ORIGINAL ARTICLE

Comparison of Lower Incisor Gingival Recession in Nonextraction Orthodontic Patients with Class I Crowding and Class II Malocclusion

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ABSTRACT

Objective: To compare lower incisor gingival recession (GR) in non extraction orthodontic patients with Class I crowding and Class II malocclusion treated using Class II elastics.

Study Design: A cross sectional comparative study.

Place and Duration of Study: Orthodontic Department, Rawal Institute of Health Sciences (RIHS), from February 10, 2024 to August 10, 2024.

Materials and Methods: Pre and post-treatment casts of 42 orthodontic patients were divided into two groups: Class I crowding (C1) and Class II elastic treatment (E2). Clinical crown height (CCH) of the lower left central incisor was measured. GR was determined as the difference in CCH before and after treatment. The data was analyzed by SPSS v.20.0. Descriptive statistics like frequency of gender and mean age in C1 and E2 group were calculated. Paired sample t-test for intra group GR (pre and post treatment) and independent sample t-test for inter group GR were applied to analyze GR between two groups. The p value ≤ 0.05 was considered statistically significant.

Results: Both groups showed an increase in GR after treatment. The mean GR1 value was slightly higher (.5214mm) than GR2 (.4262mm) depicting that the C1 group had slightly more GR than the E2 group, though this difference was not statistically significant.

Conclusion: Both treatment modalities in non extraction cases resulted in increased GR, emphasizing the need to consider periodontal implications during orthodontic planning.

Key Words: *Class II Elastics, Gingival Recession, Orthodontic Treatment, Periodontal Health.*

Introduction

Gingival recession (GR) is a common periodontal condition which is characterized by the subjection of the root surface due to the gingival margin's advancement to the cementoenamel junction, often resulting in aesthetic concerns and dentinal hypersensitivity.[1] This condition involves the loss of attachment and exposes the tooth root to the oral environment. GR can lead to discomfort and may contribute to the development of both carious and non-carious cervical lesions.[2] The condition is most frequently observed in mandibular incisors, affecting approximately 43% of cases.[3] Among the various etiological factors contributing to GR, dental alignment and occlusal relationships are particularly significant.[3] GR has been associated with the buccolingual thickness of the gingival tissue, as well as orthodontic forces that displace teeth beyond the alveolar bone's boundaries, potentially inducing localized bone dehiscence and fenestrations.[4,5] Nevertheless, some studies have reported no significant differences in the occurrence and severity of GR between patients who are orthodontically treated and their matched untreated controls.[6,7]

There is a historical concern that moving lower incisors forward (proclination) during orthodontic treatment could lead to gum recession, especially in cases with pre-existing thin gum tissue or bone.[8] Research has shown that when we treat lower incisor crowding by nonextraction orthodontic treatment the teeth align by proclination of the lower incisors. For every millimeter of crowding alleviated, there's an expected increase in proclination of around 0.5 degrees and a slight protrusion of 0.2 mm, which can lead to GR.[9] On the other hand, research also indicates that this is not a strong or consistent correlation. Jati and Firquim[10] found no significant

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link between changes in lower incisor inclination (whether through orthodontic treatment or other factors) and the development of gingival recession.

Similarly, when class II malocclusion is treated by nonextraction orthodontic treatment by class II elastics it also leads to proclination of the lower incisors which can result in GR if excessive.[11] According to a recent systematic review, Class II elastics are efficacious in correcting Class II malocclusions, with their primary effects being dentoalveolar.[12] Conversely, GR was not found in patients, who were orthodontically treated using intermaxillary elastics and the Twin Force appliance.[13,14] These conflicting findings underscore the necessity for further investigation.

In nonextraction cases, orthodontic movements, especially in the mandibular anterior region, can influence the gingival margin's stability and the underlying periodontal support. Therefore, this study was conducted to "evaluate and compare the extent of gingival recession in nonextraction orthodontic patients with Class I crowding and those treated with Class II elastics." This study will help orthodontists identify and analyze improved orthodontic treatment modalities that prioritize both aesthetic and periodontal health outcomes.

Materials and Methods

This cross-sectional retrospective study was conducted at Rawal Institute of Health Sciences (RIHS) Islamabad, approved by Institutional Review Board (IRB) of RIHS (RIHS/IRB/D/24/003). The duration of study was six months from February 10, 2024 to August 10, 2024. The sample size was 42, that was calculated by using the prevalence of GR 40%,[15] a 95% confidence level, and a 5% margin of error, by single population proportion formula:

$$n = \frac{Z^2\ [p(1-p)]}{d^2}$$

Where n is sample size, Z is 1.96 i.e. the Z-score for 95% confidence level, *p* is the estimated prevalence of GR (as a proportion), and d is margin of error i.e. 0.05.

Non-probability purposive sampling technique was done. We evaluated the amount of GR in lower incisors among two patient groups: those presenting with moderate crowding and those with Class II malocclusion treated using elastics in nonextraction cases.

Patients were divided in two groups lower incisor crowding group (C1) and class II elastic group (E2). Each group consisted of 21 patients. The inclusion criteria which was: (i) age of the patients ranged from 16 to 30 years with good oral hygiene, (ii) all patients were treated without extraction with fixed orthodontic mechanotherapy, (iii) patients having thick attached gingiva, lower incisor to mandibular plane angle not more than 95°, (iv) patients in the lower incisor crowding group should not have crowding more than 5mm, patients in the class II elastic group should have no crowding in the lower arch. The thickness of gingiva was assessed manually by a single investigator by inserting periodontal probe in the gingival sulcus. The exclusion criteria included (i) patients with a history of periodontal disease (ii) treatment prior to orthodontic intervention (iii) patients with systemic conditions affecting periodontal health and (iv) patients who underwent additional dental procedures affecting the gingiva during or after orthodontic treatment.

Dental casts taken were labeled as pre (T0C1) and post-treatment (T1C1) in C1 group. Similarly, in E2 group pretreatment casts were labelled as T0E2 and post treatment as T1E2, respectively. The dental casts were utilized to assess alterations in the clinical crown height (CCH) of the lower left central incisor following incisor proclination, as illustrated in Figure I. Dental casts after treatment (T1) were obtained one-month post-debonding. Scaling was also done at the time of debonding to eliminate potential effects of bracket-induced gingival inflammation on measurement. The CCH of the lower left central incisor was determined using a vernier caliper, measuring the perpendicular distance from the incisal edge to the most apical point of the free gingival margin. The net GR was calculated as the difference between pre and post-treatment CCH values, designated as GR1 for the C1 group and GR2 for the E2 group. To evaluate the measurement method's precision, a single operator repeated all plaster model measurements after a week. An intra class correlation coefficient (ICC) was then computed between the two measurement sets, resulting in a value of 0.96, indicating high reliability.

Descriptive statistics for both C1 and E2 groups were calculated by using SPSS 20. Data distribution was studied using a Shapiro–Wilk normality test. Paired

sample t test was used to compare intragroup pre-treatment and post-treatment values of GR. Whereas, inter group comparison was done on the differences of pre-treatment and post-treatment in CCH comprising "GR1 for C1" and "GR2 for E2" group by using independent sample t-test. The *p* value of ≤ 0.05 was considered statistically significant.

Results

The frequency of males and females was 8 (32%) and 13 (68%) in crowding (C1) group, while in Class II elastic group (E2) group it was 9(43%) and 12 (57%) respectively as shown in Figure II. The mean value for age, pre and post treatment CCH and net GR is shown in Table I for both C1 and E2 groups. Shapiro–Wilk normality test showed equal distribution of data. Results of paired sample t-test (Table II) were statistically significant (p=0.001) for both C1 and E2 groups. These results revealed that GR occurred in both groups after orthodontic treatment. Mean GR1 value was slightly higher (.5214mm) than GR2 (.4262mm) depicting that the C1 group had slightly more GR than the E2 group. However, it was not statistically significant when independent sample t-test was applied as shown in Table III (p =0.418).

Figure 1: Measurement of CCH from incisal edge to deepest gingival crevice.

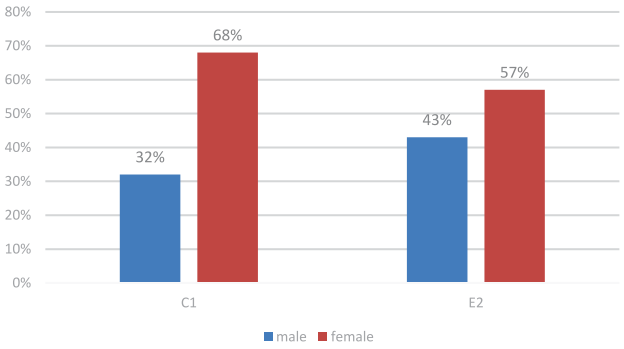

Figure 2: Percentage of males and females in C1 and E2
C1= Crowding group E2= Class II elastic group

Table I: The mean of pre and post treatment CCH in C1 and E2 groups

	n	Mean ± SD
Crowding group (C1) Age	21	16.238 ± 1.81
T0C1 (CCH)	21	7.8238 ± .814
T1C1 (CCH)	21	8.3429 ± .817
GR1	21	.5214 ± .404
Class II elastic group (E2)		
Age2	21	16.9524 ± 2.51
T0E2 (CCH)	21	7.6619 ± .780
T1E2 (CCH)	21	8.0714 ± .698
GR2	21	.4262 ± .347
Valid n (listwise)	21	

Discussion

Our study showed that significant amount of GR occurred in the post treatment phase of both class II elastics and nonextraction crowding groups. Similar to this Bin Bahar and Alkhalidy[16] revealed that while treating Class II nonextraction cases using Class II inter maxillary elastics, the lower incisors frequently procline. This proclination of the lower incisors is inevitable, and in certain cases particularly in dolichofacial individuals with a slender cortical bone structure in the mandibular symphysis—may experience periodontal complications like GR as a result of this movement. Tsolaki *et. al.,*[11] demonstrated that multibracket orthodontic treatment utilizing Class II elastics alone leads to a rapid and undesirable inclination of the labial incisors causing GR.[17]

However, in contrast to our results Rongo *et. al.,* [18] demonstrated that using Class II elastics in combination with aligners leads to effective control of lower incisors, which means less GR. Tehnia and Carlos[5] found no association between appliance-induced labial movement of mandibular incisors and GR, rather it is associated with thin thin gingiva. Additionally, according to a recent systematic review there is not enough evidence to definitively state that the forward tipping of incisors caused by fixed appliances negatively affects periodontal health. As a result, additional research is required to address this issue.[19]

This controversy also extends to cases of mild Class I crowding. In the front part of the lower jaw, significant correlations have been found between

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Table II: Intragroup paired sample t-test

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Error Mean	95% CI Difference Lower	Upper			
Pair 1	T0C1 - T1C1	-.519±.405	.08847	-.70359	-.33450	-5.867	20	0.001
Pair 2	T0E2 - T1E2	-.409±.359	.07850	-.57327	-.24578	-5.217	20	0.001

The *p* value of ≤ 0.05 was considered statistically significant.

Table III: Inter group Independent Sample T-Test

Gingival recession		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	SE of Difference	95% CI Difference Lower	Upper
GR	Equal variances assumed	.016	.900	.819	40	.418	.09524	.11635	-.13992	.33040
	Equal variances not assumed			.819	39.1	.418	.09524	.11635	-.14008	.33056

The *p* value of ≤ 0.05 was considered statistically significant.

incisor crowding and the advancement of periodontal disease.[20] Changes in soft tissues can be associated with the thickness of the labial gum tissue and the amount and type of orthodontic forces that push the teeth outside the alveolar bone envelope, leading to localized bone loss and GR.[4] In our study we have controlled this factor by including patients with thick gingival biotype on lower incisors.

On the other hand, Nastri *et. al.,*[21] found no correlation between GR and the final lower incisor to mandibular plane angle (IMPA), even when this angle exceeded 95°. Orthodontic tooth movement can cause dehiscence at the bone crest when a tooth is moved into an area of thin bone before the occurrence of actual GR. Ideally, tooth movement should only occur within the trabecular space of the alveolar bone; however, some movements may compromise the outer cortical plate, leading to dehiscence and fenestration. Labial cortical bone thickness can only be accurately assessed using cone-beam computed tomography (CBCT). In our study we selected patients with thick attached gingiva but could not assess the thickness of labial alveolar bone in lower incisors region due to the unavailability of CBCT. This might have led to biased results. Given the fragility of the periodontal labial structure and bone, careful orthodontic planning tailored to areas with thin buccal bone can help prevent GR.[22]

According to a local study done by Imtiaz and Baloch[23] most of the cases with fixed orthodontic appliances had no gingival tissue recession, only few cases were seen in Class I and Class II. However, this mild gingival tissue recession was significantly associated to oral hygienic index. Ideally, teeth should be fully "enveloped" by bone tissue on all surfaces, but this is often overlooked during treatment planning.[24] It can be concluded that it is not the orthodontic treatment itself, but rather inadequate planning, that leads to GR. In most of the cases, the incisors and canines labial surfaces—particularly the mandibular incisors—are so thin that no bone is anticipated on palpation. In such cases, applying controlled, light continuous orthodontic forces is the solution. This approach not only positions teeth toward the center of the bone but also enhances the structural thickness of the buccal periodontal tissues.[23] In contrast to this our study showed significant post treatment GR in both C1 and E2 groups.

Potential limitations of our study include the reliance on historical records, which may lead to incomplete or missing data. Furthermore, the retrospective design may introduce biases related to patient selection and variability in treatment approaches. To gain a more comprehensive understanding of the

impact of different orthodontic treatment modalities on gingival health, future research should aim for larger sample sizes and extended follow-up periods.

These results highlight the need for careful consideration of periodontal health in orthodontic treatment planning, particularly in younger patients. In future studies we should use CBCT to assess the thickness of labial cortical plate and gingival tissue. We can assess the direct effect of orthodontic treatment mechanics on GR by controlling these factors.

Conclusion

Both Class I and Class II nonextraction orthodontic treatment plans were associated with gingival recession in lower incisors.

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CONFLICT OF INTEREST
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DATA SHARING STATEMENT
The data that support the findings of this study are available from the corresponding author upon request.