

DENTAL CROWDING AND ITS RELATIONSHIP TO ARCH DIMENSIONS — GENDER DIMORPHISM

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ABSTRACT

This study was conducted on a sample of 120 individuals (60 male and 60 female individuals) with dental Class I malocclusion selected from different dental institutions of Lahore, Pakistan. The patients were divided into crowded and non crowded groups with equal numbers of males and females. The sample age ranged from 12-18 years with mean age of 15.2 years. Arch width and arch length were measured in upper and lower arches at inter-canine, inter-premolar, inter-molar distances. All measurements were taken from study dental casts by a calibrated operator using vernier caliper. Data were analyzed by using SPSS 16 version for windows. The paired t-test was used to evaluate the differences between males and females and average values of the sample.

The results showed that the average inter molar width in upper arch was 35.74mm to 36.95mm in females and males respectively in non crowded group. Average arch length was found 77.4mm to 82.7mm in upper arch with no crowding and 72.5mm to 76.1mm in crowded group. Males generally showed higher values in all dimensions but the differences were not statistically significant in comparison to females.

Key words: Arch width, Arch length, Dental crowding, Gender dimorphism

INTRODUCTION

Presently dental crowding is a most common problem among the orthodontic patients that results as a consequence of a tooth size-dental arch dimension discrepancy.^{1,2} The prevalence of crowding in the dental arch is tremendously increasing in modern dentitions.

The accurate assessment of dental crowding and the space required to alleviate this malocclusion is critical for correct orthodontic diagnosis and treatment planning. The goal of modern orthodontics is to provide best possible occlusal relationships within the acceptable framework of facial esthetics and stability of results.³

In a Pakistani sample study, it was found that 78% of Pakistani sample showed crowding of varying degree in upper arch.⁴ Identifying the etiology of this malocclusion is the most important issue in orthodontics. In literature different theories explain the etiology of dental crowding including hereditary and environmental factors.

Hamid and Rahbar⁵ found significant relationship between arch dimensions and crowding rather than to tooth size in a Pakistani sample. The relationship between arch dimensions and crowding has become subject of interest and concern to many investigators which has led to many conflicting and contradictory views. Sinclair and Little Carter⁶ and McNamara⁷ also reported significant reduction in the upper and lower arch lengths with time. In another classical study of Moorrees and Chadha⁸ showed constant values for these factors after 14 years unlikely indicated by most of orthodontic literature.

Most recently, McNamara and Brudon⁹ simplified predictions by applying average maxillary inter-molar widths of 37.4 mm for males and 36.2 mm for females.

Sex differences in crowding have also been reported by LaVelle and Foster¹⁰, Fastlicht¹¹ and Foster and associates¹² all found more dental crowding in females than in males. Foster and colleagues while studying the relationship of age and dental crowding found that

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crowding increased with age until the thirteenth or fourteenth year and then tends to decrease.

The aim of this study was to qualify the crowding by assessing the arch size discrepancy in crowded and non-crowded arches and to predict average values in males and females of Pakistani population.

METHODOLOGY

This comparative cross sectional study was conducted on 120 patients dental casts (60 males, 60 females) collected from different dental institutes of Lahore, Pakistan. Each Subject had a normal class I molar relation in centric occlusion. Patients included in the study had Good quality pretreatment maxillary and mandibular dentition from 1st to 1st permanent molar with an Age range from 12-18 years and no history of previous orthodontic treatment.

The sample was divided in two equal groups based on presence or absence of crowding on the basis of clinical examination, the sex distribution in each group was equal. Patients having missing, broken, grossly carious teeth or having other dental abnormalities were excluded from the study. No numerical value was measured in either group until the selection procedure was completed. The upper and lower dental casts of all the patients were used for all measurements with the help of vernier caliper by the investigator. Values were rounded to 0.1mm.

Arch width was measured from left 1st to right 1st permanent molar at the intersection point of lingual

TABLE 1: GENDER DISTRIBUTION OF SAMPLE

No of pts.	Sex	Group
30	M	C
30	M	N-C
30	F	C
30	F	N-C

M=Male C=Crowded

F=Female N-C= Non-Crowded

groove with the gingival margin on the dental cast with the help of vernier caliper tips. Similarly inter premolar width was measured. The Inter canine width was recorded from the canine tips.

Arch perimeter was measured with the help of brass wire from mesial marginal ridge of left to right 1st permanent molar passing over the premolar and canine regions following the respective curve of occlusion in each arch.

The data were entered in personal computer, and then analyzed by using the Statistical Analysis for Social Sciences (SPSS version 16 for windows).

Descriptive statistics were used to obtain the following measurements; Mean(x), standard deviation (SD), Standard error of the mean (SE) or minimum and maximum values.

RESULTS

The casts of 120 individuals (60 male and 60 female individuals) were analyzed with age ranges from 12 to 18 years. The mean age of the male sample was 15.4 and that of females was 14.8 years and the mean age of the whole sample was 15.2 years.

The results of this study were presented in the form of tables with their corresponding texts. In each of crowded and non-crowded group 30 patients were males and 30 females as shown in Table 1.

In this study arch dimensions of two groups, crowded and non-crowded dental casts were compared between males and females sample. The result indicates that a significant difference exists between arch dimensions of both groups but the difference was found to be non significant between the males and females.

Arch width was measured for both sexes and the mean values were predicted in Table 2. Average maxillary arch width of crowded group in males is 32.44mm and in females is 31.20mm, whereas in non crowded group the values are 36.95mm and 35.74mm respectively (Table 2). Similar measurements were found in

TABLE 2: ARCH WIDTH — MAXILLARY ARCH

Group	Region	n	Male		P	n	Female		p
			Mean	S.D			Mean	SD	
C	Inter- Canine	30	34.68	3.29	47.194	30	33.65	3.173	47.41
N		30	34.07	1.43	106.74	30	33.68	2.241	67.21
C	Inter First	30	24.88	3.495	31.82	30	23.82	1.90	56.09
N	premolar	30	28.13	2.997	44.95	30	26.97	2.59	46.63
C	Inter-First	30	32.44	1.834	78.59	30	31.20	1.87	74.46
N	molar	30	36.95	1.172	140.51	30	35.74	1.86	86.41

TABLE 3: ARCH WIDTH — MANDIBULAR ARCH

Group	Region	n	Male			P	n	Female		p
			Mean	S.D				Mean	SD	
C	Inter-Canine	30	26.93	2.456	48.86		30	26.67	2.56	47.03
N		30	28.23	1.387	91.04		30	27.26	1.82	66.68
C	Inter First premolar	30	24.37	1.80	60.55		30	23.16	1.48	69.71
N		30	27.06	2.18	57.13		30	25.89	1.85	62.16
C	Inter-First molar	30	31.29	1.68	84.99		30	30.17	1.89	72.77
N		30	35.38	1.21	133.29		30	34.17	1.733	88.46

TABLE 4: ARCH LENGTH — MAXILLAR ARCH

Group	Measurement	n	Male			P	n	Female		p
			Mean	S.D				Mean	SD	
C	Arch Length	30	76.10	4.49	75.65		30	72.47	3.89	83.50
N		30	82.65	3.56	107.41		30	77.38	4.97	69.29

TABLE 5: ARCH LENGTH — MANDIBULAR ARCH

Group	Measurement	n	Male			P	n	Female		p
			Mean	S.D				Mean	SD	
C	Arch Length	30	66.78	3.51	84.98		30	64.75	3.454	83.82
N		30	69.90	2.612	119.6		30	66.79	3.173	94.12

mandibular arch as shown in Table 3. This study also demonstrated an average of 1.21mm to 1.24mm wider upper arches in males as compared to females.

Although a significant difference was found for the maxillary and mandibular arches between crowded and non crowded but the difference between males and females was not statistically significant (Table 4). This study also showed an average of 3.77 mm to 5.27 mm longer upper arches in males as compared to females and similar measurements were also found for the lower arch.

DISCUSSION

Information regarding arch dimensions of human populations is important for clinicians in orthodontics, prosthodontics, and oral surgery. It is also for interest of anthropologists and other students of human oral biology.

The findings of this study are in agreement with that of McKeown¹³, Mills¹⁴ and How¹⁵ et al while disagrees with the findings presented by Fastlight¹⁶, Norderval¹⁷ and associates and Doris¹⁸ and his co-workers.

McKeown examined a sample of photographs of casts which were categorized as to their degree of crowding. She found that arch width and crowding are strongly correlated and that a narrow arch in man predisposes to crowding of the teeth. She found 36 mm

average inter molar width in non crowded individuals. This inter molar width is in agreement with that of our study in which inter molar width was found to be 36.95 mm for maxillary arch in males and 35.74mm for females non-crowded arch.

Radnizic¹⁹ in a study on indigenous British and Pakistani immigrants group reported that in both ethnic groups there was significant correlation in certain arch dimensions and degree of crowding. This study was on primary dentition and showed that arch dimensions are significantly correlated with that of degree of crowding irrespective of the dentition. In another similar study²⁰ done on primary dentition, it was concluded that the absolute width of the arch is the determining factor in crowding.

Nimkarn et al²¹, while studying records of 20 males and 20 females, at University of Pittsburgh by using their study casts found that only males demonstrated significance correlations between intermolar arch width discrepancy and crowding and Inter premolar widths were more consistently related with the amount of crowding in both males and females.

This study also demonstrated an average of 2.1 mm to 2.4 mm wider arches in males as compared to females and showed a little higher value as compared to our sample. The results of this study also correlate well with that of present study in the sense that dental

crowding is more related to arch dimensions. The sexual differences found in this study also correlate well with that of the present study except a little more difference between males and females. The other possible reason of the differences found in both studies might be the racial difference (Caucasian versus Pakistani sample), selection criteria, and measurements error.

Another study on Japanese children by Aichi Gakuin Daigaku Shigakkai Shi²² in 1989 concluded that the dental arch lengths and widths of crowded group were uniformly smaller than those of non-crowded group. The findings of this study are in agreement with that of present study done on Pakistani sample in general. Similarly in a separate study²³ on Chinese children consisted of 74 subjects with gross dental crowding and 89 subjects with well aligned dentition described that the dental arch width of the crowded group was significantly smaller than those of non crowded group.

Bishara et al²⁴ investigated a male - female comparisons by using student t tests and showed that male subjects were larger than female subjects in a number of dental arch parameters.

Samad Younes SA²⁵ while studying Saudi and Egyptian population tried and found that the Saudi maxillary arch dimension was greater in males than in females and similar results were found for the Egyptian group by sex. The sex differences of total Saudi and Egyptian groups combined were significantly greater than the ethnic differences. In contrast to our sample.

Buschang et al²⁶ also found that Boys have wider arches than girls, especially in the Posterior aspects and that the upper dental arch is narrower and longer in women as contrast to our sample where males has longer arches than females.

Therefore the differences and predicted values may be useful for arch perimeters comparison or sexual dimorphism and the gender difference may help the clinicians in diagnosis and treatment planning of males and females patients with arch length discrepancy.

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