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Assessment of Archwidth Changes in Extraction and Non Extraction Patients

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Conflicts of Interest: Nil.

Abstract

This retrospective study was to examine the dental arch width changes of extraction and non-extraction treatment in Class I patients. The study was performed on pre-treatment and post-treatment dental casts of 70 patients (35 extractions and 35 non-extractions).The study models are taken pre-treatment and post-treatment. The inter-canine and inter-molar arch width measurements were measured using a digital caliper. Paired samples *t*-test, ANOVA, post HOC test was used to evaluate the treatment changes within each group. To compare the changes between groups, independent samples *t*-test was performed. There is significant difference in inter-canine width as compared to inter-molar width in extraction cases while there was no significant difference in non-extraction cases. While, an overall increase in inter -molar distance and inter-canine distance of mandibular arch and decrease in maxillary inter-canine distance in non-extraction cases.

Introduction

It is well established that increases in dental arch length and width during orthodontic treatment tend to return toward pre-treatment values after retention.[1–4] An undocumented criticism of extraction treatment is that it results in narrower dental arches when compared with non-extraction therapy.[5] Non-extraction treatments have gained widespread popularity because of the condylar displacement, narrowed smiles accompanied by dark corners, dished-in profiles with extractions, and suboptimal mandibular growth.[6–13]

Some researchers have documented that arch dimensional changes occur both with the orthodontic treatment after the extraction of teeth and with the non-extraction therapy.[14,15]

The maintenance of the pre-treatment values for inter-canine and intermolar distances was suggested as the key to post-treatment stability because these values were believed to represent a position of muscular balance for the patient.[16,17] Strang[16] and Shapiro[2] concluded that the

mandibular inter-canine and inter-molar width dimensions show a strong tendency to relapse and should be considered inviolate. Although the literature has provided information regarding the effects of extraction and non-extraction therapy, the findings on the amount of inter-arch changes of Class I extraction and non-extraction therapy display variation. This may be attributed to the differing treatment modalities, malocclusion types, and sample sizes. Therefore, an attempt was made in this study to have a homogenous study group in terms of malocclusion type and treatment mechanics.

The purpose of this study was to compare the dental arch width changes of Angle Class I malocclusion after both non-extraction and four first premolar extraction therapies and to determine the changes in inter-canine and inter-molar width because of treatment.

Material And Method

A sample of 60 orthodontic patients (30 extractions and 30 non-extraction)were divided into two groups Group A (extraction) and Group B (non-extraction) respectively. The exclusion criteria was

- Subjects with craniofacial anomalies like cleft lip and palate and syndromes were not included in the study
- Edentulous spaces or mixed dentition cases
- History of trauma to dentofacial region
- Individuals with marked jaw asymmetries and TMJ abnormalities were excluded from the study
- Significant cuspal wear
- Extensive restorations or prosthetics
- Anterior and posterior crossbites.

While the inclusion criteria was

- All subjects having Angle's Class I malocclusion.
- Subjects with fully erupted permanent dentition without any missing permanent teeth or congenitally absent teeth at the starting of treatment
- Subjects without any adjunctive appliances such as a Quad Helix, a functional appliance, or a rapid palatal expander used as part of their orthodontic treatment.
- Subjects whose treatment involved extraction had undergone all first premolar extractions as part of a comprehensive orthodontic treatment plan

The inter-canine and inter-molar widths of the maxillary and mandibular dental arches were measured using a digital caliper (Sylvac, Fowler, OPTO-RS232 SIMPLEX/DUPLEX, Sweden). (Figure 1). The widths of the anterior and posterior parts of the maxillary and mandibular dental arches were measured at the canine and the first molar regions from the most labial aspect of the buccal surfaces of those teeth, as described by Gianelly.[5] The caliper was placed at the best estimate of a right angle to the palatal suture in the maxillary arch and to a line bisecting the incisor segment in the mandibular arch (Figure 3,4)..

All statistical analyses were performed For each variable, the arithmetic mean and standard deviation was calculated. A paired samples *t*-test was used to evaluate the treatment changes within each group. To compare the changes observed in both groups, independent samples *t*-test was performed. Thirty study models were selected randomly and measured by the same examiner.

Result

There is a significant difference in the inter-canine width compared to inter-molar width of Group A(Table 1) but there is no significant arch dimension changes in group B (Table2). there is a statistically significant increase (p-value >0.05) in the inter-canine distance of Group A while no significant difference in inter-molar distance. (Table3,4). There is no statistical significance in group B, however it still shows an overall increase in inter-molar distance and inter-canine distance of mandibular arch while decrease in maxillary inter-canine distance(Table

5,6) when group A and group b was compared there was significant difference in the inter-canine distance while inter-molar distance is not showing any statistically significant difference. (Table 7).There was a significant difference between post-treatment inter-canine distance of Group A & Group B maxillary arch while other variables are not significant.(Table 8).

Discussion

It is well accepted that, during orthodontic treatment involving the extraction of teeth, arch dimensional changes occur and that these dimensions continue to change after active treatment.[10,12,14,15,18]

Riedel[17] stated that arch form, particularly in the mandibular arch, could not be altered by appliance therapy. Inter-canine and inter-molar widths tend to decrease during the post-retention period, especially when expanded during treatment.[2,16,17,]

In this study, the arch width measurements in the extraction and non-extraction Class I patients was examined. The data of this study revealed that inter-canine arch widths increased in extraction cases rather than non-extraction cases. However, the inter-molar widths showed no statistical differences in both the treatment modalities. it shows an overall increase in inter-molar distance and inter-canine distance of mandibular arch while a decrease in maxillary inter-canine distance In the non-extraction group. Weinberg and Sadowsky,[19] in a retrospective study of non-extraction treated Class I malocclusion, found significant increases in the mandibular inter-canine and inter-molar arch widths and stated that the resolution of the crowding in the non-extraction therapy of Class I malocclusion was achieved by expansion of the buccal segments in the mandibular arch.

In a long-term stability study of a random sample of cases treated with non-extraction, Glenn et al[20] found that the mandibular inter-canine width increased after treatment among the 14 patients with Class I malocclusions. Their findings are in accordance with the results of this study.

In the study of Boley et al,[21] the inter-arch changes of four premolar extraction cases were evaluated. According to their findings, maxillary inter-canine widths increased one mm and the corresponding mandibular arch width increased 1.7 mm during treatment. Maxillary and mandibular inter-molar widths decreased 1.7 and 2.1 mm, respectively. These findings are in accordance with the work of this study.

On the basis of the concepts documented in the literature,[10,22,23] one might have expected to find narrower arches after extraction. In contrast to all these findings, Kim and Gianelly[24] suggested that the widths of both arches of the extraction subjects were 1–2 mm larger when compared with the arch widths of the non-extraction group at a standardized arch depth.

Conclusion

We can deduce that extraction treatment does not result in narrower dental arches compared to non-extraction treatment and constricted arch widths are not usually an offshoot of extraction treatment.

Hence we can infer that facial attractiveness of the macro level is not affected by the extraction of premolar carried out for the orthodontic purpose.

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Table 1 :Arch Width Change in Group A at T1 & T2 time interval

Arch width (mm)		Maxillary Arch				Mandibular Arch			
		N	Mean	Std. Deviation	Std. Error Mean	N	Mean	Std. Deviation	Std. Error Mean
Inter canine width	T1	35	35.97	3.33	0.56	35	28.79	2.77	0.47
	T2	35	37.11	3.28	0.55	35	29.73	2.80	0.47
inter molar width	T1	35	52.85	3.47	0.59	35	47.12	4.27	0.72
	T2	35	52.50	2.91	0.49	35	46.57	4.11	0.69

Graph 1 : Arch width in Group A at T1 & T2

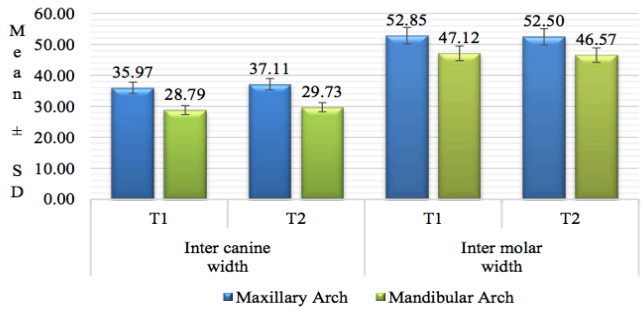


Table 2: Arch width Changes in Group B at T1 & T2 time interval

Arch Width (mm)		Maxillary Arch				Mandibular Arch			
		N	Mean	Std. Deviation	Std. Error Mean	N	Mean	Std. Deviation	Std. Error Mean
Inter canine width	T1	35	38.79	3.07	0.52	35	30.81	2.53	0.43
	T2	35	38.67	2.47	0.42	35	31.04	1.79	0.30
Inter molar width	T1	35	56.82	3.40	0.58	35	51.77	3.72	0.63
	T2	35	56.93	3.48	0.59	35	52.14	3.55	0.60

Graph 2 : Arch width in Group B at T1 & T2

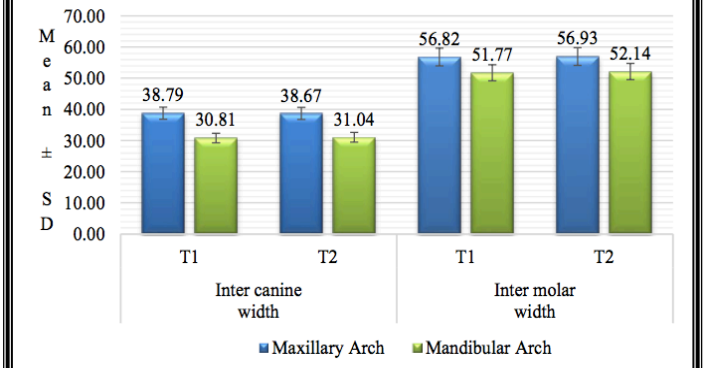


Table 3 : Comparison of Arch Width Changes in Group A Maxillary Arch at T1 & T2 time interval

Arch Width (mm)		Mean	Std. Deviation	Std. Error Mean	Mean Difference	p Value
Intercanine Width	T1	35.97	3.33	0.56	1.14	<0.001
	T2	37.11	3.28	0.55		
Inter molar Width	T1	52.85	3.47	0.59	-0.36	0.364
	T2	52.50	2.91	0.49		

Graph 3: Comparision of Arch Width Changes in Group A Maxillary Arch

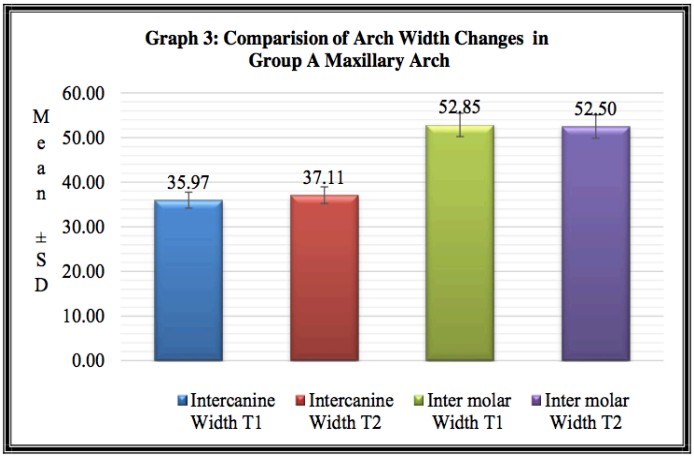


Table 4 : Comparison of Arch Width Changes in Group A Mandibular Arch at T1 & T2 time interval

Arch width(mm)		Mean	Std. Deviation	Std. Error Mean	Mean Difference	P Value
Intercanine Width	T1	28.79	2.77	0.47	0.94	0.002
	T2	29.73	2.80	0.47		
Inter molar Width	T1	47.12	4.27	0.72	-0.55	0.130
	T2	46.57	4.11	0.69		

Graph 4 : Comparision of Arch Width Changes in Group A Mandibular Arch

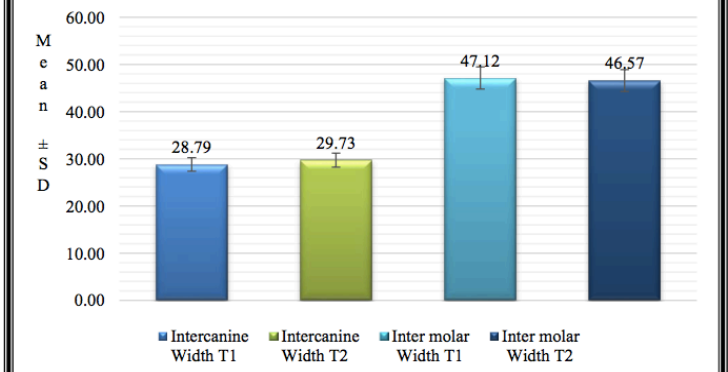


Table 5 : Comparison of Arch Width Changes in Group B Maxillary Arch at T1 & T2 time interval

Arch Width (mm)		Mean	Std. Deviation	Std. Error Mean	Mean Difference	P Value
Intercanine Width	T1	38.79	3.07	0.52	-0.11	0.699
	T2	38.67	2.47	0.42		
Inter molar Width	T1	56.82	3.40	0.58	0.11	0.645
	T2	56.93	3.48	0.59		

Graph 5 : Comparision of Arch Width Changes in Group B Maxillary Arch

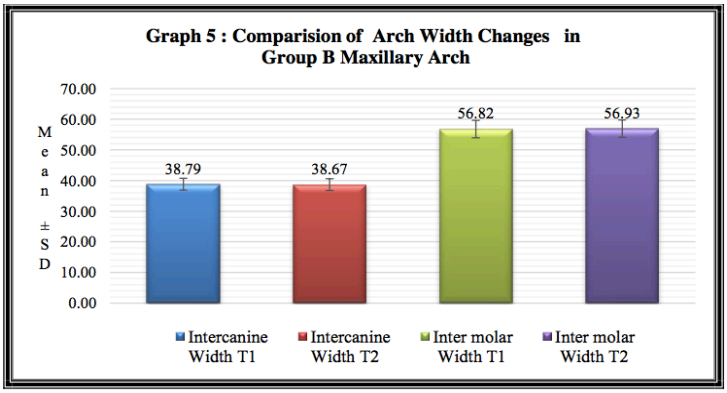
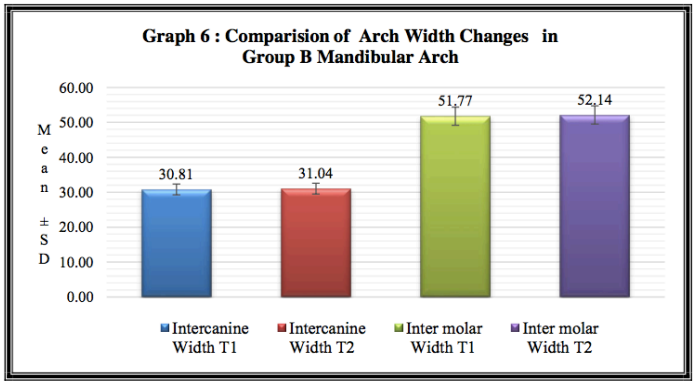


Table 6 : Comparison of Arch Width Changes in Group B Mandibular Arch at T1 & T2 time interval

Arch Width (mm)		Mean	Std. Deviation	Std. Error Mean	Mean Difference	p Value
Intercanine Width	T1	30.81	2.53	0.47	0.22	0.395
	T2	31.04	1.79	0.47		
Inter molar Width	T1	51.77	3.72	0.72	0.36	0.112
	T2	52.14	3.55	0.69		

Graph 6 : Comparision of Arch Width Changes in Group B Mandibular Arch



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	T2	52.14	3.55	0.69		

Graph 6 : Comparision of Arch Width Changes in Group B Mandibular Arch