

A Comparative Study of Dental Arch Width In Extraction and Non Extraction Cases

Lalima Kumari¹ Kamal Nayan^{2*} Anurag Rai³

¹Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Patna Dental College and Hospital, Patna, Bihar, India.

²Lecturer, Department of Prosthodontics and Crown and Bridge, Hazaribagh College of Dental Sciences and Hospital, Hazaribagh, India.

³Professor and Head, Department of Orthodontics and Dentofacial Orthopaedics, Patna Dental College and Hospital, Patna, Bihar, India.

ABSTRACT

Background: To compare changes in dental arch width in extraction and non extraction treatment modalities in Class I patients.

Materials and methods: Arch widths of the upper and lower arches of 20 patients treated by all first-premolar extraction (group 1) and 20 patients treated without extractions (group 2) were measured on study models using a digital caliper. Inclusion criteria included angle's class I malocclusion, no missing teeth, no history of previous orthodontic treatment or any anomalies. Intercanine and intermolar widths were compared between extraction and non-extraction patients. To compare the changes between groups, independent samples t-test was performed.

Result: Difference in the values of intercanine width between the two groups was statistically not significant. The maxillary and mandibular intermolar widths decreased significantly for the group 1 as compared to the group 2. The mandibular intercanine width increased significantly for the extraction group compared with non-extraction group.

Conclusion: No significant difference was found in maxillary intercanine width after treatment done by all first pre molar extraction as compared to non-extraction method. However, widening of arch width in molar region was found in non-extraction treatment when it was compared with the extraction group.

Keywords: Arch width, Dental arch width, Extraction cases.

INTRODUCTION

Class I malocclusions with mild to moderate crowding and individual tooth irregularities are usually treated by extraction or non-extraction treatment mechanics. In 1899, angle adopted a non-extraction treatment protocol whereas Tweed exercised removal of teeth for correction of malocclusion. Since then it is a matter of debate whether to go for extraction or not. 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. Meyer *et al*.,

found increases in anterior arch width in patients treated with premolar extraction as well as in patients treated without extraction.

However some investigators reported that extraction treatment results in narrower dental arches leading to a less aesthetic smile due to creation of black triangle and negative space as compared to non-extraction cases.^{2,3} Not only for aesthetics but also for stability purpose, the maintenance of the pre-treatment arch width values have been suggested as the key to post-treatment stability. Changes in mandibular intercanine and intermolar width have been used as

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*Correspondence Dr. Kamal Nayan.

Department of Prosthodontics and Crown and Bridge, Hazaribagh College of Dental Sciences and Hospital, Hazaribagh, India.

Email: kamalnayan60@gmail.com

main criteria to check for post treatment stability and retention.⁴⁻⁶ Controversial results have been obtained after extraction therapy on intercanine and intermolar width and final stability.¹⁰⁻¹²

For better treatment planning and to achieve long term stability after orthodontic treatment, it is essential to have an idea of treatment effects of extraction and non extraction treatment mechanics. And hence this study was aimed to compare arch width changes in extraction and non-extraction groups in class I malocclusion.

MATERIALS AND METHODS

For the purpose of study, a total of 40 patients (20 extraction, 20 non extraction group), treated with fixed orthodontic appliance were selected. The mean age of the patients for extraction group {group 1} was 12 ± 1.5 years whereas for non extraction category {group 2}, the mean age of the patients was 12.4 ± 1.6 years. Mean treatment time was slightly longer for extraction group with mean treatment time of 2.5 years as compared to 2 ± 0.4 years of non extraction treatment group. In group 1 patients, all first premolars were extracted depending on the presence of crowding in dental arch exceeding 7 mm and considering the facial profile of the patients. The amount of crowding was found to be -6.1 ± 2.00 mm for upper arch and -5.01 ± 2.56 mm for the lower arch in group 1 whereas crowding of 4.23 ± 0.08 mm in the upper arch and 3.46 ± 1.18 mm in the lower arch was found in group 2 patients. Patients with Angle's class I malocclusion, no previous history of orthodontic treatment, no craniofacial anomaly, presence of all first and second molars and no missing teeth were included in the study.

Both of Group 1 and group 2 patients were treated using fixed orthodontic appliance using MBT prescription (0.022 x 0.018-inch slot). The brackets used were of Ormco company. The different wires

used were 0.012, 0.014, 0.016, 0.017 x 0.025-inch nickel-titanium archwires followed by 0.017 x 0.025 and 0.019 x 0.025-inch stainless steel wire. In extraction group, active tie backs were used to close the extraction space.

A digital calliper was used to measure the intercanine and intermolar widths of upper and lower arches. The intercanine width and intermolar width were measured at the canine and the first molar regions from the most labial aspect of the buccal surfaces of those teeth respectively. All the measurements were taken thrice and average value was determined. The data thus obtained were subjected to statistical analysis using SPSS software (SPSS Inc., version 15.0, Chicago, IL, USA). Mean and standard deviations were calculated for all measurements. Independent t- test was performed to compare values between two groups. Statistical significance level was established at $P < .05$.

RESULTS

On comparing pre-treatment values, the upper and lower intercanine and intermolar widths of both groups did not differ statistically (Table 1). Post treatment values showed that difference between arch widths of both groups were statistically significant except upper intercanine width. (Table 2). The average value of lower intercanine and upper and lower intermolar arch width were found to be statistically significant with $p = 0.004$, $p = 0.006$ and $p = 0.007$ respectively. Differences in the upper intermolar width between two groups and lower intercanine and intermolar widths of both groups were found to be statistically significant. The upper and lower intermolar widths decreased significantly for group 1 (-0.74 ± 2.75 mm and -1.95 ± 2.00 mm, respectively) as compared to nonextraction group (1.28 ± 2.70 mm and 0.35 ± 1.87 mm, respectively, $P = 0.02$; $P = 0.01$). The lower intercanine width increased significantly for the extraction group.

Table 1: Comparison of pretreatment upper and lower arch width

	Upper		Lower	
	Inter canine width (mm)	Inter molar width (mm)	Inter canine width (mm)	Inter molar width (mm)
Group 1(n=20)	36.87± 2.56	56.22 ± 2.34	32.04± 1.78	54.23± 2.01
Group 2(n=20)	36.45± 2.44	56.92± 2.55	31.94± 2.01	54.92± 1.78

P value: non significant

Table 2: Comparison of post treatment upper and lower arch width

	Group 1	Group 2	difference	p value
	Mean ± S.D.	Mean ± S.D.	Mean ± S.D.	
Upper inter canine width (mm)	36.98 ±2.01	36.88 ± 2.33	0.10	0.88(ns)
Lower inter canine width (mm)	34.12± 2.01	32.11± 2.14	2.01	0.004(s)
Upper inter molar width (mm)	55.12 ±2.43	57.13 ±2.00	-2.01	0.006(s)
Lower inter molar width (mm)	54.10± 2.34	55.87 ± 1.56	1.77	0.007(s)

Table 3: Difference of upper and lower inter canine and inter molar arch width between group 2 and group 1.

	Group 1	Group 2	Difference	p value
	Mean ± S.D.	Mean ± S.D.	Mean ± S.D.	
Upper inter canine width (mm)	0.11 ±2.38	0.43 ± 2.43	0.32	0.67(ns)
Lower inter canine width (mm)	2.08± 2.33	0.17± 2.14	1.91	0.0103(s)
Upper inter molar width (mm)	0.74 ±2.75	-1.28 ±2.70	1.86	0.02(s)
Lower inter molar width (mm)	1.95 ± 2.00	-0.35± 1.87	1.6	0.01(s)

DISCUSSION

Many authors have stated that during orthodontic treatment with extraction of teeth, changes in arch width takes place.^{7,8} Riedel⁹ stated that arch form, particularly in the mandibular arch, could not be altered by appliance therapy. In the present study, changes in arch width among extraction and non extraction group were studied. Result showed that inter canine arch widths increased in both group 1 and group 2 patients. This similar increase in maxillary inter canine widths was also found in other studies¹⁰.

The maxillary inter molar width was found to be decreased in the Group 1 which can be explained by mesialization of molar to a more anterior region of the arch during space closure. Increase in the inter molar width in group 2 and a decreases in the group 1 was similar to those found in other studies and can be explained by the mesialization of the molars as a result of the previously performed extraction. Kim and Gianelly¹¹, have also reported a similar result in their study.

Bishara et al¹² studied the long-term stability of extraction and nonextraction orthodontic treatment and found that during the treatment, the maxillary

intercanine width of the males increased significantly in the extraction group because of the alignment of the crowded anterior segment. However, they did not mention the initial tooth size arch length discrepancies of the study group. The maxillary and mandibular intermolar widths increased in the nonextraction group and decreased in the extraction group. The intercanine and intermolar width findings are similar to the findings of this study, although the malocclusion types differed between the two studies.

Akyalcin *et al.* reported that all arch measurements stayed actually stable after upper and lower premolar extraction.¹³ In another study, Isik *et al*¹⁴ measured intermolar, interpremolar, and intercanine distances before and after orthodontic treatment with and without extraction. Whereas intercanine maxillary arch width was unaffected by treatment modality, similar to the present study,, increases in interpremolar and intermolar maxillary arch widths were significantly higher with nonextraction treatment when compared to extraction treatment.

CONCLUSION

Following points can be concluded from the study:

- 1) Intercanine arch widths increased both in the extraction and no-nextraction Class I patients however the difference of upper inercanine width in both the groups was statistically not significant.
- 2) Increase in mandibular intercanine arch width was statistically significant.
- 3) In the non-extraction group, maxillary and mandibular intermolar widths increased significantly compared to extraction group.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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