

# Comparison of Intercanine and Intermolar Widths in Dental Malocclusions Based Upon Angle Classification at Tertiary Care Hospital

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## Abstract

**Introduction:** Intercanine and Intermolar widths have been considered pivotal assessments on casts for better arch coordination. This study aimed at comparing the intercanine and intermolar widths in Dental Malocclusion based upon Angle Classification at tertiary level hospital. This might help clinicians to better understand how changes in inter-canine and intermolar width affect their treatment plans and retention protocols in different malocclusions.

**Material and Methods:** Sample size consisted of 78 patients, 23 (29.5%) males and 55 (70.5%) females with mean age  $18.52 \pm 5.27$  years and  $17.60 \pm 4.82$  years respectively. Universal digital caliper was used to assess width at canines and molars across the arch in Angle malocclusions

**Results:** Insignificant differences were found for inter-canine and inter-molar widths of the maxillary and mandibular dental casts across their bases in angle class I, II and III malocclusions.

**Conclusion:** Intercanine width was least in Class III and widest in Class I malocclusion whereas intermolar width was least in Class III and widest in Class II malocclusion.

**Keywords:** Dental Arch; Dentition, Malocclusion; Inter-canine width; Inter-molar width

## Introduction

Intercanine and Intermolar widths have been considered pivotal assessments on casts for better arch coordination.<sup>1</sup> These widths have been different in various malocclusions and better understanding can help in deciding whether expansions are needed as part of treatment indifferent Angle Malocclusions and thus help in achieving better posttreatment arch coordination.<sup>2</sup>

In dentistry, an individual's dental arch width is evaluated from the outermost tip of their

canine or bicuspid to the innermost tip of their first molars. You may gauge the width of your arch by measuring the distances between your canines, premolars, and molars. Dental arches reach their full size when adult molars and canines erupt. Factors such as genetics, bone development, tooth eruption, tooth inclination, muscular stresses and functions, and environmental context all play a role in determining dental arch size. The intercuspatation of a person's canines and the spacing of their molars, for example, may differ from one individual to the next.<sup>3</sup>

For correct diagnosis and treatment planning, dental arch curvature needs to be established. The process of using orthodontics to realign one's teeth in order to enhance their aesthetics, functionality, and occlusion. Specifically, Ward et al in one of the study concluded that there was statistically

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significant difference in the inter-canine widths in both arches between the orthodontically treated and untreated groups.<sup>4</sup>

Researchers have focused on dental arch forms during the past century to learn more about how teeth of different races compare in terms of size and structure.<sup>5</sup> Determining arch form and shape are crucial components of clinical diagnostics, orthodontic care, and public health.<sup>6</sup> The findings have significant useful implications in other areas of study as well, such as medicine and biology.

Arch form and arch shape are different in occlusion and malocclusion, with profound impact on arch coordination, stability, retention need and relapse. In one of the studies it was found that arch width relapse at post retention stage was relatively more across maxillary 1<sup>st</sup> molar, and canines as compared to their mandibular counterparts.<sup>7</sup> The rationale of this research study was to help clinicians to better understand how changes in inter-canine and inter-molar width affect their treatment plans and retention protocols for patients in different malocclusion. This will help them robustly manage such patients in our local population. This study aimed at comparing the intercanine and intermolar widths in Dental Malocclusion based upon Angle Classification at tertiary level hospital.

## Materials and Methods

This study was administered in the Orthodontic Department, Peshawar Dental College, from April 2022 to July 2022 as a cross-sectional study. Ethical approval is Ref: Prime/IRB/2022-413. At the time of data acquisition, informed consent was taken from the patients, who were explained about the potential impacts of the study. Sample of 78 patients was calculated using WHO formula taking 13.8%<sup>7</sup> proportion of post-retention arch width relapse in maxillary inter-canine region with 95% confidence interval and 7.7% margin of error. Overall, 23 (29.5%) males and 55 (70.5%) females with mean age 18.52±5.27 years and 17.60±4.82 years were recorded respectively.

Patients with the age range 16 to 30 years with good quality casts in white dental stone showing only mild to moderate crowding in maxillary and mandibular arches with 12 permanent teeth erupted were made study sample. Those patients were excluded from the study who have dental anomalies, extractions, large and or compromised restorations, subjects with previous orthodontic treatment, attrition of occlusal surfaces of the teeth, prosthetic replacements, craniofacial anomalies, trauma, impactions, asymmetric arches, congenitally missing teeth and periodontally compromised dentition. Distance from the midpoint of the lingual cervical area of molar and canine to the corresponding point on the antimere molar and canine was accessed using universal digital caliper (Figure 1). Data was collected through non-probability consecutive sampling technique and selected patients were grouped as group 1: Dental Class I, group 2: Dental Class II and group 3: Dental Class III.



Figure 1: Universal Digital Calliper

## Statistical Analysis:

SPSS 23.0 (IBM Corp., Armonk, NY, USA) was used to carryout quantitative analysis: mean and standard deviation and qualitative analysis: frequencies and percentages. One Way ANOVA test was used for comparing arch widths at canines and molars on dental casts across their bases in angle malocclusions keeping p value  $\leq 0.05$  significant.

## Results:

Sample size (n=78 patients), comprised of 23 (29.5%) male patients and 55 (70.5%) female patients. Mean sample age was 17.87±4.94 years. Demographics with gender-based comparisons and class of malocclusions are given in [Table I].

Insignificant differences for inter-canine width in angle class I, II, and III malocclusions were found in both arches (p=0.609) and (p=0.247) respectively. Similarly, insignificant differences of maxillary and mandibular intermolar width in angle class I, II, and III malocclusions were found (p=0.235) and 0.171 respectively. [Table II].

Age wise relation of Intercanine and Intermolar widths comparison in Angle Class I, II and III are given in [Table III].

Gender wise relation of Intercanine and Intermolar Widths Comparison in Angle Class I, II and III are given in [Table IV].

**Table I: Demographic, Gender Wise Comparison and Malocclusion**

Quantitative Variable	Mean	Std. Deviation
Age (Years)	17.87	4.942
Age Groups	Frequency	Percent
≤ 20 Years	53	67.9%
> 20 Years	25	32.1%
Total	78	100.0%
<b>Gender Groups</b>		
Male	23	29.5%
Female	55	70.5%
Total	78	100.0%
<b>Malocclusion</b>		
Class I	19	24.4%
Class II	49	62.8%
Class III	10	12.8%
Total	78	100.0%

**Table II: Inter-canine and Intermolar Widths Comparison in Angle Class I, II and III Malocclusions**

Variables	Class I Mean+SD	Class II Mean+SD	Class III Mean+SD	p-value
Maxillary inter-canine width (mm)	30.24+8.84	29.87+8.32	27.07+10.08	0.609
Mandibular inter-canine width (mm)	26.38+2.15	24.07+6.06	23.15+8.37	0.247
Maxillary intermolar width (mm)	39.88+10.91	40.56+5.78	35.56+13.00	0.235
Mandibular intermolar width (mm)	34.57+9.27	33.15+10.31	26.46+18.32	0.171

**Table III: Age wise relation of Inter-canine and Intermolar Widths Comparison in Angle Class I, II and III Malocclusions**

Age			Mean Square	p-value
≤ 20 Years	Maxillary inter-canine width (mm)	Between Groups	55.523	.530
		Within Groups	86.287	
	Mandibular inter-canine width (mm)	Between Groups	60.995	.250
		Within Groups	42.766	
	Maxillary intermolar width (mm)	Between Groups	106.645	.345
		Within Groups	98.085	
	Mandibular intermolar width (mm)	Between Groups	28.677	.822
		Within Groups	145.884	
> 20 Years	Maxillary inter-canine width (mm)	Between Groups	55.222	.364
		Within Groups	52.201	
	Mandibular inter-canine width (mm)	Between Groups	1.260	.899
		Within Groups	11.733	
	Maxillary intermolar width (mm)	Between Groups	9.895	.536
		Within Groups	15.444	
	Mandibular intermolar width (mm)	Between Groups	744.672	.000
		Within Groups	59.283	

**Table IV: Gender wise relation of Inter-canine and Intermolar Widths Comparison in Angle Class I, II and III Malocclusions**

Gender			Mean Square	p-value
Male	Maxillary inter-canine width (mm)	Between Groups	8.255	.705
		Within Groups	23.166	
	Mandibular inter-canine width (mm)	Between Groups	3.068	.725
		Within Groups	9.368	
	Maxillary intermolar width (mm)	Between Groups	36.756	.339
		Within Groups	32.129	
	Mandibular intermolar width (mm)	Between Groups	420.676	.028
		Within Groups	97.365	
Female	Maxillary inter-canine width (mm)	Between Groups	65.119	.508
		Within Groups	94.929	
	Mandibular inter-canine width (mm)	Between Groups	57.363	.268
		Within Groups	42.508	
	Maxillary intermolar width (mm)	Between Groups	136.749	.206
		Within Groups	83.985	
	Mandibular intermolar width (mm)	Between Groups	33.922	.786
		Within Groups	140.032	

## Discussion

In the study, we measured and compared intercanine, intermolar widths of the maxillary and mandibular dental casts across their bases in various malocclusions based upon angle classification using universal digital caliper. Results yielded insignificant difference for intercanine and intermolar widths among various in Angle malocclusions. Various studies have been conducted regarding inter-canine and intermolar widths and they have shown variable results.<sup>8</sup>

In this study mean maxillary intermolar width of Class I, II and III were 39.88 mm, 40.56 mm and 35.6 mm respectively ( $p=0.235$ ). This outcome is not in line with the findings of Staley et al<sup>9</sup> who found a considerable difference between the Class I and Class II, for the mean intermolar widths, suggesting that in Class II maxillary molar compensate by tilting lingually for better arch coordination.

In this study mean mandibular intermolar widths were 34.57 mm, 33.15 mm, and 26.46 mm respectively ( $p=0.171$ ) in Class I, II & III malocclusions. Howe et al<sup>10</sup> found mean mandibular intermolar width in Class I as 34.1mm whereas Staley<sup>9</sup> showed contrary results with larger mean mandibular intermolar widths in Class I than the Class II div 1 & 2 malocclusions.

Mean maxillary inter-canine widths of Angel Class I, II and III in this study were 30.24 mm, 29.87 mm and 27.07 mm respectively. In contrast, Howe et al<sup>10</sup> and Staley et al<sup>9</sup> found larger maxillary arch widths at 1<sup>st</sup> molar and canines than other malocclusions groups. In short, the differences amongst the three malocclusion groups were insignificant for intermolar and inter-canine widths in both arches thus in accordance with our findings.

Azeem et al found the same measurement for individuals with normal occlusion. It is possible that the age differences between the study's participants explain the discrepancy in the inter-canine width value for normal occlusion.<sup>11</sup> Class I malocclusions in the present study was characterized by a wider mandibular inter-canine space 26.38 mm and

a wider intermolar space 39.88 mm. Rabbani et al. found males with mandibular class I malocclusion having average inter-canine distance of 25.92.6 mm as compared to females having 25.61 mm.<sup>12</sup> Azlan et al<sup>13</sup>, 2019, showed the average intermolar width of the maxilla in men was 49.36 mm, while in women it was 46.75 mm and the corresponding figures for the mandible were 43.17 mm and 40.5 mm, respectively. We found the average width between the maxillary and mandibular intermolar as 39.88 mm and 34.57 mm, respectively. The intermolar widths of the maxilla and mandible in Class I in our study were narrower than those in normal arches, as described by Azlan et al.<sup>13</sup> Similar findings were reported by Gurjar and Purohit, who found it to be statistically insignificant. Like what Gurjar and Purohit observed, we also found statistically insignificant differences in inter-canine width between the angle's malocclusion classes of mandible ( $p=0.247$ ).<sup>14</sup> Maxillary inter-canine width was 29.87 mm for Class II, which contrasted with 33.12 mm reported by Patel et al. However, inter-canine distance of 26.7+41.4 mm was comparable to 25.6 mm obtained by Patel et al.<sup>15</sup> Mushtaq et al. showed inter-canine width of both the maxilla and mandible and they found no variation in intermolar or inter-canine widths among the five malocclusion groups.<sup>16</sup> Contrary to it, Qamar and Ahmad<sup>17</sup> found statistically significant differences in the widths of the maxillary inter-canines, but that the mandibular intermolar width was larger in class II. This is contrary to what we found in our research.<sup>17</sup> Meanwhile, contrary to the findings of Hashim et al, we found that maxillary intermolar widths were widest for classes I, II, and III malocclusion.<sup>18</sup>

## Conclusion

This study demonstrated that the mean inter-canine and intermolar widths unlike previous studies which reported significant difference among Class I, II and III malocclusions yielded insignificant differences amongst the three malocclusion groups. Moreover, inter-canine width was less in Class III when

compared to Class II & I whereas intermolar width was less in Class III than in Class I and II.

### Ethical Approval

This study was approved by Institutional Review Board of Peshawar Dental College (Ref: Prime/IRB/2022-413).

### Conflict of Interest

No conflict of interest

### Authors' Contribution

**SI:** Data Collection, Introduction, Material & methods, Results, Critical revision.

**SA:** Concept & Design, Critical revision, Supervision, Final Approval

**ZI:** Data Analysis, interpretation, results, Discussion

**SB:** Data collection, introduction, Discussion

**SN:** Data collection & Abstract

**GI:** Introduction, conclusion

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