ORIGINAL RESEARCH

Arch Widths after Extraction and Nonextraction Treatment in Class I Patients

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ABSTRACT

Aim: To compare pretreatment and post-treatment dental arches in relation to intercanine and intermolar width changes in extraction and nonextraction treatment in class I patients.

Materials and methods: In this retrospective study pretreatment and post-treatment dental casts of 60 patients (30 extractions of first premolars and 30 nonextractions) were selected.

Anterior and posterior arch widths in the canine and molar regions from the most labial aspect of buccal surfaces, the canines and the molars were measured with the help of digital caliper on the study models and compared statistically to determine whether the dental arches were narrower after extraction treatment.

Results: At the start of the treatment there were no statistically significant differences in maxillary and mandibular intercanine widths in both groups. At the end of treatment in both the groups anterior and posterior arch width changes were not significant except for the intercanine dimension which was 0.82 mm larger (p < 0.05) in the extraction group.

Conclusion: The extraction treatment does not result in narrower dental arches than nonextraction treatment in intercanine and intermolar region.

Clinical significance: It is documented that the arch widths determine smile esthetics and treatment stability. According to the findings of the present study the arch widths in extraction treatments are not narrower than nonextraction so there will not be any compromising effects on esthetics and treatment stability.

Keywords: Arch width changes, Intercanine and intermolar width, Extraction and nonextraction treatment.

INTRODUCTION

The extraction *vs* nonextraction dilemma still exists in orthodontics.

Angle[1] believed that all 32 teeth could be accommodated in the jaws, in an ideal occlusion with the first molar in class I occlusion, extractions was against his ideals as he believed bone would form around the teeth in their position according to Wolff's law.[2] However, this was criticized by case who stated that extractions were necessary in order to relieve crowding and aid stability of treatment.[3]

However, with accurate diagnosis the extraction decision should be taken. Crowding and protrusion of teeth are observed in class I malocclusion which can be treated by extraction or nonextraction treatment depending upon space discrepancy. However, the long-term stability in both treatments is surrounded by a controversy.

One of the criticism of extraction treatment is that it results in narrower arches as compared to nonextraction treatment.[4] It is believed that the pretreatment values of intercanine and intermolar widths present a position of muscular balance so it is suggested that the maintenance of these values provide postretention stability.[5,6]

In the past many studies have been carried out to study the effects of extraction and nonextraction treatment but the conclusions vary a lot which could be because of different treatment techniques, malocclusion types and sample size examined during these studies.

So the aim of present study was to compare dental arch widths changes in Angle class I malocclusion after extraction of first premolar and nonextraction within a study group with same type of malocclusion and treated with same mechanics.

MATERIALS AND METHODS

In this retrospective study orthodontic study models of 30 patients who had first premolar extractions and 30 patients treated without extractions were selected. In the extraction group there were 17 girls and 13 boys with mean age 14.7 ±

2.7 years and in the nonextraction group had 16 boys and 14 girls with mean age 14.6 ± 2.3 years. All the patients were treated with preadjusted edgewise appliance by various instructors in a dental institute.

While selection the following criteria were applied:
1. All patients had skeletal class I malocclusion.
2. All patients had full compliment of teeth up to second molars without any missing teeth, supernumerary teeth, or congenitally missing teeth.
3. None of the patients had adjunctive appliances for expansion of the arches during treatment.
4. In the extraction group all patients had first premolar extraction as a part of orthodontic treatment.

With a digital caliper (Workzone, Dario London Service Center, UK) with accuracy 0.01 mm dental arches were measured in the canine and the first molar regions from the most labial aspect of the buccal surfaces of these teeth. The caliper was placed at right angle to the palatal suture in the maxillary arch and to a line bisecting the incisor segment in the mandibular arch.[4] The average of first three measurements was considered the final value.

The random error of measurement was assessed by Dahlberg's formula:[7]

$$Sx = \sqrt{\frac{\Sigma D^2}{2N}}$$

Where, D is the difference between duplicate measurements, and N is the number of double determinations.

The range of error of measurement was 0.22 to 0.50.

The collected data was treated statistically by using two tailed t-test (p < 0.05).

RESULTS

The mandibular intercanine and intermolar widths did not show statistical differences at the start of the treatment in both the groups (Table 1).

Table 1: Pretreatment mandibular intercanine and intermolar arch widths: Means and SD (mm)

	Extraction (n = 30)	Nonextraction (n = 30)	Significance
Intercanine	30.47 ± 2.09	30.27 ± 1.82	NS
Intermolar	59.25 ± 2.92	59.05 ± 1.67	NS

NS: Not significant; p < 0.05

At the end of treatment the arch widths of both the groups were also statistically similar except in mandibular canine region (Table 2).

The average mandibular intercanine dimension was 0.82 mm larger in extraction sample than nonextraction sample. During treatment the mean mandibular canine width increase was 1.28 mm in extraction group and the 0.66 mm increase in nonextraction group which was not statistically significant (Tables 3 and 4).

The mandibular intermolar widths for both extraction and nonextraction group were not changed.

DISCUSSION

The two reasons for which the extraction treatments are criticized are that they result in narrow dental arches which are unesthetic because of large black triangles in buccal corridors and it is stated that the intercanine and intermolar widths tend to decrease during postretention period.[6,8]

According to findings of the present study the arch widths in both canine and molar region in the mandibular arches did not show any statistical significant results. In fact the arches in extraction group were approximately 0.82 mm wider than nonextraction group. The results of this study can be compared with studies in which post-treatment long term stability of mandibular intercanine width stability was found acceptable. The mandibular intercanine width increased 1.07 mm in an extraction sample.[9] While nonextraction subjects where the increase in mandibular intercanine dimension was less than 1 mm in class I[10,11] and II patients.

In borderline cases the long-term increase in intercanine width was 1 mm in extraction treatments and 0.5 mm in nonextraction[12] treatments. Luppanapornlarp and Johnston found that mandibular intercanine width of extraction subjects was greater at all stages of treatment in extraction cases than in nonextraction cases which indicate that extraction of four first premolars does not indicate narrowing of arches.[13] BeGole et al[14] found 1.58 mm increase in extraction sample as compared to 0.95 mm in nonextraction sample. Udhe et al[15] found a larger increase in extraction group than in nonextraction group.

Gianelly[4] studied interarch changes of extraction and nonextraction groups and found that the changes in

Table 2: Post-treatment maxillary and mandibular arch intercanine and intermolar widths: Means and SD (mm)

	Extraction (n = 30)	Nonextraction (n = 30)	Difference	Significance
Mx intercanine	39.12 ± 1.98	39.84 ± 1.81	0.72	NS
Md intercanine	31.75 ± 1.84	30.93 ± 1.92	0.82	0.01
Mx intermolar	61.01 ± 1.98	60.98 ± 2.09	0.03	NS
Md intermolar	59.81 ± 1.25	59.01 ± 1.98	0.80	NS

Mx: Maxillary; Md: Mandibular; NS: Not significant; p < 0.05

Table 3: Mandibular intercanine and intermolar width changes: Means and SD (mm)			
Extraction (n = 30)			
Pretreatment	Post-treatment	Difference	Significance
Md intercanine	30.47 ± 2.09	31.75 ± 1.84	1.28	0.02
Md intermolar	59.25 ± 2.92	59.81 ± 1.25	0.56	NS

Md: Mandibular; NS: Not significant

Table 4: Mandibular intercanine and intermolar width changes: Means and SD (mm)			
Nonextraction (n = 30)			
Pretreatment	Post-treatment	Difference	Significance
Md intercanine	30.27 ± 1.82	30.93 ± 1.92	0.66	NS
Md intermolar	59.05 ± 1.67	59.01 ± 1.98	0.04	NS

Md: Mandibular; NS: Not significant

maxillary and mandibular arch widths indicated that extraction treatment does not result in narrower arches than nonextraction groups. This finding is in accordance with the present study. On the basis of concepts documented in the literature one might expect narrower arches after extraction. However, Kim and Gianelly[16] suggested that the widths of the both the arches were 1 to 2 mm larger when compared with the arch widths of nonextraction group at a standardized arch depth. The intermolar widths of both the groups were same after treatment; this finding supports the view of Johnson and Smith[17] who stated that arch width at any particular location is maintained or slightly increased after extraction.

Weinberg and Sadowsky[18] found significant increase in mandibular intercanine and intermolar width in class 1 malocclusion treated nonextraction and stated that the expansion of buccal segments in the mandibular arches helped in resolution of class I crowding. However, 16 out of 30 patients had some kind of palatal expander which might have contributed to mandibular expansion. In the present study no treatments were given for expansion.

To some investigators maxillary arch width is determinant of smile esthetics,[19] the maxillary arch widths in extraction and nonextraction groups were same so it can be expected that the treatment effects in maxillary arches will be the same, and there will be no difference in esthetic scores in both the groups. In fact the intercanine widths in extraction groups were wider than nonextraction group. However, the future studies in the maxillary arches in various malocclusion classifications with various treatment mechanics will be productive.

It is stated that expansion more than 1 to 1.5 mm in intercanine expansion is unstable so appliances designed to increase arch width more than this were not used in the present study.

On the basis of findings of the present study it can be said that extraction cases do not result in narrow dental arches than nonextraction cases and thereby do not have compromising effect on smile esthetics and stability of orthodontic treatment. However, future studies with various malocclusion groups, treatment mechanics, larger sample size and long-term changes in arch dimensions will be useful.

CONCLUSION

The present study findings indicate that the premolar extractions to relieve crowding does not result in narrowing of dental arches in extraction treatments when compared to nonextraction treatments. A proper treatment plan and treatment mechanics in accurately diagnosed case can result in treatment success regardless of extraction or nonextraction treatment.

CLINICAL SIGNIFICANCE

The cases which require extraction of teeth for correction of crowding and protrusion of teeth do not have narrow dental arches than the cases which do not require extraction of teeth. So these extraction cases can be treated without any compromising effects on esthetics and treatment stability.

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