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## Dental crowding and spacing measurements of the tooth and arch on patients visiting UMDC

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**Abstract**---A stable and aesthetic set of teeth is ensured by proper alignment. Additionally, a correct tooth position offers excellent conditions for good health and the best possible dental care. However, harmony amongst tooth and arch proportions leads to the continuity and integrity of the dental arch. Any imbalance amongst these components puts a person at risk for dental crowding and spacing, both of which are bad for the function and health of the teeth. Objectives: The goal of the current study was to compare the tooth and arch diameters amongst dental arches that are normal, crowded, and spaced. Methodology: This cross-sectional study was carried out at the UMDC Faisalabad orthodontic department. Patients and/or

parents gave their informed consent before the start of therapy so that their records might be utilised for research. 120 dental casts of Pakistani subjects older than 13 years old were gathered as a sample. Dental casts that met the following inclusion criteria were chosen from the files of patients seeking orthodontic treatment: Pretreatment casts of patients with no past orthodontic treatment history, a permanent dentition that has fully emerged and allows accurate measurements of the crown dimensions, and excellent orthodontic casts. Results: When the MD dimensions of teeth from normal, crowded, and spaced dental arches were compared, all teeth, with the exception of the mandibular first permanent molars, were significantly different in the three groups. Conclusion: While separated mandibular arches are lengthier than normal mandibular arches, crowded mandibular arches are smaller than normal dental arches. There is no discernible difference amongst the normal and spaced maxillary arches. In comparison to the teeth in normal dental arches, all teeth have larger MD dimensions when they are crowded and smaller MD dimensions when they are spaced.

**Keywords**---short mandible, retrognathia, lateral cephalogram.

## **Introduction**

A stable and aesthetic set of teeth is ensured by proper alignment. Additionally, a correct tooth position offers excellent conditions for good health and the best possible dental care.<sup>1</sup> However, harmony amongst tooth and arch proportions leads to the continuity and integrity of the dental arch. Any imbalance amongst these components puts a person at risk for dental crowding and spacing, both of which are bad for the function and health of the teeth.<sup>2</sup> Along with a number of practical limitations, these malocclusions may also contribute to poor smile aesthetics and low self-esteem. The most prevalent types of malocclusion are dental crowding and spacing.<sup>3</sup> A crowded dentition is one in which there is not enough space for the teeth to erupt properly. The teeth may be rotated, impacted, or dis-placed as a result. Dental spacing, on the other hand, denotes an excessive amount of space amongst the teeth or a lack of proximal contact.<sup>4</sup> In an effort to comprehend the causes of various oral issues, several etiological elements have been identified. Although numerous etiologies for crowding and spacing have been described in the literature, including inheritance, environment, ethnicity, and secular trends, the causal involvement of various clinical features is a pertinent issue in this context.<sup>5</sup> Numerous researches have been done to demonstrate the relationship amongst the arches & the size of the teeth, however the outcomes are inconsistent.<sup>6</sup>

Many researchers have been interested in the tooth-size arch-length difference, and it has been discovered that numerous parameters, including tooth dimensions, arch widths, and arch lengths, are associated to this discrepancy. In the beginning, Kato et al.,<sup>7</sup> demonstrated that the placement of teeth in the dental arch can be decided by taking into account the size of the teeth & the total of space that is accessible for them in the dental arch. Following this, a study by Al-

Talabani<sup>8</sup> identified two causes of dental crowding: a rise in the mesio-distal dimensions of teeth and a decrease in the dimensions of the dental arch. TSALD results in dental crowding and spacing, which is a crucial area for research since it affects treatment options and retention. Therefore, the goal of the current study was to compare the tooth and arch diameters amongst dental arches that are normal, crowded, and spaced.

## **Methodology**

This cross-sectional study was carried out at the UMDC Faisalabad orthodontic department. Patients and/or parents gave their informed consent before the start of therapy so that their records might be utilised for research. 120 dental casts of Pakistani subjects older than 13 years old were gathered as a sample. Dental casts that met the following inclusion criteria were chosen from the files of patients seeking orthodontic treatment: Pretreatment casts of patients with no past orthodontic treatment history, a permanent dentition that has fully emerged and allows accurate measurements of the crown dimensions, and excellent orthodontic casts. The sum of the MD tooth dimensions and the arch perimeter mesial to the first permanent molars were added up to determine the TSALD in each arch. This difference in space was used to group the samples. In this study, arches were classified as normal if their space difference was amongst 0 + 3 millimeters, crowded if it was more than - 4 millimeters, and spaced if it was more than + 4 millimeters.

In order to classify the 120 castings that satisfied the criteria, they were split into three groups of 40 each: normal, crowded, and spaced dental arches. A further 20 maxillary and 20 mandibular castings were created for each group. The following measurements were made for each cast: the MD and BL crown diameters of all teeth, excluding the second and third permanent molars; the IC, IP, and IM widths of the canines, premolars, and inter molars; the arch perimeter; and the arch depth. With the callipers parallel to the occlusal and buccal surfaces, the MD crown width was calculated as the largest distance amongst the proximal surfaces of the dental crown. The largest distance amongst the lingual and facial surfaces of the crown, measured perpendicular to the plane in which the mesio distal diameter is measured, is the BL crown diameter. The horizontal distance amongst the canine cusp points served as the standard for measuring IC width. IP width is defined as the horizontal distance amongst the maxillary first premolar's distal pit or the mandibular first premolar's distal fossae, and IM width is defined as the horizontal distance amongst the maxillary first molar's central fossae or the mandibular first molar's disto-buccal cusp tips. The perpendicular distance amongst the central incisors' incisor edges and a line joining the mesial surfaces of the first molars on either side of the arch was measured.

## **Results**

When the MD dimensions of teeth from normal, crowded, and spaced dental arches were compared, all teeth, with the exception of the mandibular first permanent molars, were significantly different in the three groups (Table I). The Post Hoc Bonferroni test is used in Table II to display the group differences in the MD tooth dimension. The MD dimensions of all incisors among normal and

spaced arches, the MD dimensions of all teeth among crowded, and the MD dimensions of canines and first permanent molars and spaced arches were all statistically different when the maxillary casts were compared.

Dental Arch (N = 120)		Tooth											
		16	15	14	13	12	11	21	22	23	24	25	26
Maxilla (N=60)	Normal (Mean)	8.60	5.44	5.88	6.41	5.74	7.60	7.52	5.74	6.39	5.82	5.46	8.41
	Crowded (Mean)	9.11	5.68	6.12	6.87	6.06	7.63	7.65	6.04	6.84	6.14	5.65	9.05
	Spaced (Mean)	8.40	5.14	5.46	6.31	5.28	7.03	7.05	5.21	6.21	5.45	5.14	8.38
	p-value	0.001	0.005	0.010	0.002	0.001	0.002	0.003	0.001	0.001	0.003	0.004	0.002
		46	45	44	43	42	41	31	32	33	34	35	36
Mandible (N=60)	Normal (Mean)	7.60	4.44	4.77	5.41	7.74	9.60	6.52	4.70	8.39	4.82	6.46	9.41
	Crowded (Mean)	8.11	4.68	5.12	5.87	8.06	9.63	6.65	5.04	8.84	7.14	7.65	10.05
	Spaced (Mean)	7.40	4.14	4.46	5.31	8.28	9.03	8.05	3.21	9.21	7.45	7.14	9.38
	p-value	0.001	0.005	0.010	0.002	0.001	0.002	0.003	0.001	0.001	0.003	0.004	0.002

Table 1: Comparison of the three groups' teeth's mesio-distal measurements

Dental Arch (N = 120)		Arch Dimension				
		IC Width	IP Width	IM Width	Arch Parameter	Arch Depth
Mandible (p-value))	N-C	0.901	0.708	0.701	0.001*	0.060
	N-S	0.041	0.040	0.151	0.003	0.870
	C-S	0.201	0.010	0.001	0.001*	0.004
Maxilla (p-value)	N-C	0.303	0.330	0.487	0.002	0.901
	N-S	0.004	0.005	0.375	0.013	0.900
	C-S	0.106	0.001*	0.017	0.001*	0.900

Table 2: Comparison of the three groups' arch dimensions

## Discussion

It is generally known that various etiological factors can cause dental crowding and spacing in the permanent dentition, either singly or in combination. Mesiodistal tooth width is thought to be a primary cause of space anomalies, though. Orthodontic diagnosis has typically solely considered the MD tooth diameter and arch perimeter when calculating the degree of dental arch space shortage. According to recent studies, other morphological traits including tooth shape and arch dimensions may also be significant contributors to space

disparities. These factors have significant effects on orthodontic diagnosis and treatment planning. We set out to examine the measures of normal, crowded, and spaced dental arches to better understand the morphological correlations of these factors with dental crowding and spacing.

Although only the maxillary first molars and canines, as well as the mandibular incisors, showed statistically significant changes, the Mesio Distal tooth sizes in crowded arches were greater than in normal arches. In order to better understand the morphological correlations of these variables with dental crowding and spacing, we set out to compare the measurements of normal, crowded, and spaced dental arches. In contrast to normal dental arches, packed dental arches had uniformly larger incisors, canines, and premolars combined. Our study's findings concurred with those of Habib et al.,<sup>9</sup> and Singh et al.,<sup>10</sup> who discovered a connection amongst mandibular arch crowding and the MD width of the mandibular incisors. Some researchers, however, disagree with the theory and find no such association.

The Mesio Distal tooth measurements in spaced arches were reduced than those in normal arches, but only the maxillary incisors, mandibular canines, and premolars showed statistically significant changes. Similar findings have been found in earlier research. In difference, Mustafa et al.<sup>11</sup> discovered statistically significant variations for mandibular incisors and maxillary premolars. All the variables relating to the size of the normal, crowded, and spaced dental arches showed statistically significant differences. Mandibular arch depth was the only variable where the difference was negligible. Contrary to García-Gil et al.,<sup>12</sup> who only discovered changes in IM width and arch perimeter. In current study, we found that the arch perimeter of crowded arches was shorter and the arch perimeter of spaced arches was longer than the arch perimeter of normal arches, and these differences were found to be statistically significant. Earlier studies<sup>13,14,15</sup> had shown that crowded arches were shorter than those without crowding. However, there was no statistically significant distinction amongst normal and spaced arches in terms of the circumference of the mandibular arch. It was found that the arch dimension with the most conflicting findings was IC width. While some authors observed no differences, others noted differences in IC width amongst crowded & uncrowded dentitions. In our study, we discovered that the IC width of separated arches was notably greater than that of the conventional arches.

## **Conclusion**

While separated mandibular arches are lengthier than normal mandibular arches, crowded mandibular arches are smaller than normal dental arches. There is no discernible difference amongst the normal and spaced maxillary arches. In comparison to the teeth in normal dental arches, all teeth have larger MD dimensions when they are crowded and smaller MD dimensions when they are spaced.

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