiva

Table 1: Correlation of gingival thickness with gingival width, probing depth and papillary fill

	Mean gingival width (mm)	Mean probing depth (mm)	Percentage of papillary fill
Gingival thickness (thick)	4.6964*	1.0409	86.5
Gingival thickness (thin)	4.2284*	1.1014	87.3
P	<0.0001	0.0065	0.6163
95% CI for rho	0.201-0.281	−0.0995–−0.0163	−0.0546-0.0324

*Statistically significant. CI: Confidence interval

Correlation between gingival thickness and papillary fill

87.3% of teeth with thin gingival biotype showed complete PF, whereas 86.5% of teeth with thick gingival biotype showed complete PF. There was a weak negative correlation between GT and PF ($r = -0.0111$) which was not statistically significant [Table 1 and Graph 2].

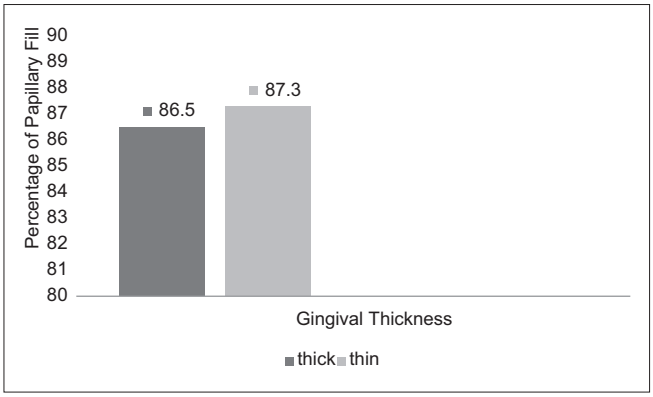
Discussion

In 1969, Ochsenbein and Ross described 2 main types of gingival contours-flat contour and highly scalloped contour,[6] after which a series of research began to find the association between gingival contour and tooth shape. Later in 1991, Olsson and Lindhe[1] related this feature with "periodontal biotype," a term given by Siebert and Lindhe in 1989.[2] The classification initially divided the biotype into two extreme types-thick flat biotype and thin scalloped biotype.[2]

The different biotypes have diverse effects on the clinical outcome of any therapeutic procedures. Evaluation of the biotypes can help in the prediction of treatment outcomes; the stability of osseous crest and position of the free gingival margin are directly proportional to the thickness of the bone and gingival tissue.[7] There are various methods to evaluate the thickness of gingiva. These are conventional histology on cadaver jaws, injection needles, transgingival probing, histologic sections, cephalometric radiographs, probe transparency, ultrasonic devices, and cone-beam computed tomography (CBCT).[8]

In this study, we have used the probe transparency method described by Kan *et al*. in 2003.[9] This method is a noninvasive method to differentiate between thick and thin gingiva based on the visibility of the probe through the gingival margin. De Rouck *et al*. in 2009 found this method to have a high reproducibility, showing 85% interexaminer repeatability.[10]

Thick gingiva has long been speculated to be more resistant to physical trauma and gingival recession, and allows better tissue management, leading to better esthetic outcomes.[5]



Graph 2: Percentage of papillary fill in thick and thin gingival biotype

It is possible that thicker tissue may better resist bacterial and mechanical insult. It has been shown that delicate, thin tissue is more susceptible to recession[7] and poor outcomes of therapy.[11] In a study done by Olsson *et al*. in 1993, there was found to be a strong relationship between GT and width of keratinized tissue.[12] In this study, we found a significant positive correlation between GT and GW ($r = 0.241$), which was statistically significant ($P < 0.0001$).

Another study done by Cook *et al*. in 2011 analyzed upper anterior teeth of sixty subjects using CBCT and probe transparency method. The authors found a partial positive correlation between periodontal thickness and width of keratinized tissue.[13] It was shown that thin periodontal biotype showed a narrower zone of keratinized tissue as compared to thick periodontal biotype.

In this study, we found a nonsignificant ($P = 0.0065$) negative correlation between GT and PD in periodontally healthy young adults ($r = -0.0580$). A study carried out by Müller *et al*. in 2000 found that subjects with thicker gingiva had significantly higher mean PD.[14] A positive relationship was observed between the thickness of free gingiva and the PD ($r = 0.73$) in a study done by Goaslind *et al*. in 1977,[15] which was also in accordance with the data presented by Olsson *et al*. in 1993.[12] De Rouck *et al*. in 2009 stated in their study that significant distinction in pocket depth in relation to biotype could not be found as periodontally healthy subjects were included in their study,[10] which was also the case in our study. The results of our study were in accordance with the study done by De Rouck *et al*.

Our study found a nonsignificant ($P = 0.6163$) weak negative correlation between GT and PF ($r = -0.0111$). Thin biotype has been related to a higher risk of recession in buccal area and greater difficulty to papillary filling.[16] It has been found in the previous studies that GT is greater in males.[14,17] As the number of females included in this study (81%) were more than males, teeth having thin gingiva were greater (62.39%) than those having thick gingiva. We also found that 87.3% of the thin biotype had complete PF. This fact could have influenced the negative correlation seen between GT and PF in our study. In a study conducted by Romeo *et al*., the presence of papilla between the immediate single implant and adjacent teeth has been found to be significantly correlated to thick peri-implant mucosa.[18] Kan *et al*. in 2010 stated that the effect of gingival biotype was limited to facial gingival recession, and was greater in thin biotypes. The biotype was not found to have any effect on the interdental papilla.[19]

Conclusions

The present study confirmed a positive correlation between GT and GW. A weak negative correlation was found between GT and PD. This could be attributed to the fact that only

subjects with healthy periodontium were selected for this study. A weak negative correlation was also found between GT and PF in this study. This could have likely been due to the presence of more number of female subjects in the study population.

Future directions

The determination of gingival biotype is required for treatment planning of regenerative procedures and implant surgery; it can be used to predict the outcome of therapy. As gingival biotype was shown to have little influence on PF and PD in the present study, long-term randomized control trials with greater sample size could be undertaken in future to establish the correlation of gingival biotype with PF and PD.

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Conflicts of interest

There are no conflicts of interest.

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