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ORIGINAL ARTICLE

Maxillary and Mandibular Interarch Width AmongDifferent Malocclusions

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ABSTRACT

Objective: To determine the association of maxillary and mandibular interarch width among different malocclusions.

Material and Methods: This cross-sectional study was done at the Department of Orthodontics of the Dr. Ishrat Ul Ibad Khan Institute of Oral Health Sciences, Dow University of Health Sciences, Karachi, during a period of one year from January 2017 to December 2017. Individuals with a Class I canine and molar relationship with minor crowding, normal growth and development, and mal-aligned upper and lower dental arches. Class II molar and canine relationship on at least one side, Class II division 1 or 2 groups, bilateral Class III molar relationship in centric occlusion, Class III permanent canine relationship with excessive negative overjet, good facial symmetry, and participants had to have all their permanent teeth present except for their third molars were included. Readings were obtained by measuring the interarch width using a vernier gauge caliper. The calibration of the vernier caliper was checked daily using the standard technique. The intercanine arch width was measured from the cusp tip of one canine to the contralateral canine. Intermolar width was assessed as the distance between the central fossae of the left and right first molars. The readings were taken by a single examiner, and the measurement was repeated three times with an interval of two minutes between each measurement to reduce the possibility of errors. To assess the reliability of the measurements, the intra-examiner reliability was determined using the intraclass correlation coefficient (ICC). The collected data was analyzed using statistical software, SPSS version 26.

Results: The study examined the maxillary and mandibular interarch widths of participants with different types of malocclusions. Class I had the highest maxillary intercanine width, and Class III had the highest maxillary intermolar width. Class III had the highest mandibular intercanine and intermolar width. Class II Division 2 had the lowest intercanine and intermolar width in both arches. Significant differences were observed in the mean intermolar width in the mandibular arch between Class II Division 2 and Class III malocclusions and in the maxillary intercanine width between Class I and Class II Division 2 malocclusions. No significant difference was found in other width measurements among the different types of malocclusions.

Conclusion: It has been concluded that patients with Class III malocclusion had narrower upper width measurements compared to the normal occlusion sample.

Keywords: Maxillary, mandibular, interarch width, malocclusion

INTRODUCTION

Orthodontists, prosthodontists, and oral surgeons require knowledge of maxillary arch measurements, as it is a fundamental aspect of their respective fields.[1] knowledge regarding arch-width characteristics that are associated with different types of malocclusions is beneficial in establishing treatment goals and anticipating potential aftereffects following orthodontic treatment.[2] Assessing the interarch discrepancy is a straightforward and efficient method of evaluating the transverse similarity of dental arches.[3] The shape and the size of dental arches are important in orthodontic treatment and the diagnostic plannings as they have a significant impact on available space, dental aesthetics, and the stability of the final outcome.[4] Medical professionals have identified several factors, including but not limited to nasal blockage, finger sucking, tongue-thrusting habits, a low resting position of the tongue, and irregular sucking and swallowing patterns, contribute to reduced maxillary arch widths in patients with malocclusions when compared to individuals with normal occlusions.[5] Arch width comparisons between individuals with normal occlusions and those with various malocclusions have been thoroughly researched.[2,6-10] Moorrees et al. conducted a study which showed that the individuals having Class II Division 2 malocclusions had above-average maxillary and mandibular intercanine widths, while their intermolar widths were within normal ranges. Conversely, “Class II Division 1” patients exhibited intermolar and intercanine distances that were below average when compared to the general population. Buschang et al. reported that cases with Class II Division 2 malocclusion had wider maxillary intercanine and intermolar distances compared to those with Class II Division 1 malocclusion. On the other hand, Class II Division 2 individuals showed narrower mandibular intercanine and intermolar widths than both Class I and Class II Division 1 individuals. Staley et al[7] in a study, revealed that individuals with Class II division 1 malocclusion had a narrower maxillary arch. In accordance to Braun et al[11] the mandibular dental arches of the cases having ClassIII are wider than the Class I, whereas Class III maxillary arch widths are wider than the Class I. Maxillary and mandibular interarch width are important parameters in the orthodontic management and diagnostic plannings. Malocclusion refers to the misalignment of the teeth and jaws, and different types of malocclusions can have varying effects on interarch width. Therefore, the assessment of maxillary and mandibular interarch width is an important aspect of orthodontic management and diagnostic plannings. This study has been done to assess the correlation of maxillary and mandibular interarch width among different malocclusions. Proper evaluation of interarch width can help the orthodontist determine the appropriate treatment plan to correct malocclusions and achieve optimal dental and facial aesthetics.

MATERIALS AND METHODS

This cross-sectional study was done at department of Orthodontics of Dr. Ishrat Ul Ibad Khan Institute of Oral Health Sciences, Dow University of Health Sciences, Karachi, during a period of one year from January 2017 to December 2017. The study enrolled individuals who exhibited minor dental crowding, normal growth and development, and malocclusion characterized by misalignment of the upper and lower dental arches, but who had Class I canine and molar relationships. Additionally, individuals with at least one side exhibiting Class II molar and canine relationships, those with Class II Division 1 or 2 malocclusions, those with bilateral Class III molar relationships in centric occlusion, permanent canines have an excessive horizontal distance between them, which causes a negative horizontal overlap of the front teeth (overjet), and those exhibiting good facial symmetry, no significant medical or dental history, and no history of trauma were considered eligible for participation in the study. All participants had to have all their permanent teeth present except for their third

molars, patients who were in the mixed dentition phase, had ectopic or the impacted canines, severe dental crowding, or severely decayed molars, 1st or 2nd molars missing, cleft patients, and a history of previous orthodontic treatment were excluded. All participants gave their permission after being fully informed about the study's purpose, methods, potential risks, and benefits. The measurements were taken by using a vernier gauge caliper to measure the width between the upper and lower dental arches. On a daily basis, the accuracy of the vernier caliper was verified using standard methods. To determine the intercanine arch width, measurements were taken from the cusp tip of one canine tooth to the opposite canine tooth. The intermolar width was measured as the distance between the central fossae of the first molars on both sides. The readings were taken by a single examiner, and the measurement was repeated three times with an interval of two minutes between each measurement to reduce the possibility of errors. To assess the reliability of the measurements, the intra-examiner reliability was evaluated using the intraclass correlation coefficient (ICC). The collected data was analyzed using statistical software SPSS version 26. Descriptive statistics such as means and standard deviations were calculated for the interarch width measurements. The ICC was calculated to determine the reliability of the measurements. The significance level was set at 0.05.

RESULTS

Among the participants, there were 59 individuals with Class I malocclusion, 88 with Class II Division 1 malocclusion, 32 with Class II Division 2 malocclusion, and 16 with Class III malocclusion. In terms of maxillary interarch width, class I had the highest intercanine width (30.93±3.40 mm) and class II division 2 had the lowest intercanine width (28.88±2.43 mm). Class III had the highest intermolar width (43.25±2.88 mm), and class II division 2 had the lowest intermolar width (40.41±3.12 mm). Regarding mandibular interarch width, class III had the highest intercanine width (24.56±2.44 mm), and class II division 2 had the lowest intercanine width (22.69±2.07 mm). Class III had the highest intermolar width (38.75±2.72 mm), and class II division 2 had the lowest intermolar width (35.84±2.91 mm). Table.1

The study revealed a significant difference in the mean intermolar width in the mandibular arch between Class II Division 2 and Class III malocclusions. Similarly, the maxillary intercanine width was significantly different between Class I and Class II Division 2 malocclusions. However, no significant difference was observed in other width measurements among the different types of malocclusions. Table.2

Table1: Descriptive Statistics of interarch width among different malocclusions n=195

		N	Mean	Std. Deviation	95% Confidence Interval forMean		p-value
					Lower Bound	Upper Bound	
Maxillary intercanine widthin (mm)	Class 1	59	30.93	3.403	30.05	31.82	
	Class 2 division 1	88	29.64	2.623	29.08	30.19	
	Class 2 division 2	32	28.88	2.433	28.00	29.75	0.002
	Class 3	16	30.88	2.872	29.34	32.41	
	Total	195	30.01	2.954	29.59	30.42	
Maxillary intermolar width (mm)	Class 1	59	41.98	3.376	41.10	42.86	
	Class 2 division 1	88	41.72	2.682	41.15	42.28	
	Class 2 division 2	32	40.41	3.120	39.28	41.53	0.110
	Class 3	16	43.25	2.887	41.71	44.79	
	Total	195	41.71	3.055	41.28	42.14	
Mandibular intercanine width (mm)	Class 1	59	23.41	3.147	22.59	24.23	
	Class 2 division 1	88	23.26	2.136	22.81	23.71	
	Class 2 division 2	32	22.69	2.070	21.94	23.43	0.015
	Class 3	16	24.56	2.449	23.26	25.87	
	Total	195	23.32	2.520	22.96	23.67	
Mandibular intermolar width (mm)	Class 1	59	36.24	3.137	35.42	37.05	
	Class 2 division 1	88	37.25	2.627	36.69	37.81	
	Class 2 division 2	32	35.84	2.919	34.79	36.90	0.004
	Class 3	16	38.75	2.720	37.30	40.20	
	Total	195	36.84	2.936	36.42	37.25	

Table 2: Bonferroni Post HOC n=195

Malocclusion	Mandibular Intermolar widthin MM		Mandibular Intercaninewidth in MM		Maxillary Intermolar width in MM		Maxillary Intercaninewidth in MM	
	Mean Difference	Sig.	Mean Difference	Sig.	Mean Difference	Sig.	Mean Difference	Sig.
Class 1 vs class 2 division 2	.394	1.000	.719	1.000	.267	1.000	2.057*	.008
class 2 division 1 vs class 1	1.013	.214	.145	1.000	1.577	.105	1.296	.048
class 2 division 1 vs class 2 division 2	1.406	.106	.574	1.000	1.310	.213	.761	1.000
class 3 vs class 1	2.513	.012	1.156	.616	1.267	.811	.057	1.000
class 3 vs class 2 division 1	1.500	.323	1.301	.342	1.534	.366	1.239	.686
class 3 vs class 2 division 2	2.906*	.006	1.875	.091	2.844	.013	2.000	.145

DISCUSSION

The findings of our study indicate that Class III malocclusion is the least common among the four classifications established by Edward H. Angle. Another study suggests that except for mandibular intercanine width, arch widths in the maxilla and mandible of Class II Division 2 patients are comparable to those of other patients undergoing orthodontic treatment. The dental arches beyond the canines seem to have a good occlusal relationship with each other.[2] Our study also confirms this relationship between postcanine dental arches, with the exception of significant differences in intercanine width between Class III and Class I, as well as intermolar width which was found to be 3-4mm narrower in Class I and 1-2mm wider in Class III. Braun and colleagues discovered that the width of the maxillary arch in Class III malocclusion patients is, on average, 5.1 mm larger than in Class I patients, which is an unexpected finding. The researchers explained that this was due to the difference in the anteroposterior position of the upper and lower jaws, where the lower jaw is positioned more anteriorly relative to the upper jaw. On the other hand, Uysal et al[5] conducted a study where they discovered that the maxillary intermolar widths in the Class III group were considerably narrower than those in the Class I sample.[5] When the interarch widths were appropriately matched, the maxillary arch

widths were typically wider than the mandibular arch widths, which is different from the findings of Uysal et al[5] and Braun et al[11], who reported that the on average, the mandibular arches in Class III occlusions were found to be 2.1 mm wider compared to the mandibular arches in Class I. Uysal et al's study found that the mandibular dental arches of individuals with Class III occlusions were wider compared to those with normal occlusion. This difference in width starts from the canine area and extends towards the distal end of the arch. One possible reason for the wider dental arches in Class III patients could be that the combined widths of all the teeth in the arch represent a particular dimension. The results of this study showed that individuals with Class III malocclusion had narrower upper arch width measurements compared to the normal occlusion group. Similarly, to the current study, Uysal et al. found that the mandibular dental widths were greater in Class III malocclusion patients compared to a normal occlusion sample.[5] On the other hand, Ning R et al[14] reported that there is a correlation between maxillary width and vertical and sagittal skeletal patterns, and a lack of adequate maxillary width can result in unfavorable skeletal patterns. Additionally, there are variations in the shape of the craniomaxillofacial bone between males and females. As a result, clinicians can use these findings as a reference for developing differential diagnoses and treatment plans.[14] Although Mishra RK et al[15] reported that they did not find any noteworthy difference in the ratios of tooth size in the anterior and overall regions between the normal occlusion, Class I, and Class II malocclusion groups. Patel D et al[16] reported that ehen contrasted with the other forms of malocclusions, maxillary arch of a patient who had a CIId1 malocclusion. Compared to the other forms of malocclusions, the arch of the mandible of a CIII malocclusion was the greatest. Then other forms of malocclusions, gender dimorphism is more frequently observed in cases of CI normal occlusion. In the CIId1 group, there is no evidence of gender dimorphism. Arch width disparities between the various forms of malocclusions were found to be significantly greater in men than in women, according to comparisons made between the sexes.[16] In another study by Akan B et al[17] observed that the untreated pseudo-Class III and true Class III malocclusions exhibit significant differences in the shapes of the dental arches and the skeletal mandibular-maxillary bases. Malocclusions can have multiple causes, including genetic, environmental, or developmental factors, which can affect the relationship between maxillary and mandibular interarch width differently. Measuring interarch width accurately can be challenging due to variations in dental arch shape, tooth inclination, and gingival contour. Standardized measurement methods for interarch width should be used to minimize errors due to variations in dental arch shape, tooth inclination, and gingival contour. This will also make it easier to compare interarch width between patients with different malocclusions. Overall, further research is needed to better understand the association of maxillary and mandibular interarch width among different malocclusions. By addressing the limitations of current studies and employing advanced techniques and larger sample sizes, can gain a more comprehensive understanding of the complex relationship between these two parameters.

CONCLUSION

It has been concluded that patients with Class III malocclusion had narrower upper width measurements compared to the normal occlusion sample. The finding highlights the importance of evaluating maxillary interarch width in orthodontic diagnosis and treatment planning for Class III malocclusion patients. Clinicians should consider the potential impact of insufficient maxillary width on the overall skeletal pattern and dental arch morphology. By addressing maxillary width deficiencies, orthodontic treatments can improve the aesthetic and functional outcomes for patients with Class III malocclusion.

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