ORIGINAL RESEARCH

Comparison of the dental arch changes in patients with different malocclusions

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ABSTRACT

Aims and Objectives: To evaluate the pre-treatment and post-treatment dental arch changes in both upper and lower arches in orthodontic patients treated with extraction of first premolar teeth.
Subjects and Methods: Measurements were made on casts of 50 post treated cases in the age group of 12–30 years for individual tooth measurements, width of the arches (inter-incisal, inter-canine, inter-premolar and inter-molar) arch length (both right and left sides, anterior segment, posterior segment and total arch length for both for the maxillary and mandibular dental casts.
Statistical Analysis Used: Kolmogorov-Smirnov test for Normality, Regression Analysis was done as variables were tested and proved to follow normality. Statistical software Statistical Package for the Social Sciences version 18 (SPSS Inc.; Chicago, Illinois, USA) was used for data analysis. Descriptive statistics and paired *t*-tests were used to compare the changes in the Class I and Class II div 1 groups.
Results: There was a significant increase in the inter-incisor and inter-canine width post-treatment in the Class I and Class II div 1 subjects in the upper arch but no significant change in inter-incisor width in the lower arch in class I subjects. A significant decline in the inter-molar arch width in both the groups were seen. The inter-premolar arch width declined significantly in Class I cases while it increased significantly in Class II div 1 subjects. There was a significant increase in anterior arch length and a significant decrease in posterior arch length in all subjects.
Conclusions: The findings of this original clinical research should significantly help the orthodontists in orthodontic treatment planning in patients requiring extractions of premolars.

Key words: Dental arch, extractions, malocclusion, orthodontic treatment

Time has come when the orthodontic diagnosis and treatment planning must be based on evidence based clinical research and not just on the basis of experience, convenience or individual preferences of clinicians.

In a time when diagnosis has been advanced and even dominated by the cephalometrics, the study of plaster casts has been rendered less fashionable. A return to the study of plaster seems essential even though such research is unspectacular and undramatic.[1]

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The success of orthodontic treatment is influenced by the clinician's ability to develop an optimal treatment plan as well as his or her mastery of the techniques used for treating different types of malocclusions. Both patients and orthodontists would like the treatment results to be stable, but realistically, changes do occur following orthodontic treatment. These changes may be desirable and called "settling of occlusion" or undesirable and labeled "relapse".[2]

Regardless of the definition, clinicians should expect some changes following orthodontic treatment. Some of these changes are unpredictable or unavoidable; therefore, the orthodontist should present the patient with this information during the original case presentation.

Germec-Cakan *et al.*[3] conducted a study on arch-width and perimeter changes in patients with Class I malocclusion treated with extractions or without extractions with air rotor stripping and found that the maxillary and mandibular inter molar widths and arch perimeters decreased in the extraction group while in the nonextraction group, the

inter molar widths decreased but arch perimeters did not change significantly. After treatment, the maxillary and mandibular inter canine widths were not different in the two groups.

Little, Wallem and Riedel[4] evaluated 65 cases treated with four first premolar extractions followed for 10 years with retention. Their results indicated that arch length and width generally decreased, while crowding increased. In addition, stability of mandibular anterior alignment was observed in <30% of the cases. They concluded that variables such as severity of initial crowding, age, sex, Angle's classification and length of retention were not useful parameters in predicting the stability of mandibular incisor alignment.

Dong *et al.*[5] compared the changes of arch width in anterior and posterior arch after four premolar extraction and nonextraction treatment in 50 randomly selected patients (25 extraction and 25 non extraction) and concluded that maxillary inter canine width increased in both the groups while the mandibular inter canine width of the extraction group increased greater than the nonextraction group.

Kim and Gianelly[6] compared the changes of arch width and smile esthetics in 30 nonextraction and 30 patients with extraction of four first premolars and found that the inter premolar and the inter molar distance decreased in both mandibular and maxillary arch in the extraction group and increased in the nonextraction group, while the mean esthetic score and the number of teeth displayed during a smile did not differ between the groups.

In evaluating the stability of the mandibular arch following orthodontic treatment, Gardner and Chaconas[7] examined the clinical records of 74 non extraction and 29 extraction patients. Their findings indicated that: (a) Inter canine width tends to return to its normal dimension in both extraction and nonextraction cases, (b) inter-second premolar width increases during treatment and shows some decrease post-treatment in nonextraction patients while in extraction patients it decreases during treatment and continues to decrease after treatment, (c) changes in inter molar width are similar in extraction and nonextraction patients, and (d) arch length decreases in both the groups of treatment.

The changes that occur following the expansion of the dental arches have also received considerable interest from a number of investigators. In general, they have observed that any increase in mandibular inter canine width during treatment tends to relapse after treatment.[8-10] Even in cases where the canines move distally in the arch, their width still tends to decrease following treatment.[11] Inter molar expansion does not fare much better, although the increases tend to be relatively more stable in the maxilla than in the mandible.[12]

Other investigators found that lower incisor crowding recurs after treatment, accompanied by a decrease in arch length. Few explanations offered for this crowding are: Large tooth size, canines expanding during treatment, and excessive proclination of the lower incisors and/or late skeletal growth.[8] Other investigators have been unable to find a relationship between lower incisor crowding before treatment and relapse after treatment.[5] In some cases, the lower incisors were proclined considerably and remained stable in their new positions, particularly if they were initially retroclined.[13] Furthermore, re crowding has often been noted even in cases treated with lower incisor extraction.[14]

The present literature review points to a lack of consensus regarding post-treatment dental arch changes that occur in cases treated with extraction of teeth. So the present study is being carried out to evaluate the treatment and post-treatment dental arch changes in two classes of orthodontic patients visiting the Dental Hospital, that is, Class I and Class II div 1 in both upper and lower arches treated with the extraction of first premolar teeth.

SUBJECTS AND METHODS

Subjects

Casts of 50 subjects in the age group of 12–30 years were taken from the treated cases in the Department of Orthodontics and Dentofacial Orthopedics at Dr. Harvansh Singh Judge Institute of Dental Sciences and Hospital, Panjab University, Chandigarh, India. Case selection was based on the following criteria: (1) Consecutive patients reporting to the department who had originally diagnosed as having Class I and Class II div 1 malocclusion (2) patients with and without crowding of teeth requiring extraction of premolar teeth, (3) all cases receiving comprehensive orthodontic treatment using the pre-adjusted Edgewise Appliance with a similar Slot (0.022 MBT) and similar standard protocol of wire sequence for extraction cases: 16 A-NiTi, 16 SS, 18 SS, 19 × 25 SS, 18 × 22 SS T-Loop; 21 × 25 beta-Ti: (4) Patients having full complement of teeth present at the occlusal plane (5) dental casts were taken prior to and following orthodontic treatment.

Cases having deciduous teeth or having mixed permanent and deciduous teeth, Class III and surgically treated cases, cases which did not require extraction of teeth for orthodontic treatment and cases with congenital anomalies, syndromic patients, patients with significant facial asymmetries or congenitally missing teeth were not included in the study.

Dental cast analysis

The length and width of the arches, as well as the tooth sizes, were determined from the maxillary and mandibular dental casts. The dental arch width measurements included:

- Incisor arch width: The distance between the distal anatomical contact points of the lateral incisors

- Canine arch width: The distance between the canine cusp tips
- Premolar arch width: The distance between the distal pits of the second premolars
- Molar arch width: The distance between the mesial pits of the first permanent molars.

Dental arch lengths were measured for both right and left sides of the maxillary and mandibular dental casts and included:

- Anterior segment: Measured from the mesial contact point between the central incisors to the contact point between the canine and premolar
- Posterior segment: Measured from the distal contact point of the canine to the contact point between the second premolar and the first permanent molar
- Total arch length: The sum of the right and left posterior and anterior segments of each dental cast.

All permanent teeth, except permanent molars, were measured to determine their mesio-distal diameter. The mesio-distal diameter was considered to be the distance between the anatomical contact points.

Tooth size-arch length discrepancy

Total tooth size-arch length discrepancy (TSALD) was calculated by subtracting the sum of the tooth sizes of the teeth anterior to the first permanent molars from the total arch length. Anterior TSALD was calculated by subtracting the size of the six anterior teeth from the anterior arch length. A negative sum reflected crowding while a positive reflected spacing.

Reliability of the measurements

Landmarks on the dental casts were located and marked with a sharp lead pencil. The casts were mounted on Leone plastic base formers with the help of a mounting jig (Dentaurum Corp., Germany) and then the measurements were taken. The measurements were made by means of (1) a digital Vernier caliper (Proskit, Taiwan) (2) 0.015" brass ligature wire (3) a pair of fine pointed dividers and (4) a stainless steel standard millimeter rule [Figure 1].

Each cast was measured on separate occasions by two investigators (1st author and 2nd author) using a digital caliper accurate to 0.05 mm. Additional measurements were taken if arch measurements differed by more than 0.5 mm. Cast measurements were evaluated statistically for validity and consistency. These measurements were made by two well-experienced orthodontists (author 1 and author 2) under identical conditions, and mean parameters were taken [Figure 2].

Statistics

Statistical software SPSS version 18 was used for data analysis. All parameters were tested for Normality using "Kolmogorov-Smirnov test for normality" and all parameters were found best fit for a normal distribution.

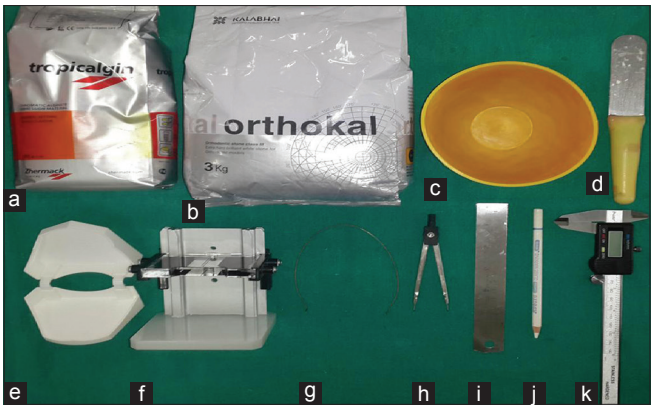

Figure 1: Materials used for the Study: (a) Alginate impression material. (b) Dental stone (c) Mixing bowl. (d) Mixing spatula. (e) Plastic base formers (f) Mounting jig. (g) brass wire. (h) Dividers. (i) Stainless steel millimeter ruler. (j) Marking pencil. (k) Digital Vernier calipers

Regression analysis has been done as variables have been tested and proved to follow normality. Results of regression analysis estimating arch width on the basis of the rest of the variables are incorporated for both the groups at pre intervention stage.

Since all parameters were normally distributed, therefore, all of the studied parameters were evaluated. Descriptive statistics for the absolute measurements and the incremental changes were calculated. These included: Means, standard deviations, minimum and maximum values for each parameter, measured at the two time intervals pre-treatment and post treatment. The pre-post comparisons were valid using paired – *t*-test of significance (the level of significance was set at the 0.95 level of confidence) to compare the changes in the Class I and Class II div 1 groups.

RESULTS

Arch width changes

Maxillary arch

There was a significant increase in the inter-incisor as well as the inter-canine width post treatment in the Class I and Class II div 1 subjects. There was also a significant decline in the inter molar arch width in both Class I and Class II div. 1 subjects while there was a significant decrease in the inter premolar arch width changes in Class I while there was a significant increase in Class II div 1 subjects. The overall inter class maxillary arch width changes were however significant post treatment as compared to the pre-treatment values of Class I and Class II div 1 subjects. The pre-treatment values between the classes were insignificant [Table 1].

Mandibular arch

The pattern of arch width changes in the mandibular arch followed the following pattern: Increase in the inter incisor, the inter canine and inter pre-molar widths post treatment and decrease in the inter molar width in Class II div 1 subjects while in Class I subjects inter incisor, the inter canine widths

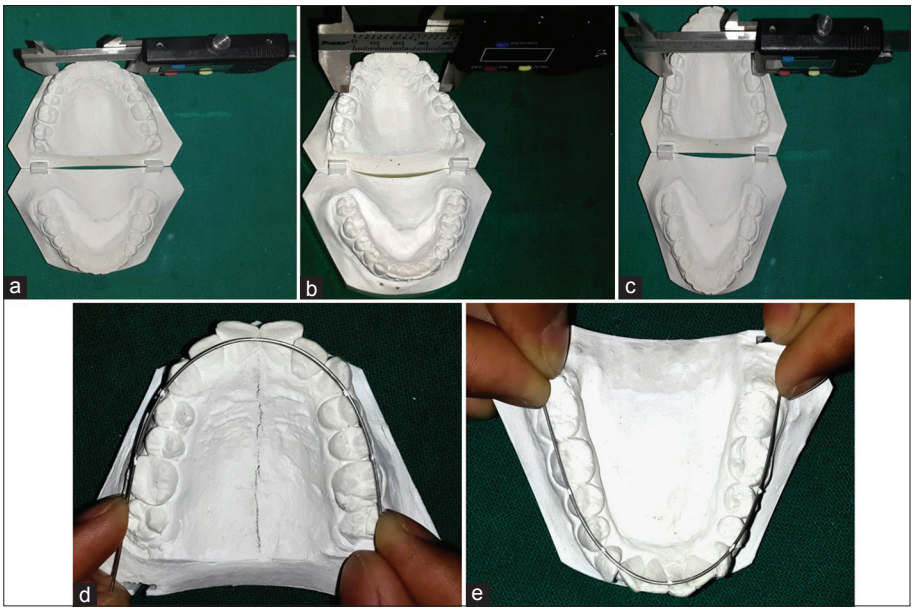

Figure 2: Method used for making the measurements on the dental casts. (a) Measurement for canine width. (b) Measurement for premolar width. (c) Measurement for molar width. (d) Measurement for maxillary arch length. (e) Measurement for mandibular arch length

Table 1: Descriptive and comparative statistics of upper arch width changes

Class	Parameter	Incisor (pre-Rx)	Incisor (post-Rx)	Canine (pre-Rx)	Canine (post-Rx)	Premolar (pre-Rx)	Premolar (post-Rx)	Molar (pre-Rx)	Molar (post-Rx)
I	*n*	25	25	25	25	25	25	25	25
	Maximum	31.09	32.69	37.54	38.63	42.14	41.18	45.99	43.43
	Minimum	24.82	26.36	30.26	30.45	33.70	34.55	40.42	40.24
	Mean	27.64	28.93	33.66	34.84	38.21	37.75	43.30	41.49
	SD	1.50	1.96	2.19	2.51	2.93	1.74	1.41	1.18
II	*n*	25	25	25	25	25	25	25	25
	Maximum	30.80	32.67	40.35	39.71	42.36	42.53	49.23	46.87
	Minimum	21.23	24.55	29.66	31.07	34.71	34.58	37.84	38.28
	Mean	28.07	30.39	34.67	36.68	39.48	39.72	44.27	42.80
	SD	2.17	1.98	2.62	2.20	2.58	2.34	2.98	2.22
I and II	Significant (two-tailed)	0.409	0.011	0.147	0.008	0.112	0.001	0.148	0.013
	P	NS	S*	NS	S**	NS	S**	NS	S*

SD=Standard deviation, S=Significant, NS=Not significant, *=Statiscally significant, $P \leq 0.05$, **=Statiscally significant, $P \leq 0.01$

increased while inter pre-molar and inter-molar widths decreased. There was, however, a decrease in the mean post treatment premolar width in both the Class I and Class II div 1 subjects in the mandibular arch which differed with the findings of the maxillary arch. Also, all the interclass changes between Class I and Class II div 1 were insignificant as compared to the significant changes in the maxillary arch except for the incisor arch width changes pre-treatment [Table 2].

The overall arch width changes within the Classes I and II were also significant except inter-premolar arch width changes in the maxillary arch both in Class I and Class II div 1 subjects and the inter-incisal arch width changes in Class I subjects in the mandibular arch [Table 3].

Arch length changes

As expected there was a significant increase in the post treatment anterior arch lengths in both the maxillary and mandibular arches of Class I and Class II div 1 subjects due to the retraction of the anterior teeth in the wider extraction space of the first premolars. Also, there was significant decreases in both maxillary and mandibular posterior arch lengths in both Cass I and Class II div 1 subjects due extraction of first premolars [Tables 4-6].

Tooth size-arch length discrepancies

The changes in the TSALD of both Class I and Class II div 1 subjects were non-significant as expected as both the groups underwent extraction of first premolars in the study [Table 7].

DISCUSSION

The controversy of extraction versus non-extraction in orthodontics is centuries old. The review of the literature shows that numerous studies have been done on the advantages and disadvantages of both. For almost a century, the use of extractions to treat malocclusions has been hotly debated in orthodontic circles. Both sides of the extraction

Table 2: Descriptive and comparative statistics of lower arch width changes

Class	Parameter	Incisor (pre-Rx)	Incisor (post-Rx)	Canine (pre-Rx)	Canine (post-Rx)	Premolar (pre-Rx)	Premolar (post-Rx)	Molar (pre-Rx)	Molar (post-Rx)
I	*n*	25	25	25	25	25	25	25	25
	Maximum	25.35	27.27	30.35	31.49	38.29	37.88	41.64	40.28
	Minimum	20.21	19.75	22.26	24.52	32.20	30.27	34.17	32.36
	Mean	22.22	22.71	26.57	27.52	35.26	33.36	38.77	36.52
	SD	1.47	1.96	2.23	2.01	1.79	2.11	2.18	2.28
II	*N*	25	25	25	25	25	25	25	25
	Maximum	23.85	25.53	32.35	34.12	28.26	37.20	42.59	40.65
	Minimum	18.13	19.14	20.55	23.12	27.38	27.35	32.31	31.44
	Mean	21.03	23.11	25.86	28.11	23.32	32.96	37.97	36.23
	SD	1.74	1.67	3.00	2.16	6.99	2.53	2.84	2.46
I and II	Significant (two-tailed)	0.012	0.445	0.349	0.316	0.387	0.548	0.268	0.665
	P	S*	NS	NS	NS	NS	NS	NS	NS

SD=Standard deviation, S=Significant, NS=Not significant, *=Statiscally significant, $P \leq 0.05$

Table 3: Comparative statistics of upper and lower arch width changes

	Class	Parameter	Location	Paired differences					*t*	Significant (two-tailed)	*P*
				Mean	SD	SEM	95% CI of the difference				
							Lower	Upper			
Upper arch	I	Pair 1	Incisor (pre-Rx) – incisor (post-Rx)	−1.29	1.96	0.391	−2.10	−0.485	−3.30	0.003	S**
		Pair 2	Canine (pre-Rx) – canine (post-Rx)	−1.18	1.71	0.342	−1.89	−0.475	−3.46	0.002	S**
		Pair 3	Premolar (pre-Rx) – premolar (post-Rx)	0.455	2.33	0.467	−0.508	1.42	0.975	0.339	NS
		Pair 4	Molar (pre-Rx) – molar (post-Rx)	1.81	1.05	0.216	1.40	2.29	8.55	0.000	S**
	II	Pair 1	Incisor (pre-Rx) – incisor (post-Rx)	−2.32	2.29	0.460	−3.27	−1.38	−5.06	0.000	S**
		Pair 2	Canine (pre-Rx) – canine (post-Rx)	−2.02	2.43	0.487	−3.02	−1.01	−4.15	0.000	S**
		Pair 3	Premolar (pre-Rx) – premolar (post-Rx)	−0.25	2.02	0.403	−1.08	0.587	−0.611	0.547	NS
		Pair 4	Molar (pre-Rx) – molar (post-Rx)	1.48	1.57	0.314	0.832	2.13	4.71	0.000	S**
Lower arch	I	Pair 5	Incisor (pre-Rx) – incisor (post-Rx)	−0.499	1.40	0.281	−1.08	0.081	−1.78	0.089	NS
		Pair 6	Canine (pre-Rx) – canine (post-Rx)	−0.948	1.76	0.351	−1.67	−0.222	−2.70	0.013	S*
		Pair 7	Premolar (pre-Rx) – premolar (post-Rx)	21.92	1.50	0.300	21.30	22.54	73.03	0.000	S**
		Pair 8	Molar (pre-Rx) – molar (post-Rx)	2.26	1.36	0.273	1.69	2.82	8.27	0.000	S**
	II	Pair 5	Incisor (pre-Rx) – incisor (post-Rx)	−2.09	1.18	0.236	−2.57	−1.60	−8.82	0.000	S**
		Pair 6	Canine (pre-Rx) – canine (post-Rx)	−2.25	1.98	0.397	−3.07	−1.43	−5.68	0.000	S**
		Pair 7	Premolar (pre-Rx) – premolar (post-Rx)	27.32	29.77	5.95	15.04	39.61	4.59	0.000	S**
		Pair 8	Molar (pre-Rx) – molar (post-Rx)	1.74	1.35	0.270	1.19	2.31	6.46	0.000	S**

SD=Standard deviation, SEM=Standard error of the mean, CI=Confidence interval, S=Significant, NS=Not significant, *=Statiscally significant, $P \leq 0.05$, **=Statiscally significant, $P \leq 0.01$

Table 4: Descriptive and comparative statistics of upper arch length change

Class	Parameter	Upper anterior		Upper posterior		Upper anterior		Upper posterior	
		RT (pre-Rx)	LT (pre-Rx)	RT (pre-Rx)	LT (pre-Rx)	RT (post-Rx)	LT (post-Rx)	RT (post-Rx)	LT (post-Rx)
I	*n*	25	25	25	25	25	25	25	25
	Maximum	27.16	25.43	16.18	16.24	29.07	28.95	9.78	8.74
	Minimum	17.25	17.27	12.36	12.51	18.11	18.14	6.28	6.40
	Mean	20.55	20.05	13.59	13.99	23.15	23.07	7.56	7.32
	SD	2.88	2.105	1.02	0.89	2.97	2.78	0.83	0.55
II	*n*	25	25	25	25	25	25	25	25
	Maximum	25.21	23.66	16.84	15.68	29.27	28.92	17.71	18.49
	Minimum	16.58	15.28	12.14	12.57	19.61	19.72	6.63	7.08
	Mean	20.93	20.34	14.67	14.70	25.45	25.60	8.58	8.59
	SD	1.94	2.32	1.051	0.83	2.59	2.50	2.81	3.00
I and II	Significant (two-tailed)	0.585	0.639	0.001	0.005	0.005	0.001	0.088	0.041
	P	NS	NS	S**	S**	S**	S**	NS	S*

SD=Standard deviation, S=Significant, NS=Not significant, *=Statiscally significant, $P \leq 0.05$, **=Statiscally significant, $P \leq 0.01$, RT=Right side

debate have claimed similar improvements in facial esthetics and comparable stability of the treatment results.

This clinical research is an attempt to help the clinician to plan orthodontic treatment for those patients who definitely require extractions of premolars as part of their orthodontic treatment and the knowledge of the various post treatment dental arch changes, can definitely be helpful in such cases.

Findings from this study indicate that, the overall arch width changes within the Classes I and II were also significant except inter-premolar arch width changes in the maxillary arch both in Class I and Class II div 1 subjects and the inter-incisal arch

Table 5: Descriptive and comparative statistics of lower arch length changes

Class	Parameter	Lower anterior		Lower posterior		Lower anterior		Lower posterior	
		RT (pre-Rx)	LT (pre-Rx)	RT (pre-Rx)	LT (pre-Rx)	RT (post-Rx)	LT (post-Rx)	RT (post-Rx)	LT (post-Rx)
I	*n*	25	25	25	25	25	25	25	25
	Maximum	20.44	20.53	16.60	15.90	21.61	21.67	8.63	8.39
	Minimum	13.45	12.10	13.18	13.27	16.20	16.39	6.34	4.81
	Mean	15.67	14.73	14.47	14.36	18.87	18.80	7.35	7.38
	SD	1.66	2.07	1.11	0.86	1.73	1.81	0.58	0.82
II	*n*	25	25	25	25	25	25	25	25
	Maximum	16.81	17.76	16.90	18.26	22.26	22.72	18.82	17.75
	Minimum	13.66	12.23	11.72	11.12	15.41	15.18	7.12	7.09
	Mean	15.47	15.30	14.73	14.52	19.55	19.17	8.86	9.00
	SD	0.87	1.49	1.10	1.76	2.07	2.04	2.98	2.79
I and II	Significant (two-tailed)	0.60	0.26	0.40	0.67	0.21	0.50	0.02	0.01
	P	NS	NS	NS	NS	NS	NS	S*	S*

SD=Standard deviation, S=Significant, NS=Not significant, *=Statiscally significant, $P \leq 0.05$

Table 6: Comparative statistics of upper and lower arch length changes

Class	Parameter	Location	Paired differences					*t*	Significant (two-tailed)	*P*
			Mean	SD	SEM	95% CI of the difference				
						Lower	Upper			
Upper arch I	Pair 9	RT (pre-Rx) upper anterior– RT (post-Rx) upper anterior	−2.61	2.88	0.575	−3.79	−1.42	−4.53	0.000	S**
	Pair 10	LT (pre-Rx) upper anterior – LT (post-Rx) upper anterior	−3.02	1.93	0.387	−3.82	−2.22	−7.80	0.000	S**
	Pair 11	RT (pre-Rx) upper posterior – RT (post-Rx) upper posterior	6.02	0.68	0.136	5.74	6.30	44.24	0.000	S**
	Pair 12	LT (pre-Rx) lower posterior – LT (post-Rx) lower posterior molar (post-Rx)	6.68	1.07	0.214	6.23	7.12	31.25	0.000	S**
II	Pair 9	RT (pre-Rx) upper anterior – RT (post-Rx) upper anterior	−4.52	2.50	0.501	−5.56	−3.49	−9.01	0.000	S**
	Pair 10	LT (pre-Rx) upper anterior – LT (post-Rx) upper anterior	−5.26	2.14	0.427	−6.14	−4.37	−12.30	0.000	S**
	Pair 11	RT (pre-Rx) upper posterior – RT (post-Rx) upper posterior	6.09	3.10	0.620	4.81	7.37	9.81	0.000	S**
	Pair 12	LT (pre-Rx) upper posterior – LT (post-Rx) lower posterior molar (post-Rx)	6.10	3.38	0.677	4.70	7.50	9.02	0.000	S**
Lower arch I	Pair 13	RT (pre-Rx) lower anterior – RT (post-Rx) lower anterior	−3.20	1.35	0.270	−3.75	−2.64	−11.82	0.000	S**
	Pair 14	LT (pre-Rx) lower anterior – LT (post-Rx) lower anterior	−4.07	1.77	0.354	−4.80	−3.34	−11.50	0.000	S**
	Pair 15	RT (pre-Rx) lower posterior – RT (post-Rx) lower posterior	7.11	1.13	0.226	6.65	7.58	31.46	0.000	S**
	Pair 16	LT (pre-Rx) lower posterior – LT (post-Rx) lower posterior molar (post-Rx)	6.98	1.18	0.237	6.48	7.46	29.43	0.000	S**
II	Pair 13	RT (pre-Rx) lower anterior – RT (post-Rx) lower anterior	−4.08	1.69	0.338	−4.78	−3.39	−12.09	0.000	S**
	Pair 14	LT (pre-Rx) lower anterior– LT (post-Rx) lower anterior	−3.87	2.24	0.448	−4.80	−2.95	−8.64	0.000	S**
	Pair 15	RT (pre-Rx) lower posterior – RT (post-Rx) lower posterior	5.87	3.44	0.688	4.46	7.29	8.53	0.000	S**
	Pair 16	LT (pre-Rx) lower posterior – LT (post-Rx) lower posterior	5.52	3.34	0.667	4.14	6.90	8.27	0.000	S**

SD=Standard deviation, SEM=Standard error of the mean, CI=Confidence interval, LT=Left side, RT=Right side, S=Significant, *=Statiscally significant, $P \leq 0.05$,

Table 7: Descriptive and comparative statistics of TSALD

Class	Parameter	Total					Significant (two-tailed)	*P*
		U1	L1	U2	L2	Average		
I	*n*	25	25	25	25	25		
	Maximum	−4.01	−2.77	−3.67	−2.78	−3.31		
	Minimum	−8.73	−8.99	−9.02	−9.50	−9.06		
	Mean	−7.68	−7.99	−7.63	−7.96	−7.81		
	SD	1.24	1.32	1.15	1.34	1.21		
II	*n*	25	25	25	25	25		
	Maximum	−5.53	−5.15	−5.06	−5.44	−5.81		
	Minimum	−11.91	−13.32	−11.26	−13.52	−12.22	0.398	NS
	Mean	−7.89	−8.42	−7.95	−8.33	−8.15		
	SD	1.52	1.90	1.47	1.97	1.53		
Total	*n*	50	50	50	50	50		
	Maximum	−4.01	−2.77	−3.67	−2.78	−3.31		
	Minimum	−11.91	−13.32	−11.26	−13.52	−12.22		
	Mean	−7.79	−8.20	−7.79	−8.14	−7.98		
	SD	1.37	1.63	1.31	1.68	1.38		

SD=Standard deviation, TSALD=Tooth size arch length discrepancy, NS=Not significant

width changes in Class I subjects in the mandibular arch. There was also a trend of an increase in the anterior arch lengths in the subjects post-treatment, and a decrease in the posterior arch lengths due to the removal of first premolars.

Prior to treatment, there was a significant difference in anterior and total TSALD with both the Class I and the Class II div 1 groups having a significantly large discrepancy. The presence of a significant TSALD is obviously one of the main criteria for extracting premolars. Other parameters that may influence the extraction decision include: lip protrusion, inclination of the incisors, treatment and biomechanical philosophies of the clinician, growth potential of the patient, and the severity of the antero-posterior and vertical dentofacial discrepancies.

A number of factors have been suggested as important for enhancing the stability and the treatment results, including establishment of a good functional occlusion in harmony and balance with muscle function,[15-18] attainment of good inter-digitation with normal axial inclination of the teeth,[15,16,19] providing a healthy environment for the periodontium,[15,17] having proper mandibular incisor position and angulation,[15,16,20] achieving a normal jaw relationship[15,17] and the presence of favorable growth.[17] On the other hand, the major factors that have been suggested as enhancing relapse include poor treatment results,[15,16,19,21] expanding the arches and changing their shape,[16,19] the inability to eliminate etiology, e.g. persistent habits,[16,19] and insufficient retention period.[16,19]

Most clinicians agree that the retention is an integral part of orthodontic treatment and should be maintained for a sufficient period to allow reorganization of the investing tissues.[9,16,20,22-25] Although different types of retention appliances are used, full-time wear of the appliances in the early period of retention – about 6[22,24,25] to 12 months[20] is generally recommended. This period is then followed by another about 6[22,24,25] to 12 months[20] of night wear only. Retention appliances should be discontinued gradually.[22,24,25] Some clinicians recommended that the retention period should be roughly equal to the active treatment time.[21] Others suggest that the removal of fixed retainers should be postponed until growth is completed.[16,20,22]

In summary, the severity and characteristics of the malocclusion,[9] the magnitude of the changes achieved during treatment,[9,25] the length of time the malocclusion existed before treatment[25] and the functional demands of the stomatognathic system[25] are all factors that need to be considered when planning the length of the retention period and the design of the retention appliance.

CONCLUSIONS

The findings of this evidence based clinical research indicate that the extraction of premolars as a part of orthodontic treatment significantly improves the discrepancy between tooth size and arch length. The authors are of the view that the finding of this study will definitely help the clinicians in planning orthodontic treatment in patients where extractions are indicated in the arch length-tooth material discrepancy cases.

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