RESEARCH ARTICLE

Intermolar and Intercanine width Changes among Class I and Class II Malocclusions Following Orthodontic Treatment

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Abstract

Introduction: Arch width discrepancy is important to predict treatment outcome as it affects the space availability and stability of dentition. Negligence to maintain arch form has been recognized as a prime cause of relapse.

Aim and objective: To assess the differences in intermolar and intercanine distances among class I, class II division 1, and class II division 2 malocclusion following orthodontic treatment.

Materials and methods: The study was performed on models of pre- and posttreatment from records of 100 patients visiting the Department of Orthodontics, MMCDSR using a digital Vernier caliper to measure intermolar and intercuspid distance. The sample comprised of both male and female patients of age group 14–25 years divided into three different groups, group I—class I malocclusion, group II—class II division 1 malocclusion, and group III—class II division 2 malocclusion. The results obtained were subjected to statistical analysis. Group II showed higher pretreatment intercanine width than group I whereas group III had lower pretreatment intercanine width than both group I and group II. Group I showed higher pretreatment intermolar width than group II. Pretreatment intercanine width was higher in group II compared with group I whereas it was lower for group III when compared with group I for the mandible.

Keywords: Class II malocclusion, Index for orthodontic treatment need, Malocclusion.

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Introduction

Arch length and arch width discrepancies are considered important diagnostic aids, which help an orthodontist to predict the treatment outcome of a particular case. The orthodontist should know the growth and development of dentition and arch changes that take place with age which helps in preventive as well as interceptive orthodontic procedures that at times, become necessary to deal with developing malocclusion.[1–4] A stable, functional, and esthetic arch form is of at most importance in orthodontics.[5–7] Dental arch changes resulting from growth and treatment are important to the orthodontist.[8–10]

Materials and Methods

- The study was performed on study models of pretreatment and posttreatment from records of patients visiting the postgraduate department of orthodontics.
- A Titan Stainless steel digital Vernier caliper (Fig. 1) with calibration in accordance with international length standards was used for the study.

Four width measurements were taken on the dental casts of each subject.

- Maxillary intercanine width—between maxillary canine cusp tips (Fig. 2).
- Maxillary intermolar width—measurement is taken from the mesiobuccal cusp tips of first molars on right and left sides (Fig. 2).
- Mandibular intercanine width—measurement from mandibular canine cusp tips on both sides (Fig. 3).
- Mandibular intermolar width—measuring the most gingival extension of buccal grooves on first molars (Fig. 3).

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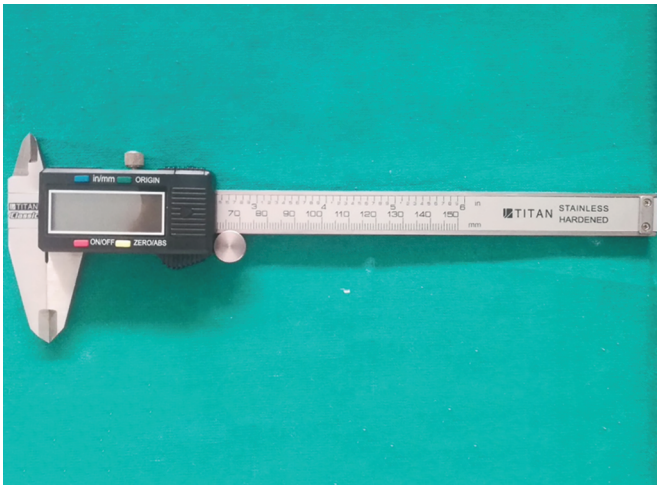

Fig. 1: Titan stainless steel digital Vernier caliper

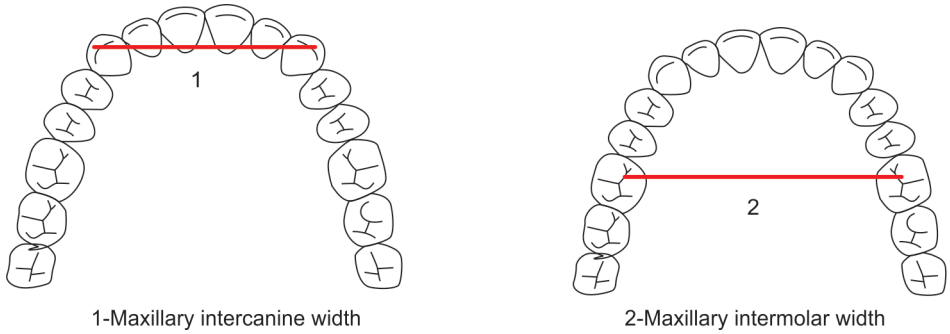

Fig. 2: Maxillary intercanine width

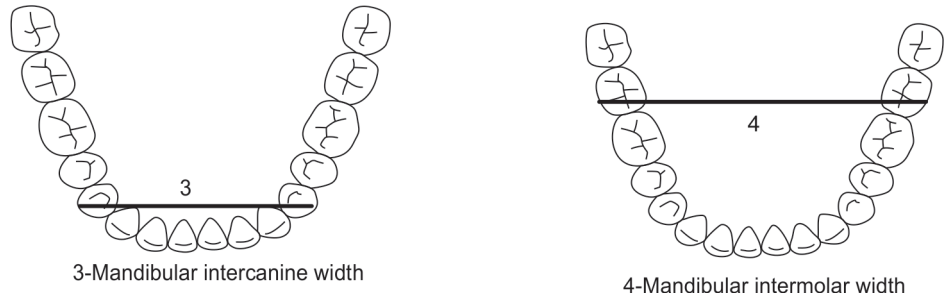

Fig. 3: Mandibular intercanine width

Study models were segregated into three groups:
Group I—25 males and females with Angle's class I malocclusion.
Group II—20 males and females with class II div 1 malocclusion.
Group III—10 males and females with class II div 2 malocclusion.

- Both the subjects in the age group 14–25 years were considered for the study.

Null Hypothesis

There is no difference in intermolar and intercanine distance among class I, class II division 1, and class II division 2 malocclusion following orthodontic treatment.

Statistical Analysis

Statistical analysis was done to calculate the mean and standard deviations for all groups. Intergroup differences were evaluated using ANOVA with Tukey's *post hoc* test.

Result

Tables 1 and 2 show a comparison of pre- and posttreatment intercanine width among males for maxilla and mandible, respectively, where posttreatment intercanine width has increased for maxilla and mandible both for all three malocclusions.

Tables 3 and 4 show intercanine width pre- and postorthodontic treatment for females. Following orthodontic treatment, mandibular intercanine width has increased for both class II div 1 and class II div 2 malocclusion, whereas mean width decreased for class I malocclusion. Tukey's *post hoc* test shows the statistically significant difference for class I vs class II, div 1 malocclusion.

Table 5 shows the average mean maxillary intermolar width for males increased in all three malocclusions following orthodontic treatment.

Table 6 shows mean mandibular intermolar width increased in males for class II div 1 and class II div 2 malocclusions whereas there was a decrease in mean width for class I malocclusion following orthodontic treatment.

Table 7 shows an increase in maxillary intermolar width in females increased following orthodontic treatment in all three malocclusions.

In Table 8, the mean mandibular intermolar width decreased in class II div 1 patients for females following orthodontic treatment, whereas it increased marginally for class I and class II div 2 malocclusions.

Arch Width Comparison in the Maxilla

- Group II showed higher pretreatment intercanine width than group I.
- Group III had lower pretreatment intercanine width than both group I and group II.
- Group I showed higher pretreatment intermolar width than group II.

Arch Width Comparison in the Mandible

- Pretreatment intercanine width was higher in group II compared with group I whereas it was lower for group III when compared with group I.

Discussion

Arch shape and arch size have considerable implications in diagnosis and treatment planning from an orthodontist's point of view as it affects the available space, dental esthetics, and stability of dentition.[1,11] After measuring intercanine and intermolar width of from study models of all the samples, the results obtained were subjected to statistical analysis. Class II div 1 malocclusion showed higher pretreatment intercanine width than class I malocclusion, while class II div 2 had lower pretreatment intercanine width than both class I malocclusion and class II div 1 (Figs 4 and 5).

Table 1: Comparison of pre- and posttreatment intercanine width among the males (maxilla)

	Maxilla					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	34.57	1.84	35.54	1.73	1.92	0.06
Class II, div 1	37.68	6.72	38.62	6.45	0.51	0.62
Class II, div 2	32.07	0.52	34.19	1.99	5.15	<0.01*
ANOVA test		14.63		7.96		
p value		<0.01*		0.001*		
Tukey's HSD *post hoc* test			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = 3.1100, 95% CI = 0.6230 to 5.5970, $p = 0.01$*			Class I vs class II, div 1: Diff = 3.0800, 95% CI = 0.3569 to 5.8031, $p = 0.02$*			
Class I vs class II, div 2: Diff = −2.5000, 95% CI = −4.9870 to −0.0130, $p = 0.04$*			Class I vs class II, div 2: Diff = −1.3500, 95% CI = −4.0731 to 1.3731, $p = 0.46$			
Class II, div 1 vs class II, div 2: Diff = −5.61, 95% CI = −8.0970 to −3.1230, $p \leq 0.01$*			Class II, div 1 vs class II, div 2: Diff = −4.43, 95% CI = −7.1531 to −1.7069, $p = 0.001$*			

*Statistically significant

Table 2: Comparison of pre- and posttreatment intercanine width among the males (mandible)

	Mandible					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	26.73	1.33	27.34	1.01	0.62	0.47
Class II, div 1	29.85	7.15	30.62	7.01	0.56	0.60
Class II, div 2	26.59	0.77	27.90	1.07	4.97	<0.01*
ANOVA test		4.76		4.50		
p value		0.01*		0.01*		
Tukey's HSD *post hoc* test…			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = 3.1200, 95% CI = 0.2620 to 5.9780, $p = 0.03$*			Class I vs class II, div 1: Diff = 3.2800, 95% CI = 0.4808 to 6.0792, $p = 0.02$*			
Class I vs class II, div 2: Diff = −0.1400, 95% CI = −2.9980 to 2.7180, $p = 0.99$			Class I vs class II, div 2: Diff = 0.5600, 95% CI = −2.2392 to 3.3592, $p = 0.88$			
Class II, div 1 vs class II, div 2: Diff = −3.2600, 95% CI = −6.1180 to −0.4020, $p = 0.02$*			Class II, div 1 vs class II, div 2: Diff = −2.7200, 95% CI = −5.5192 to 0.0792, $p = 0.06$			

*Statistically significant

Table 3: Comparison of pre- and posttreatment intercanine width among the females (maxilla)

	Maxilla					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	35.21	1.71	36.19	1.28	2.29	0.03*
Class II, div 1	37.57	6.81	37.63	6.96	0.03	0.98
Class II, div 2	30.82	2.24	32.16	1.63	2.42	0.02*
		16.20		11.43		
p value		<0.01*		<0.01*		
Tukey's HSD *post hoc* test…			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = 2.3600, 95% CI = −0.5419 to 5.2619, $p = 0.13$			Class I vs class II, div 1: Diff = 1.4400, 95% CI = −1.3980 to 4.2780, $p = 0.44$			
Class I vs class II, div 2: Diff = −4.3900, 95% CI = −7.2919 to −1.4881, $p = 0.002$*			Class I vs class II, div 2: Diff = −4.0300, 95% CI = −6.8680 to −1.1920, $p = 0.003$*			
Class II, div 1 vs class II, div 2: Diff = −6.75, 95% CI = −9.6519 to −3.8481, $p \leq 0.01$*			Class II, div 1 vs class II, div 2: Diff = −5.47, 95% CI = −8.3080 to −2.6320, $p = 0.0001$*			

*Statistically significant

Table 4: Comparison of pre- and posttreatment intercanine width among the females (mandible)

	Mandible					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	27.25	1.45	27.03	1.48	0.51	0.59
Class II, div 1	29.92	7.15	30.26	7.19	0.41	0.52
Class II, div 2	26.92	1.79	27.63	2.35	0.89	0.42
ANOVA test		3.59		3.73		
p value		0.03*		0.03*		
Tukey's HSD *post hoc* test…			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = 2.6700, 95% CI = −0.2656 to 5.6056, *p* = 0.0821			Class I vs class II, div 1: Diff = 3.2300, 95% CI = 0.2179 to 6.2421, *p* = 0.03*			
Class I vs class II, div 2: Diff = −0.3300, 95% CI = −3.2656 to 2.6056, *p* = 0.9609			Class I vs class II, div 2: Diff = 0.6000, 95% CI = −2.4121 to 3.6121, *p* = 0.88			
Class II, div 1 vs class II, div 2: Diff = −3.00, 95% CI = −5.9356 to −0.0644, *p* = 0.04*			Class II, div 1 vs class II, div 2: Diff = −2.63, 95% CI = −5.6421 to 0.3821, *p* = 0.09			

*Statistically significant

Table 5: Comparison of pre- and posttreatment intermolar width among the males (maxilla)

	Maxilla					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	51.89	2.31	52.04	2.04	0.19	0.72
Class II, div 1	51.40	1.81	51.92	1.58	0.37	0.68
Class II, div 2	51.58	1.28	52.67	1.28	3.01	0.004*
ANOVA test		0.45		1.47		
p value		0.64		0.24		
Tukey's HSD *post hoc* test…			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = −0.4900, 95% CI = −1.7412 to 0.7612, *p* = 0.6187			Class I vs class II, div 1: Diff = −0.1200, 95% CI = −1.2456 to 1.0056, *p* = 0.9648			
Class I vs class II, div 2: Diff = −0.3100, 95% CI = −1.5612 to 0.9412, *p* = 0.8243			Class I vs class II, div 2: Diff = 0.6300, 95% CI = −0.4956 to 1.7556, *p* = 0.3783			
Class II, div 1 vs class II, div 2: Diff = 0.18, 95% CI = −1.0712 to 1.4312, *p* = 0.9368			Class II, div 1 vs class II, div 2: Diff = 0.7500, 95% CI = −0.3756 to 1.8756, *p* = 0.2546			

Table 6: Comparison of pre- and posttreatment intermolar width among the males (mandible)

	Mandible					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	45.87	2.18	45.34	2.30	0.54	0.58
Class II, div 1	45.58	1.83	45.97	2.15	0.46	0.63
Class II, div 2	47.99	1.27	48.95	1.28	2.66	0.01*
ANOVA test		13.37		24.14		
p value		<0.01*		<0.01*		
Tukey's HSD *post hoc* test…			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = −0.2900, 95% CI = −1.5080 to 0.9280, *p* = 0.8366			Class I vs class II, div 1: Diff = 0.6300, 95% CI = −0.6982 to 1.9582, *p* = 0.4958			
Class I vs class II, div 2: Diff = 2.1200, 95% CI = 0.9020 to 3.3380, *p* = 0.0002*			Class I vs class II, div 2: Diff = 3.6100, 95% CI = 2.2818 to 4.9382, *p* ≤ 0.01*			
Class II, div 1 vs class II, div 2: Diff = 2.41, 95% CI = 1.1920 to 3.6280, *p* ≤ 0.01*			Class II, div 1 vs class II, div 2: Diff = 2.9800, 95% CI = 1.6518 to 4.3082, *p* ≤ 0.01*			

*Statistically significant

Table 7: Comparison of pre- and posttreatment intermolar width among the females (maxilla)

	Maxilla					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	50.74	1.07	51.13	1.18	1.22	0.23
Class II, div 1	49.39	1.35	49.98	1.24	0.98	0.32
Class II, div 2	48.67	2.39	49.93	2.34	1.88	0.07
ANOVA test		9.54		4.11		
p value		0.002*		0.02*		
Tukey's HSD *post hoc* test…			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = −1.3500, 95% CI = −2.5013 to −0.1987, *p* = 0.02*			Class I vs class II, div 1: Diff = −1.1500, 95% CI = −2.2830 to −0.0170, *p* = 0.04*			
Class I vs class II, div 2: Diff = −2.0700, 95% CI = −3.2213 to −0.9187, *p* = 0.0002*			Class I vs class II, div 2: Diff = −1.2000, 95% CI = −2.3330 to −0.0670, *p* = 0.04*			
Class II, div 1 vs class II, div 2: Diff = −0.72, 95% CI = −1.8713 to 0.4313, *p* = 0.2986			Class II, div 1 vs class II, div 2: Diff = −0.05, 95% CI = −1.1830 to 1.0830, *p* = 0.99			

*Statistically significant

Table 8: Comparison of pre- and posttreatment intermolar width among the females (mandible)

	Mandible					
	Pretreatment		*Posttreatment*			
Treatment	*Mean*	*SD*	*Mean*	*SD*	*t-test*	*p value*
Class I	44.03	1.59	44.29	2.07	0.49	0.64
Class II, div 1	44.09	1.54	43.80	1.85	0.60	0.55
Class II, div 2	44.26	1.34	44.56	1.88	0.65	0.52
ANOVA test		0.16		0.99		
p value		0.85		0.38		
Tukey's HSD *post hoc* test…			Tukey's HSD *post hoc* test…			
Class I vs class II, div 1: Diff = 0.0600, 95% CI = −0.9512 to 1.0712, *p* = 0.9889			Class I vs class II, div 1: Diff = −0.4900, 95% CI = −1.8003 to 0.8203, *p* = 0.6452			
Class I vs class II, div 2: Diff = 0.2300, 95% CI = −0.7812 to 1.2412, *p* = 0.8497			Class I vs class II, div 2: Diff = 0.2700, 95% CI = −1.0403 to 1.5803, *p* = 0.8748			
Class II, div 1 vs class II, div 2: Diff = 0.17, 95% CI = −0.8412 to 1.1812, *p* = 0.9148			Class II, div 1 vs class II, div 2: Diff = 0.76, 95% CI = −0.5503 to 2.0703, *p* = 0.3525			

*Statistically significant

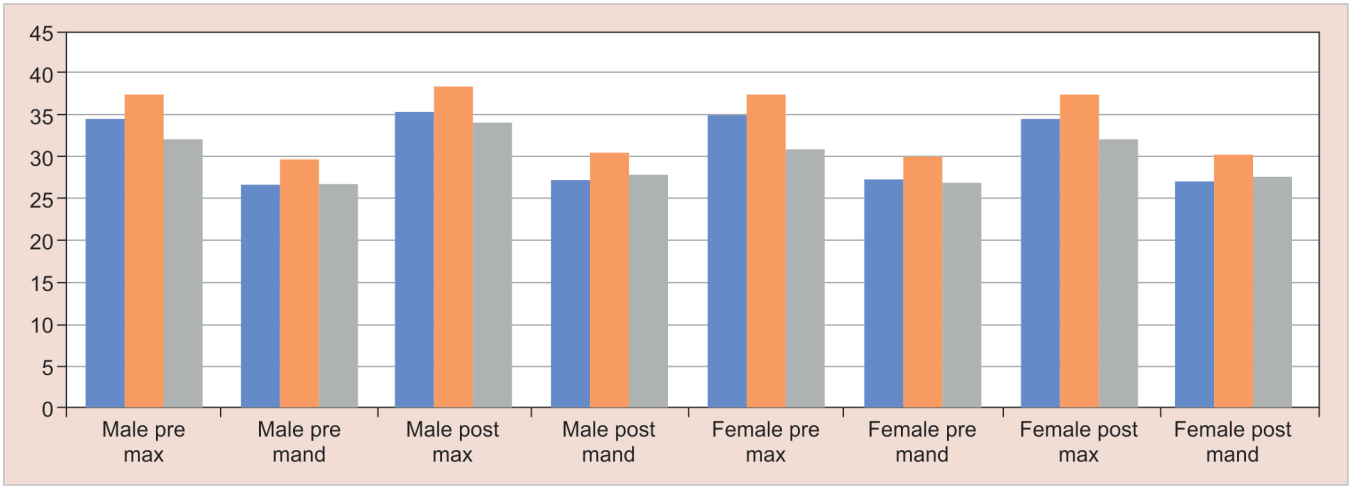

Fig. 4: A comparison of pre- and posttreatment intercanine width among class I, class II div 1, class II div 2 malocclusions for both males and females

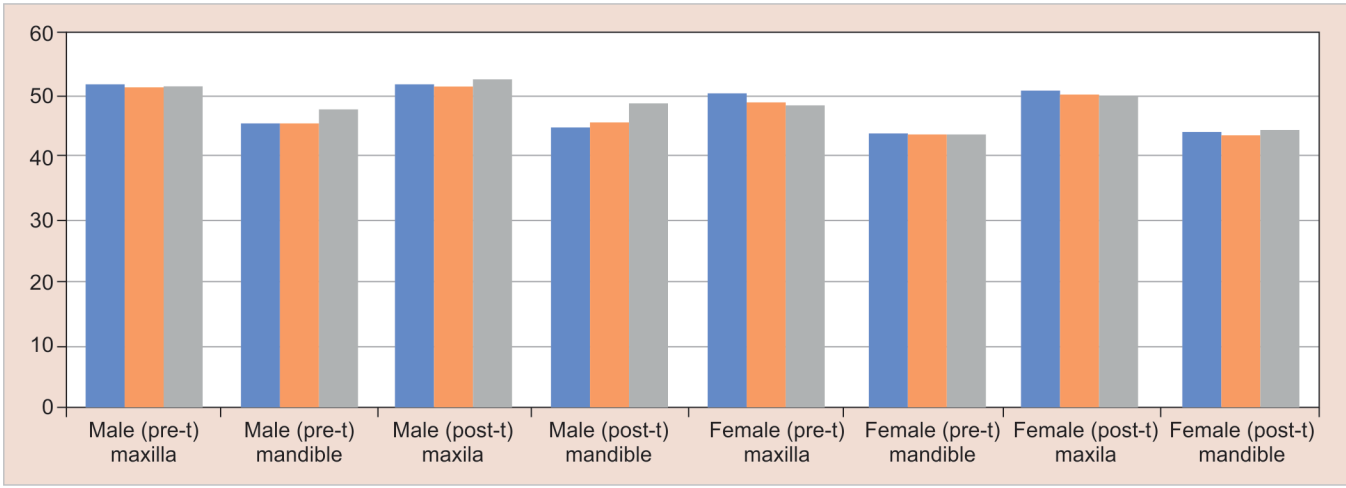

Fig. 5: A comparison of pre- and posttreatment intermolar width among class I, class II div 1, class II div 2 malocclusions for both males and females

Class I group showed higher pretreatment intermolar width with a mean of 51.89 mm in the maxilla and 52.04 mm in the mandible for males and 50.74 mm in the maxilla and 44.03 mm in the mandible for females than class II malocclusion.

Pretreatment intercanine width was higher in group class II div 1 with a mean of 37.68 mm in the maxilla and 29.85 mm in the mandible for males and 37.57 mm in the maxilla and 29.92 mm in the mandible for females compared with class I whereas the mean was 34.57 mm in the maxilla and 26.73 mm in the mandible for males and 35.21 mm in the maxilla and 27.25 mm in the mandible for females whereas it lower for class II div 2 with mean of 32.07 mm in the maxilla and 26.89 mm in the mandible males and 30.82 mm in the maxilla and 26.92 mm in the mandible for females when compared with class I. Tukey's *post hoc* test showed differences among intermolar and intercanine width among different malocclusions, hence the null hypothesis was rejected.

Conclusion

- Higher pretreatment intercanine and intermolar width in both the arches of class II div 1 malocclusion than class I malocclusion.
- Lower maxillary pretreatment intercanine width in class II div 2 malocclusion than class I and class II div 1 malocclusion.
- Increased maxillary pretreatment intermolar width in class I malocclusion than class II div 1 malocclusion.
- Males and females showed a decrease in intermolar width after completion of orthodontic treatment in class I malocclusion.
- Males had higher intercanine and intermolar width compared with females after orthodontic treatment in all groups except group I.
- Males and females of both class II div 1 and div 2 showed an increase in maxillary and mandibular intercanine and intermolar width postorthodontic treatment.

As shown with Tukey's *post hoc* test, a significant difference was found in intermolar and intercanine width among the three groups following the orthodontic treatment, hence the null hypothesis was rejected.

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