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Assessment of Gingival Biotype in Mandibular Anterior Segment with Different Malocclusion

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ABSTRACT

Objectives: To assess the effect of different dental malocclusion on gingival biotype in the mandibular anterior tooth region and their significant relation.

Materials and Methods: This cross-sectional study was conducted at the Institute of Dentistry, Orthodontics Out-Patient Department, Liaquat University of Medical & Health Sciences, Jamshoro. The sample size was calculated using the Epitool sample size calculator. Non-probability convenient sampling was used. Those patients who met the selection criteria were enrolled in the study and were divided into three groups; Angle Class I, Class II and Class III malocclusion. Measurement of gingival biotype was done by a periodontal probe by the trans gingival probing method by probing the sulcus of the mid-facial aspect through the gingival margin. Statistical analysis was carried out by using the program SPSS Statistics version 22.0 (IBM Co, Armonk, NY, USA). Descriptive statistics for quantitative variables were presented as mean and standard deviation. Frequency and percentage were calculated for categorical variables. Differentiation between the means of these variables was calculated by variance analysis (ANOVA) analysis.

Results: Mean age of the patients was 18.15±4.085. It is observed that the gingival biotype of the teeth in the lower anterior region is thin except for the right lateral incisors which showed a thick gingival biotype in angle class I and class II malocclusion. No statistically significant differentiation was seen in our study among the gingival biotype of lower anterior teeth and type of malocclusion, except for right and left lower lateral incisors with *p*-values of 0.33 and 0.28 respectively.

Conclusion: This study concludes that the gingival biotype has no statistically significant difference with different types of malocclusion groups.

Keywords: Gingival Biotype, Gingival Margin, Mandibular Anterior Teeth, Malocclusion.

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INTRODUCTION

Periodontal biotype is the term used to describe the contour of the gingiva, gingival thickness, alveolar bone contour and thickness.[1] The gingival biotype is defined as the thickness of the gingiva in a bucco-lingual direction.[2-4]

Various scientists define gingival biotypes based on several characteristics such as tooth shape degree of scalloping thickness and width of the gingiva, degree of epithelial keratinization, the height of the papilla, melanin pigmentation, characterization of bone and dimension of the crown.[5] Gingival biotype is mainly divided into two types thick-flat and thin-scalloped.[1,2,6-8]

Qualitative information about thick and thin gingiva is very useful for practitioners and provides them knowledge about the sensitive area which may undergo the break-down inflammatory procedure, para-functional habits and trauma due to the restorative procedure.[9] The gingival margin stability and prevention of gingival recession are much more dependent upon the thickness gingiva and bone.[10]

The thick gingival biotype is characterized by thick bony architecture, flat gingival contour and a broad zone of keratinized tissue and is more resistant to trauma and inflammation[6,8] and its fibrotic and resilient nature make it more resistant to surgical procedure and prone towards pocketing rather than recession.[11] The characteristics of the thin gingival biotype are thin bony architecture, scalloped gingival contour and thin keratinized tissue.[6] It is noticed that a reduced gingival thickness plays a major role in periodontal detachment and marginal tissue recession.[6,8]

It has been observed that from gingival recession and interproximal bone resorption loss of soft tissue occurs which always compromises the esthetic.[11] For the measurement of gingival thickness various invasive and non-invasive methods are used.[3,7] Biotype can be determined by different methods such as ultrasonic device method, probe transparency method (TRANS), direct measurement and most the recent method for determining the gingival thickness is cone beam computed tomography (CBCT) method.[10,12]

Several factors such as gingival biotype, the architecture of gingiva, shape of anterior teeth are responsible for a successful esthetic restoration.[6] In esthetic-driven dentistry, it is important that a clinician should have a better knowledge of gingival response to various restorative, prosthetic, periodontal, and orthodontic procedures.[1,3] Final esthetic outcomes are largely dependent on the gingival morphology.[6]

The gingival biotype described the soft tissue limitation of tooth movement so careful assessment of the gingival biotype is important before planning orthodontic treatment.[13] It is observed that gingival recession most commonly occurs in mandibular teeth than maxillary teeth. As the person gets older the frequency of gingival recession increases with time, which more frequently seems to occur facially than lingually.[14] Orthodontic tooth movement is also considered an important cause of the gingival recession, usually when teeth are moving labially or lingually outside the alveolar plate and leading to bone dehiscence.[15]

The purpose of this study was to evaluate the gingival biotype in the region of the mandibular anterior teeth with different malocclusion in patients reporting to Orthodontic OPD, LUMHS Jamshoro. The study will be beneficial for patients as well as clinicians, as it will help the clinicians to propose a proper treatment plan in class II malocclusion cases where the proclamation of the lower incisor is needed. Accurate knowledge about the gingival biotype will help to decide whether the change in inclination will be beneficial or harmful for dentition after the completion of treatment. The study of gingival thickness will help to minimize the subsequent periodontal lesion during orthodontic treatment and will impact the success rate. The objective of this study was to assess the effect of different dental malocclusion on gingival biotypes in the mandibular anterior tooth segment and their significant relationships.

MATERIALS AND METHODS

This cross-sectional study was carried out at the Orthodontic Department, Faculty of Dentistry LUMHS, Jamshoro from January 2019 to June 2019. Patients of both genders who required orthodontic treatment were included in this study. Patients of ages 12 to 30, having healthy Periodontium and complete permanent dentition except (third molar) were also included in this study.

Patients with previous orthodontic treatment, Pocketing greater than 4mm, presence of Crown or extensive restorations, patients who were Pregnant or in lactation period, patients with Systemic problems and

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medication, patients who have a habit of smoking and Patients taking prophylactic antibiotics were excluded from this study. The sampling was done using Non-probability and convenient sampling and sample size was calculated using the Epitool sample size calculator. By putting the figure from reference study[2] according to software the assumed population standard deviation ± 1.19 (WKG) of mandibular anterior teeth according to the angle class I, the SD in angle class I tooth number (31) was used at 95% confidence interval using 0.2 acceptable error. The total sample size calculated was 136.

After the approval of the research ethics committee, the research was done following the declaration of Helsinki. Informed Consent was obtained from all patients reporting orthodontic department at the Lumhs Jamshoro. Before enrollment for the study patient was examined for periodontal depth (PD), gingival index (GI) and plaque index (PI). Those patients, who met the selection criteria, were enrolled in the study and will be divided into three groups; Angle Class I, Class II and Class III malocclusion. Based on the transparency of the periodontal probe, the evaluation of the gingival biotype was done. Measurement was done by a periodontal probe by trans-gingival probing method at the mid-facial aspect via probing the sulcus through the gingival margin. Visibility of the periodontal probe outline measurements through the gingiva was considered as a thin gingival biotype otherwise it was measured as a thick gingival biotype. SPSS statistics version 23.0 (IBM Co, Armonk, NY, USA) was used for Statistical analysis. Quantitative variables such as mean and standard deviation were calculated. Frequency and percentage were calculated for categorical variables. Differentiation between the means of these variables was calculated by variance analysis (ANOVA) analysis.

RESULTS

The total number of patients included in this study was 136 of which 44 (32%) were male and 92 (68%) were female. Ages ranged from 12 to 30 years in the study whereas the mean age was 18.15±4.085 (Table-1). Patients were divided into three groups of malocclusion Angle Class I, Class II and Class III. The total number of subjects examined in Angle Class I was 90 (66.2%), 38 (27.9%) subjects were examined in Class II and 8 (5.9 %) subjects were examined in Class III (Table-2).

The gingival biotype was measured according to angle classification as described in Table 3. It is observed that the gingival biotype of the teeth in the lower anterior region is thin except for right lateral incisors which showed thick gingival biotype in Class I and Class II Angles classification. No statistically significant difference was seen in our study among the gingival biotype of lower anterior teeth and type of malocclusion when related to Angle's malocclusion groups, except right and left lower lateral incisors which show a significant difference between the gingival biotype with Angle's classification with *p*-value 0.33 and 0.28 respectively ($p < 0.05$).

Table 1: Age distribution of the study participants (N=136)

Minimum Age of the patient	12
Maximum Age of the patient	30
Mean Age of the patient	18.15 ± 4.085 (SD)

Table 2: Patient distribution according to Angle's classification

Angle's Classification	Number of patients	Percentage
Angle Class I	90	66.2%
Angle Class II	38	27.9%
Angle Class III	8	5.9%

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Table 3: Distribution of gingival biotype in mandibular anterior teeth according to Angles classification

Tooth number	Angle's Classification	Thin Gingival biotype	Thick Gingival biotype	*p*-value
Right Central Incisor	Class I	60(66.6%)	30(33.3%)	0.217
	Class II	30(79%)	8(21%)	
	Class III	7(87.5%)	1(12.5%)	
	Total	97(71.3%)	39(28.6%)	
Right Lateral Incisor	Class I	36 (40%)	54(60%)	**0.033**
	Class II	18(47.3%)	20 (52.6%)	
	Class III	7(87.5%)	1(12.5%)	
	Total	61(44.8%)	75(55.2%)	
Right Canine	Class I	57(63.3%)	33(36.7%)	0.111
	Class II	30(79%)	8(21%)	
	Class III	7(87.5%)	1(12.5%)	
	Total	94(69%)	42(30.88)	
Left Central Incisor	Class I	60(66.6%)	30(33.3%)	0.138
	Class II	31(81.5%)	7 (8.5%)	
	Class III	7(87.5%)	1(12.5%)	
	Total	98(72%)	38(28%)	
Left Lateral incisor	Class I	40(44.4%)	5(55.6%)	**0.028**
	Class II	23(60.5%)	15(39.5%)	
	Class III	7(87.5%)	1(12.5%)	
	Total	70(51.4%)	66(48.5%)	
Left Canine	Class I	65(72%)	25(8%)	0.508
	Class II	30(79%)	8(21%)	
	Class III	7(87.5%)	1(12.5%)	
	Total	102(75%)	34(25%)	

DISCUSSION

In our society, the artistic view of the gingiva is a significant image outline for a patient's restorative treatment and smile. Vital role in treatment planning for procedures as such as placement of implants, extractions, root coverage and especially orthodontics, mainly in the anterior maxillary region, depends upon determining the gingival tissue thickness.[9,14] So during treatment planning, the modifications in gingival tissue must be taken into consideration. Even if the alveolar bone is absent or reduced, a gingival recession could be avoided if the attached gingiva is thicker. The Thickness of the gingiva is evaluated by a non-invasive and invasive method. Cephalometric radiographs, histological sections, probes and injection needles are invasive methods whereas cone beam computed Tomography, probe transparency, the use of ultrasonic devices and visual examination are non-invasive methods.[16-18] We used the probe transparency method for the assessment of the gingival biotype. The sample size of our study was (n=136) and participants who fulfilled the inclusion criteria were assessed for gingival biotype. Participants were divided into three groups based on molar relationship according to Angle's classification. Individuals included in our study group were up to 30 years of age, having all their permanent

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teeth erupted suggesting gingival biotype would not be significantly affected by age-related factors. Kaya et al study's findings are in agreement with the findings of our study, which also had patients in the same age group.[2] No statistically significant difference was found in genders in terms of mean age and number of the patient.[2]

Some studies have established that the differences between biotypes were more noticeable in maxillary teeth which is in contrast to our study.[18,19] No statistically significant difference was found in genders in terms of mean age and number of the patient.[18,20,21] A critical factor that defines the result of dental treatment mainly depends on the Tissue biotype. The initial thickness of the gingiva foretells the consequence of any restorative treatments and root coverage procedures.[22] Gingival recession is likely seen in patients, following nonsurgical periodontal therapy, with a thin gingival biotype.

A more favourable treatment outcome can be done in thin biotypes as it can enhance the quality of tissue using periodontal surgical procedures.[23] Gingival thickness reported in a study by Viller, has shown that females have less Gingival thickness than males.[24] This result is different from this study as the ratio between females' and males' gingival thickness in our study group showed no significant difference.[24]

Thin gingival tissues are more prone to periodontal diseases and there is more chance of alveolar bone resorption after tooth extraction. Thin gingival biotype cases require careful assessment before going for a treatment plan; sometimes it is necessary to increase gingival thickness surgically before starting treatment.8 According to this study mandibular anterior teeth collectively showed a thin gingival biotype, this finding is in agreement with the study conducted by Cuny-Houchmand et al[4] who showed that the classification based on the individual mandibular or maxillary anterior teeth with thin gingival biotype was statistically significant. A study by Kaya et al[2] also supports the result of our study. Whereas the results of a study conducted by Vandana[25] showed that mandibular teeth have a thick biotype, this finding is in contrast with our study. Gingival thickness is a more significant factor and protrusive movement among the parameters studied during orthodontic treatment planning. A study conducted by Shah et al[7] evaluated that the thickness of gingival tissue depends upon the tooth position in alveolar bone, while Alkan et al[26] demonstrated the relation of maxillary anterior teeth with gingival biotype with a different type of malocclusion. The result of these studies is in agreement with our study as they evaluated that there is no statically significant relationship between gingival biotype and different groups of malocclusion.

A study conducted by Matarese et al[27] included 76 subjects in their study and evaluated the maxillary anterior teeth with gingival biotype by the mid-facial probing method. No statically significant relation was present in the results of their study between different malocclusion groups and gingival biotypes.

Another study carried out by Zawawi et al[28] evaluated the association of different types of malocclusion and gingival biotype, while Kaya et al[2] evaluated the relationship of a gingival biotype of lower anterior teeth with angles classifications. The results of our study are in agreement with the results of this research. This also demonstrates that there is no statistically significant relationship between the gingival biotypes with different malocclusion groups. The gingival biotype of permanent canines is considered as low as compared to both the incisors i.e. central and lateral, this is because the position of the tooth bud of permanent canines and the root of deciduous canine are located at the same location, if there is lack of space in the canine region the permanent canine erupt most commonly in vestibule.[15,29] The results of our study show that the gingival biotype of mandibular canine is less than the lateral incisor and central incisors, these findings strengthen the conclusion of above mention literature.

CONCLUSION

This study concludes that the gingival biotype has no statistically significant difference with different types of malocclusion groups. Furthermore, more confirmation can be done by using a larger sample size which can include a varied population.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

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ETHICAL STATEMENT

An ethical clearance letter was obtained from the Research Ethics Committee at Liaquat University of Medical & Health Sciences, Jamshoro. (Ref No.: LUMHS/REC/680 dated 31/05/2018).

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