Assessment of Keratinized Gingival Width in Mandibular Anterior Segment with Different Malocclusion and Level of Crowding

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Abstract- To assess the effect of different dental malocclusion and crowding groups on keratinized gingival width in the mandibular anterior tooth region and their significant relation. This cross-sectional study was conducted at the Institute of Dentistry, Orthodontics Out Patient Department, LUMHS, Jamshoro. The study included a total of 136 patients, comprising 44 males (32%) and 92 females (68%). The epitool sample size calculator was used to calculate the sample size. Patients meeting the selection criteria were enrolled in the study and categorized into three groups: Angle Class I malocclusion, Angle Class II, and Angle Class III. Each Angle classification group was further subdivided based on the degree of anterior region crowding. After evaluation the score was calculated. Data was analyzed via SPSS version 22. Descriptive statistics such as percentage, frequency distribution, cross tabulation were included in data analysis. The level of significance was set at <0.05%. The average age of the patients was 18.15±4.085. Results from ANOVA test showed that keratinized gingival width in lower anterior teeth had no significant difference when related to Angles classification except for the lower left lateral incisor with a P value of (P value 0.010). The difference in keratinized gingival width of different crowding groups assessed with the application of ANOVA test were not statically significant except for the lower right lateral Incisor & left Lateral incisor in which this difference was noted to be statically significant ($p < 0.05$).

Index Terms- Angle's dental malocclusion, Dental crowding, Mandibular anterior teeth, Width of keratinized gingiva

I. INTRODUCTION

On anatomical basis, the gingiva is divided into three types such as free gingiva, attached gingiva and interdental gingiva [1]. Biological width has an important role in maintaining the gingival health, damage of the periodontal supporting structure will occur if any type of problems occurs in this space [2]. It is believed that in the presence of sufficient amount of keratinized gingiva, it is possible to prevent the gingival as well as periodontal health [3]. The width of the keratinized gingiva may vary between 1 and 9 mm [4,5]. Existence of sufficient amount of keratinized gingiva is considered necessary for preservation as well as sustentation of periodontium health [3]. The Gingival thickness of Keratinized gingiva extends from free gingival margin to mucogingival junction and necks of all teeth are surrounded by it [5]. On the basis of histological appearance when keratinized gingiva is compared with non- keratinized alveolar mucosa, it is evaluated that attached gingiva is tightly adhering with the tooth and with surrounded bone as well, it is keratinized in nature and possess a fine distinguishable epithelial ridge, because of this attached gingiva can bear a sufficient number of mechanical forces and more sufficiently protect the nearby tissue. Result of study describes that the keratinized gingival tissue with 2 or more than 2 mm width remain healthier than the keratinized gingiva less than 2mm, so this study showed that it is necessary for the maintenance of periodontium health status that the amount of keratinized tissue should be 2mm [6].

Orthodontic tooth movements can lead to change in mucogingival complex with respect to soft tissue margin and gingival tissue dimension so it is necessary to evaluate the proper direction of tooth movement during orthodontic treatment for proper orthodontic treatment planning it is imperative to carefully determine the gingival thickness [7-8].

Various mucogingival surgical procedures other than free gingival grafting and sub epithelial connective tissue graft are used to increase the width of keratinized gingiva in the area of decrease amount of keratinized gingiva and these procedures are named as coronal advancement flaps, a cellular dermal graft, and enamel matrix proteins. At the time of orthodontic treatment for evaluation of periodontal problems it is necessary to assess the width of keratinized gingiva [9].

Recently kaya et al [4] in their study investigated the relationship of gingival biotype and relationship of keratinized gingival width with different malocclusion groups and level of crowding. This study showed that there is no correlation between gingival thickness and different malocclusion pattern.

Shah et al [10] in research evaluated the prevalence of gingival biotype and its relationship to clinical parameters. They concluded that the gingival thickness and keratinized gingival width are directly related to each other.

The present study aims to investigate the relationship of width of keratinized gingiva with different malocclusion groups and amount of crowding.

II. MATERIALS AND METHODS

This cross-sectional study was conducted at the Institute of Dentistry, Orthodontics Out Patient Department, LUMHS, Jamshoro from 1ST June 2018 to 31st December 2018. The study was commenced after obtaining approval from the Research Ethics Committee. Total number of patients included in this study were 136 in which 44(32%) were male and 92(68%) were female. The sample size was determined using

the Epi-tool sample size calculator. A non-probability convenience sampling method was employed.

The study group consisted of participants with either gender, age range from 12 to 30, periodontally healthy subjects, who have not undergone orthodontic treatment before, have completed permanent dentition except third molar. Informed consent was obtained from all patients.

Those patients, who meet with the selection criteria was enrolled in the study, will be divided into three groups; Angle class I malocclusion, Angle class II, Angle class III. Each Angle classification group was subdivided according to the degree of anterior crowding. Space analysis was conducted to assess the degree of crowding. The mesiodistal width of each tooth, including the canines, was measured on plaster models using a Vernier caliper. The required space for each tooth was determined by subtracting the mesiodistal width of the tooth from the available space. This study was determined the level of crowding by the sum of the lack of all space, and it was classified by three ways; mild, (< 4mm) moderate (5-9mm), sever (10 or > 10mm). Keratinized gingival width was measured from the mucogingival junction to the free gingiva at the mid facial point margin at the labial area of the mandibular anterior region by periodontal probe (Michigan O probe with William marking). Statistical analysis was carried out by using the program SPSS statistics version 22.0 (IBM Co, Armonk, NY, USA). Frequency and percentage were calculated for categorical variables. The association between these variables was calculated by variance analysis (ANOVA).

III. RESULTS

A total of 136 patients were included in the study, with 44 males (32%) and 92 females (68%). The study included patients aged between 12 and 30 years, with an average age of 18.15 ± 4.085 years.

Patients included in this study were divided into three groups of malocclusion as Angle Class I, Class II, and class III and total subjects examined in Angle class I were 90(66.2%),38(27.9%) subjects were examined in Class II and 8 (5.9 %) subjects were examined in Class III (Table-1).

Patients included in this study were divided into three subgroups according to crowding. Number of Patient reported in mild, moderate, sever crowding groups were 55 (40.4%), 44(32.4%), 37(27.2%) respectively (Table 2).

Keratinized gingival width when measured in different Angle's classification, showed to be highest in class I malocclusion. Keratinized gingival width in class I malocclusion of lower anterior teeth was observed to be 4.37 ±1.56, 5 .51±1.76, 4.22±1.67, 4.30±1.64, 5.74±2.28, 4.14 ±1.61 in right central incisor, lateral incisor and canine and left central and lateral incisor and canine respectively. In class III malocclusion, except the lower left Canine, all lower anterior teeth showed a keratinized gingival width of less than that observed in Class I and II. The keratinized gingival width of left lower canine was 3.93±2.30 in class III cases. Results from ANOVA test showed that keratinized gingival width in lower anterior teeth had no significant difference when related to Angles classification except for the lower left lateral incisor with a P value of (P value 0.010) (Table 3).

When an association of the keratinized gingival width of lower anterior teeth has measured with a different crowding group, it was observed that keratinized gingival width was higher in severe crowding group. The keratinized gingival width in severe crowding was 4.7, 6.3, 4.5, 4.6, 6.7, and 4.2 in lower right central incisor, lateral incisor and canine and lower left central incisor, lateral incisor and canine respectively. Value of keratinized gingival width of all anterior mandibular teeth except left lateral incisor and left canine were lowest in moderate crowding. The difference in keratinized gingival width of different crowding groups assessed with the application of ANOVA test were not statically significant except for the lower right lateral Incisor & left Lateral incisor in which this difference was noted to be statically significant ($p < 0.05$). Detailed information of this association is shown in (Table 4).

Table I: Patient distribution according to Angle's classification

Distribution of patients 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%

Table 2: Patient distribution according to severity of crowding

Patient distribution according to severity of crowding		
Crowding	**Number of patients**	**Percentage**
Mild	55	40.4%
Moderate	44	32.4%
Severe	37	27.2%

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

Tooth	Angle's Classification	Keratinized Gingival Width	*p*-value
Right central Incisor	Class I	4.3722± 1.56	0.625
	Class II	4.1316±1.50	
	Class III	4.0000±1.41	
Right lateral Incisor	Class I	5.5178±1.76	0.348
	Class II	5.2500±1.91	
	Class III	4.6250±1.50	
Right canine	Class I	4.2278±1.67	0.115
	Class II	3.6579±1.35	
	Class III	3.5000±1.53	
Left central incisor	Class I	4.3089±1.64	0.428
	Class II	4.0132±1.53	
	Class III	3.6875±1.75	
Left lateral incisor	Class I	5.7444±2.28	**0.010**
	Class II	4.5921±1.81	
	Class III	4.2500±2.71	

Left canine	Class I	4.1444±1.61	0.078
	Class II	3.4605±1.18	
	Class III	3.9375±2.30	

Table 4: Distribution of keratinized gingival width in mandibular anterior teeth according to severity of crowding

Tooth	Angle's Classification	Keratinized Gingival Width	*p*-value
Right central Incisor	Mild	4.1000±1.50	0.164
	Moderate	4.1705±1.44	
	Severe	4.6892±1.63	
Right lateral Incisor	Mild	4.6564±1.50	**0.001**
	Moderate	5.5114±1.78	
	Severe	6.3378±1.79	
Right canine	Mild	3.8545±1.42	0.121
	Moderate	3.8523±1.45	
	Severe	4.4865±1.92	
Left central incisor	Mild	4.0273±1.62	0.258
	Moderate	4.0795±1.62	
	Severe	4.5622±1.58	
Left lateral incisor	Mild	4.6000±1.87	**0.001**
	Moderate	5.0909±1.98	
	Severe	6.7162±2.47	
Left canine	Mild	3.9182±1.47	0.432
	Moderate	3.7500±1.61	
	Severe	4.2027±1.65	

IV. DISCUSSION

In modern society, the aesthetic appearance of the gingiva plays a crucial role in shaping the overall appearance of a patient's smile and in restorative treatment. Assessing the thickness of the gingival tissue is essential in treatment planning for orthodontics, root coverage, extractions, and implant placement, especially in the maxillary anterior region [11,12]. So, it is important to take into consideration the modifications in gingival tissue during treatment planning.

Gingival thickness is evaluated by an invasive and a non-invasive method. Invasive methods such as injection needle, probe, histological sections or cephalometric radiographs whereas non-invasive methods included visual examination, the use of ultrasonic devices, probe transparency and cone beam computed Tomography [13].

Individuals included in our study group up to 30 years of age, so all the permanent teeth erupt and suggesting, gingival thickness would not be substantially affected age related factors. The findings of this study are in agreement with the study conducted by kaya et.al [4]. In our study no statistically, significant difference was found between genders in terms of number and mean age of the patient. In addition, there was no statistically significant difference in terms of the number of patients between Angle classification and number of crowding groups.

Few previous studies have indicated that males have greater gingival thickness than females [14]. These results are different from this study because no significant difference was observed between males and females gingival thickness in our study group.

According to different studies, In the case where crowding is issuing mandibular permanent lateral incisor is erupted more lingually than mandibular central incisors because the tooth germ of the lower lateral incisor more lingually positioned than tooth germs of lower central incisors in crowding cases.4 So it is determined that the keratinized gingival width and gingival thickness of lingually positioned is more than that a labially placed tooth [15].

The results of our study show that the keratinized gingival width of mandibular canine is less than the lateral incisor and central incisors. Results from research by kata et.al [4] are in agreement of our according to their study keratinized gingival width and GINGIVAL THICKNESS of mandibular incisors are more than mandibular canine. The Results of their study showed that there is no statically significant difference between gingival thickness and the different crowding groups [16].

Kaya et.al [4] on the basis of other study conducted in which they suggested that the variation in thickness of gingival tissue depends where the tooth located in the alveolus, determine the gingival thickness in relation to level of crowding in mandibular anterior dentition [17].

The literature review includes a variety of perspectives on the role keratinized gingival width plays in preserving periodontal health during orthodontic therapy. Through analyzing 209 people operated through fixed orthodontic appliances, researcher studied the relation between the initial keratinized gingival width and gingival recession and found that there was no substantial difference in the initial keratinized gingival width for individuals. Who had or had not had gingival recession. It is therefore important to keep in mind that the mean keratinized gingival width of all teeth in this research was greater than 2mm [18].

In another research it is indicated that such a keratinized gingival width less than 2mm would be sufficient for people with good oral hygiene [19].

The result of present study determines that the mean value of keratinized gingival width of all mandibular anterior in relation to different malocclusion groups is more than 2 mm which range from 3.4605±1.18, lower left canine in angle's class II and 5.74±2.28 in lower lateral incisor in angle's class I and it is considered as sufficient for maintenance of periodontal health which are in agreement of the study by closs et. Al [20].

Results of our study from ANOVA test in agreement of study conducted by kaya et al 4 showed that the keratinized gingival width in lower anterior teeth had no significant difference when related to Angle's classification except for the lower left lateral incisor with a P value of (P value 0.010). The width of the gingiva decreases with the recession, and hence, to assess the keratinized gingival width and its relationship with

gingival thickness, patients demonstrating no recession were included (n = 334). The mean keratinized gingival width was the greatest for the lateral incisor followed by the central incisor and canine. These findings are in agreement with those of the previous studies [21].

A significant positive co relation has been observed between keratinized gingival width and gingival thickness for maxillary central incisor, lateral incisor, and canine, i.e., the patients with a thinner gingiva frequently present with a limited amount of attached gingiva. Considering the role of keratinized gingiva in periodontal health [22], this finding further supports the notion that patients with a thin biotype require a more careful treatment planning.

Limited number of researches were conducted to detect the relationship between different level of crowding and keratinized gingival width, results from the previous study by kaya et al [4] demonstrated that the keratinized gingival width in the sever crowding group were higher in tooth number 31, 32 and 42 with statistically significant difference, keratinized gingival width of 41 is higher in the severe crowding group but with no statically significant difference as compare to other groups. They also demonstrated that the keratinized gingival width of the mandibular canine show higher value in the mild group with a statically significant difference with ($P \leq 0.05$). Our research demonstrates keratinized gingival width of mandibular teeth is higher in sever crowding groups. Studies with a larger sample size and including heterogeneous population are needed to confirm the results of present study.

IV. CONCLUSION

This study concludes that the keratinized gingival width has no statistically significant difference in relation to different type of malocclusion group. Keratinized gingival width of mandibular anterior teeth is higher in sever crowding groups, while the thickness of gingiva is lowest in mild crowding group. Furthermore, it is necessary to have detail information about periodontium including gingival thickness, and keratinized gingival width, because appropriate knowledge about keratinized gingival width can lead to proper treatment planes. Results of this study assessed that the mandibular anterior teeth exhibit mean keratinized gingival width more than 2 mmm.

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