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Dental crowding and its relationship to tooth size and arch dimensions

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Abstract

Background: Well alignments of the teeth in the dental arches achieves good esthetics and stability, and a perfect tooth position provides ideal conditions for good health and optimal care of teeth. However, crowding of teeth is considered as the most common type of malocclusion.

Aims: To quantify crowding by assessing the tooth size arch size discrepancy in crowded and non crowded arches.

Materials and methods: The study was conducted on study casts obtained from sixty randomly selected students from College of Dentistry– University of Sulaimani in Kurdistan of Iraq with their age ranged from 19-24 years who were divided into crowded and noncrowded groups. For each group cumulative and individual tooth width and arch length were measured. They have been diagnosed and selected according to some specific criteria.

Results: The study showed significant difference in the arch length measurement between the non crowded & crowded (P>0.01). No significant difference of the mesiodistal sums of entire arches between the non crowded and crowded samples (P>0.05) was observed while by individual measurements of tooth mesiodistal dimension highly significant difference were found only in the right lateral incisor (P=0.001)

Conclusion: The arch length was the associated factors in contribution of dental crowding.

Keywords: Dental crowding, malocclusion, arch dimensions.

Introduction

Crowding of teeth is considered as the most common type of malocclusion. Dental crowding can be defined as a disparity in the relationship between the tooth size and jaw size which result in the imbrications and rotation of teeth. Tooth size-arch length discrepancy (TSALD) is a well defined means of assessing dental crowding (Warren JJ, Bishara SE, Yonezu - 2003).

Reliable measurements of the human dentition are needed in many disciplines of dentistry. Such measurements are generally made from dental casts or directly from the teeth in the oral cavity. These measurements are predominantly used for research and clinical purposes, particularly in orthodontics. Application of such data in the day today clinical practice has, however, remained limited. It is known that several etiologic factors are associated individually or in groups to dental crowding in the permanent dentition (Van der Linden FP -1974). Mesiodistal tooth width is considered a primordial etiologic factor in space anomalies, which together with tooth width discrepancy may cause malocclusion (Lündstrom A-1955, BoltonWA-1958, Bolton WA-1962). Even though differences between mesiodistal tooth width in crowded and noncrowded dentitions have been reported in several studies, (Lündstrom A-1955,Fastlicht J-1970, Norderval K, Wisth PJ, Boe OE-1975, Doris JM, Bernard BW, Kuftinec MM, Stom D -1981, Adams CP -1982, Smith RJ, Davidson WM, Gipe DP -1982, Chang HF, Shiau YY, Chen KC -1986, Yoshihara T, Matsumoto Y, Suzuki J, Sato N, Oguchi H -1999) only few of these analyzed mesiodistal tooth width collectively instead of individually.

The mesiodistal dimension of a tooth, i.e. the distance between its mesial and distal surfaces, which is the commonly used measure of the occlusal size of the tooth (Gaan SM, Lewis AB, Walenga AJ 1968) has been variously defined as diameter (Seipel CM -1954, Moorrees CFA -1959) breadth (Lundstrom A -1954, Selmer-Olsen R -1954) and width (Beresford JS -1969). According to Moorrees -1959 the term crown length used by some investigators, as synonymous with mesiodistal teeth diameter, is not appropriate. Neither length nor breadths are completely satisfactory substitutes for this term. Some anthropologists have used the marginal ridges for measurement of mesiodistal tooth width (Remane A. Zur messtechnick der primatein E -1930). These ridges have also been recommended by the Federation Dentaire Internationale (FDI). McCanne -1988 considered this method a suitable approach for determining tooth width in the casts of repaired cleft lip and palate patients. However, most clinical studies, particularly those investigating crowding or dental irregularities have used contact points to define mesiodistal tooth width.

Material and methods:

This is the first study has been conducted in sulaimani city which was done on study casts obtained from sixty randomly selected students from the College of Dentistry– University of Sulaimani, aged from 19 - 24

years, they have been diagnosed and selected according to some specific criteria then sub divided into two equal groups 30 with crowding and 30 without crowding.

The mandibular dental arch was examined clinically with reference to the dental cast, the crowded cases were separated from non crowded and spaced cases. In the crowded cases, the difference between the sum of mesiodistal widths of teeth crowns (available space) and dental arch length (necessary space) values yielded the space deficit in the lower dental arch (i.e dental crowding).

PARAMETERS MEASURED: Plaster casts were measured by one investigator with vernier caliper (electronic).

TOOTH SIZE MEASUREMENT: All mandibular permanent teeth excluding second and third permanent molar were measured with the help of sharpened points of vernier calipers from the anatomical contact points.

ARCH LENGTH: Arch length 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

Exclusive Criteria:

1- Extraction or congenital missing of any permanent tooth except third molar (in the lower arch).
2- Orthodontic treatment (previous or present).
3- Presence of an artificial crown.
4- History of oral habits (finger sucking or nail biting).
5- Presence of supernumerary tooth or teeth.
6- Students out of sulaimani governorate.
7- Proximal caries that affect the mesiodistal dimension of the teeth.
8- Proximal restoration.

Results

In this study the tooth size, and arch length of non crowded and crowded adult dentition was compared**.** The readings of our study showed the difference in the mean values for the sum of mesiodistal tooth diameters between noncrowded and the crowded group to be 1.4186mm which is not statistically significant. Significant differences were found in the arch length measurement between the non crowded & crowded (P>0.01). The mean of the arch length for the non crowded group was 66.5100mm larger than the mean value of crowded group 61.1933mm. (Table 1).

The result indicates a non significant difference of the mesiodistal sums of entire arches between the non crowded and crowded samples (P>0.05), while in comparing by individual measurements of tooth mesiodistal dimension highly significant difference were found only in the right lateral incisor (P=0.001) between non crowded and crowded groups. The mean difference between the two groups for individual right lateral incisor was 0.317mm (Table 2).

Discussion

One of the most common malocclusions facing the orthodontist is the crowding of the teeth before as well as after the completion of orthodontic treatment. The current emphasis on non extraction therapies has result in significant reduction in number of teeth extracted for the orthodontic treatment. The relationship between dental crowding and different dental parameters such as tooth size and arch dimension has been studied in great detail by investigators such as LundstromA -1951and Mills -1964. The finding of this study partially agreed to Fastlischt J -1970 finding showed a significant relationship between crowding and mesiodistal width of incisor. The difference in the mean values collective of mesiodistal tooth ameters between the crowded and the non crowded group was found to be not stastically significant.in agreement with Waheed -Ul- Hameed -2005. Gilmore CA, Little RM -1984 findings showed that there is a weak correlation between mesiodistal width of incisors and irregular alignment of teeth over long term study but previous authors have suggested that well aligned mandibular incisor are narrower mesiodistally than incisors which are crowded.

The arch length was measured in the present study to indicate role in dental crowding. In our study there was statistically significant differences in arch length in agreement with the findings of Saman Saman F, Mubassar F, Attiya S -2012 and Waheed -Ul- Hameed -2005 and the disagreement to Mills1964 that reported that the arch length was a non contributor towards manifestation of dental crowding.

While our findings near to that of Radnzic et al.-1988 on indigenous British and Pakistani immigrants group reported that in both ethnic groups there were significant correlation between certain arch dimensions and the degree of crowding, and established that the arch length is highly correlated with crowding while there was no significant correlation between cumulative mesiodistal crown width and dental crowding.

The results of the current study suggest further investigation because the findings of our study shows that arch length are associated factors in contribution of dental crowding so this study may have some clinical importance in the treatment planning of dental crowding. If crowding in a patient is due to small arch length than that of larger teeth, considerations should be given to increase arch dimensions by expansion particularly in younger patients or other latest techniques may be used to increase arch perimeters.
Clinical examination of the two groups was used to differentiate the crowded and non crowded arches. The selection procedure was intestinally based to produce two dissimilar groups, one with dental crowding and other with well aligned arches.

Conclusion:

The results of the current study suggest further investigation because the findings of our study shows that arch length are associated factors in contribution of dental crowding so this study may have some clinical importance in the treatment planning of dental crowding.

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Table 1: Descriptive analysis and t-test comparing crowded and non crowded groups .

	groups	Sample no.	Mean and Std. Deviation	p-value
Teeth width	control	30	66.1 ±2.99	0.063
	test	30	67.5 ± 2.78	
Arch length	control	30	66.5 ± 3.07	0.012
	test	30	61.1 ± 10.75	

Table 2: Descriptive analysis and t-test comparing crowded and non crowded groups tooth by tooth.

Tooth	Groups	Sample no.	Mean and Std. Deviation	p-value
Rt 6	control	30	11.08 ± .60	0.554
	test	30	11.16 ± .51	
Rt 5	control	30	7.14 ± .44	0.127
	test	30	7.30 ± .35	
Rt 4	control	30	7.07 ± .43	0.051
	test	30	7.31 ± .49	
Rt 3	control	30	7.03 ± .47	0.808
	test	30	7.06 ± .47	
Rt 2	control	30	6.13 ± .33	0.001
	test	30	6.44 ± .34	
Rt 1	control	30	5.62 ± .46	0.302
	test	30	5.73 ± .36	
Lt 1	control	30	5.55 ± .33	0.036
	test	30	5.73 ± .29	
Lt 2	control	30	6.13 ± .33	0.028
	test	30	6.35± .39	
Lt 3	control	30	7.01 ± .44	0.776
	test	30	7.04 ± .47	
Lt 4	control	30	7.18 ± .42	0.822
	test	30	7.23 ± 1.11	
Lt 5	control	30	7.25 ± .37	0.349
	test	30	7.34 ± .32	
Lt 6	control	30	11.24 ± .56	0.951
	test	30	11.25± .47	

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