Original Article

Assessment of gingival biotype in different facial patterns: A cross-sectional study

ABSTRACT

Objective: The aim of the present study is to evaluate the relationship of gingival biotype in different malocclusions.

Methods: A total of 157 periodontally healthy subjects (88 males and 69 females) were enrolled in this cross-sectional study. The study participants were divided into three groups of skeletal class I, class II, and class III. The probe transparency method was used to determine the quality and gingival tissue into thick and thin biotype.

Results: There was significant difference in gingival biotype among different skeletal malocclusion with high prevalence of thin gingival biotype in class I subjects and more prevalence of thick biotype in class II and class III individuals (*P*-value: 0.022). Pairwise comparison of gingival biotype in class I versus class II showed significant difference (*P*-value: 0.032); however in class I versus class III and class II versus class III, the test result was nonsignificant. The overall frequency of thin gingival biotype was significantly less in female subjects with respect to males (*P*-value: 0.025).

Conclusion: A significant relationship is present between skeletal malocclusion and quality of gingival biotype. The prevalence of thick gingival biotype is found more in females as compared to male individuals. The thin gingival biotype is more commonly seen in skeletal class I than class II and class III.

Keywords: Gingival biotype, gingival recession, malocclusion, probe transparency

INTRODUCTION

Gingival biotype is the faciopalatal thickness of gingiva and its clinical texture differs from person to person.[1] It is very important in clinical practice to identify the hard and soft tissue biotype since gingival architecture has been shown to exhibit a significant impact on integrity of periodontium during orthodontic treatment. In order to prevent pathological problems, such as gingival recession due to orthodontic treatment, it is mandatory to evaluate gingival biotype during treatment planning phase.[2,3]

The tooth movement performed within the anatomical limit of the alveolar bone by applying the controlled orthodontic force does not cause any pathological problem.[4] It has been observed that dehiscence and fenestration are due to tooth movement exceeding the anatomical limit of the alveolar bone, causing gingival recession, especially in individuals with a thin gingival biotype.[5]

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According to Ochsenbein and Ross,[6] there were two main types of gingival morphology, namely, the scalloped and thin or flat and thick gingiva. Seibert and Lindhe[7] later introduced the term "Periodontal biotype" and categorized the gingiva

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into "thick-flat" and "thin-scalloped" biotypes. 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 of ≥2 mm.[8] Many methods were introduced to measure gingival biotype, such as direct measurements,[9] probe transparency,[10] ultrasonic devices,[11] and, most recently, cone-beam computed tomography (CBCT). Purpose of the present study was to evaluate the gingival biotype in different malocclusion.

MATERIALS AND METHODS

A total of 157 participants (88 males and 69 females) were included in this cross-sectional study, all of them are presented in the Department of Orthodontics and Dentofacial Orthopaedics. Mean age of subjects in class I, class II, and class III group is 23.66 ± 4.31 years, 17.26 ± 4.22 years, and 16.17 ± 4.28 years, respectively [Table 1]. All the subjects were voluntarily involved and written informed consent was obtained. The study has been approved by the institutional ethical committee vide letter no Dean/2019/EC/1722 dated 18.11.2019.

The exclusion criteria were subjects with extensive restoration or crowns on their maxillary incisors, history of previous orthodontic treatment, subjects on certain medication with their effect on periodontium, gingival inflammation, dental developmental disorders, pregnant females, attachment loss or pocket depth deeper than 4 mm, the administration of antibiotic premedication due to any disturbance within the recent 6 months, and subjects with smoking habit. Consequently, periodontally healthy subjects with complete permanent dentitions (except third molars) were included in the study.

The subjects were categorized into three groups of skeletal class I, class II, and class III according to cephalometric readings of Angle formed by connecting lateral cephalometric point A (Subspinale), Nasion and point B (Supramentale) angle[12] and Wit's appraisal.[13] Gingival biotype in different malocclusion was assessed by probe transparency method by inserting the periodontal probe into the gingival sulcus on facial aspect of maxillary incisors and canine and probe transparency decides the type of tissue. The gingival biotype is considered thin if the periodontal probe is shown through the gingival sulcus and thick if not visible[14] [Figure 1]. This method of recording is simple, rapid, and minimally invasive.

Table 1: Age-wise distribution of study participants

Class	Mean age	SD
I	23.66	4.31
II	17.26	4.22
III	16.17	4.28

RESULTS

Qualitative data of gingival biotype were recorded and subjected to statistical analysis using SPSS v25 statistics software for Windows. The sample size was determined by considering the minimum 80% power value and the 5% type I error. In addition, the Kolmogorov–Smirnov test was used to decide the normality of the variables and Levene's test was also performed to determine the homogeneity of variances. The Chi-square test was implemented to determine the gingival biotype and its relationship with different skeletal malocclusion and gender.

For the class I malocclusion, the percentage of male gender was 59.1% and of female gender was 40.9%; for the class II malocclusion, the percentage of male gender was 48.6% and of female gender was 51.4%; for the class III malocclusion, male and female percentages are equal, that is, 50% male and 50% female [Table 2].

There was significant difference in gingival biotype among different skeletal malocclusion (*P*-value: 0.022) with high prevalence of thin gingival biotype in class I subjects and more prevalence of thick biotype in class II and class III individuals [Table 3]. Pairwise comparison of gingival biotype in class I versus class II showed significant difference (*P*-value: 0.032); however in class I versus class III and class II versus class III, the test result was nonsignificant [Table 4].

The gender-wise result of gingival biotype was nonsignificant in class II and class III, while in class I subjects, the result was statistically significant (*P*-value: 0.020) and showed high frequency of thin biotype in males (63.1%) and thick biotype in

Figure 1: Gingival biotype assessment on the basis of translucency of periodontal probe through the gingival margin at the facial aspect of central incisor, lateral incisor and canine

females (60%). In addition, the overall frequency of thin gingival biotype was significantly less in female subjects (36.2%) with respect to males (54.5%), while the frequency of thick gingival biotype was higher in females (63.8%) with respect to males (45.5%) [*P*-value: 0.025; Table 5].

DISCUSSION

The gingival biotype plays a significant role in dental aesthetics, functions, and long-term prognosis after orthodontic treatment, especially in maxillary anterior region.[15] The soft and hard tissue biotype may play a critical role in orthodontic treatment outcome; a thin and scalloped biotype has a higher prevalence of gingival recession than thick and flat biotype.[16,17]

Periodontal assessment is usually done in clinical practice by an invasive approach like injection needle or probe, and histological section, while noninvasive method includes visual examinations, with the help of ultrasonic devices, gingival probing transparency method, and CBCT.[18] The visual assessment method of gingival biotype evaluation may not be sufficiently predictable and reproducible as suggested by previous study.[19] The CBCT technique was considered more accurate in assessing thickness of periodontium and alveolar bone.[18] However, high economic cost and radiation exposure can be the disadvantage of CBCT, that is, why probe transparency method was chosen as the method is less traumatic, rapid, easy, and considerably reliable.[20]

Table 2: Gender-wise distribution of study participants

Class	Male	Female
I	65 (59.1%)	45 (40.9%)
II	17 (48.6%)	18 (51.4%)
III	6 (50%)	6 (50%)

Table 3: Comparison of gingival biotype among different classes of skeletal malocclusion

Class	Thick	Thin	*P*
I	51 (46.4%)	59 (53.6%)	0.022*
II	24 (68.6%)	11 (31.4%)	
III	9 (75%)	3 (25%)	

Chi-square test; *indicates significant difference at $P \leq 0.05$

Table 4: Pairwise comparison of gingival quality

Pair	*P*
Class I vs. Class II	0.032*
Class I vs. Class III	0.073 (NS)
Class II vs. Class III	1.000 (NS)

Chi-square test; *indicates significant difference at $P \leq 0.05$

Table 5: Association of gender with gingival quality

Class	Gender	Thick	Thin	*P*
I	Male	24 (36.9%)	41 (63.1%)	0.020*
	Female	27 (60%)	18 (40%)	
II	Male	12 (70.6%)	5 (29.4%)	1.000 (NS)
	Female	12 (66.7%)	6 (33.3%)	
III	Male	4 (66.7%)	2 (33.3%)	1.000 (NS)
	Female	5 (83.3%)	1 (16.7%)	
Overall	Male	40 (45.5%)	48 (54.5%)	0.025*
	Female	44 (63.8%)	25 (36.2%)	

Chi-square test; *indicates significant difference at $P \leq 0.05$

In the present study, a significant difference between male and female subjects in the gingival thickness was found. A thin gingiva was found in 36.2% of female participants and 54.5% of males. However, previous studies suggest higher prevalence of thin gingival biotype in females as compared to males. In addition, it was also reported in literature that younger individuals had significantly thicker gingival biotype than older subjects.[21-23]

This study also demonstrates statistically significant relationship between gingival biotype and skeletal malocclusion (*P*-value: 0.022) and suggests that the prevalence of thick biotype is higher in class II (68.6%) and class III (75%) subjects than class I participants (53.6%) [Table 3]. However, previous studies reported in literature are not in support of this cross-sectional analysis.[24,25]

Various studies reported spontaneous improvement in gingival recession after orthodontic retraction of teeth into alveolar housing without considering their gingival biotype.[26-29] Studies have shown that extrusion or forced eruption of teeth having gingival inflammation reduces bleeding tendency, decreases pocket depth, forms new bone at alveolar crest as teeth erupts, and reduces number of pathogenic bacteria.[30,31] Intrusion is hazardous to periodontium and causes root resorption, pulpal damage, and deepen pocket depth in both thick and thin type of gingival biotype.[32] Tipping tooth movement damages periodontal tissue by causing attachment loss and angular bony defects irrespective of its biotype.[33] Bodily movement of tooth into a periodontal defect causes narrowing of lesion with better healing potential and prevents further attachment loss in both types of gingival tissue.[34,35] There are dilemmas encountered during the treatment of orthodontic patients with susceptible periodontium and cases with gingival recession or bony defects.[36]

Limitations of study

The limitation of this study is that it was cross-sectional and hence gives no indication of the sequence of events. Another limitation is that the sample was drawn from a pool of

patients from one center and that may prejudice the findings. Various factors such as tooth position, its relation to basal alveolar bone, overjet, overbite, and environmental or genetic factors also influence the soft tissue biotype. Further study is recommended to evaluate the effect of orthodontic and periodontal therapy in relation to gingival biotype.

CONCLUSION

Following conclusions can be made from the results of this cross-sectional study:

1. A significant relationship is present between skeletal malocclusion and quality of gingival biotype.
2. The prevalence of thick gingival biotype is found more in females as compared to male individuals.
3. The thin gingival biotype is more commonly seen in skeletal class I than class II and class III.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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