MESIODISTAL TOOTH WIDTH IN A SAUDI POPULATION: A PRELIMINARY REPORT

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تهدف هذه الدراسة إلى قياس العرض الأنسي الوحشي للسن الدائمة في عينة من الأفراد السعوديين وأخذت القياسات من ٣٠ زوج من القوالب السنية المختارة عشوائيا لمرضى يعالجون في عيادات تقويم الأسنان بكلية طب الأسنان بالرياض. ولقد تراوحت أعمار هؤلاء المرضى ما بين ١٣ إلى ٢٠ عاما. واستخدم مقياس ثخانة إلكتروني لهذه القياسات. وخضعت البيانات لعملية إحصاء وصفي. وتقدم نتائج هذه الدراسة متوسط قيم العرض الأنسي الوحشي للسن الدائمة في كلا القوسين، العلوي والسفلي والخطأ الناشيء في هذه الطريقة وكذلك معامل الانحراف.

ولقد تفاوت الخطأ الناشيء بطريقة الدراسة ما بين ٠,٠٢ جم إلى ٠,٣٠ جم، أقل معامل انحراف كان للارحاء الأولى وأعلى معامل للانحراف كان للثنايا والرباعيات.

وعلى هذا يمكن لهذه النتائج أن تصبح ذات فائدة عظيمة في التقويم الإكلينيكي لتقدير المسافة، وهي كذلك ذات أهمية كبيرة لعلماء علم الأسنان وسوف تستخدم كأساس للدراسات المستقبلية.

The purpose of this study was to establish the mesiodistal tooth width of permanent teeth in a Saudi population sample. The measurements were obtained from 30 pairs of randomly selected dental casts. The subjects age ranged from 13 to 20 years. An electronic digital caliper was used for the measurements. Descriptive statistics was used for the analysis of the data. The results of this study presents the mean values of the mesiodistal tooth width of permanent teeth in both arches, the error of the method, and the coefficient of variation. The error of the method in the present study ranged from 0.02 mm to 0.30 mm, with the first molars exhibiting the least coefficient of variation while the central and the lateral incisors showed the most. Hence, the results obtained could be of help in clinical orthodontics for space assessment. Results are also of importance to anthropologists and may be used as a basis for future studies.

Introduction

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 to day clinical practice has, however, remained limited.

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In the past, researchers have employed the contact method using simple instruments such as a pair of dividers with a millimeter ruler[1,2,3] or sliding calibrated calipers for dental cast measurements.[4,5] Other researchers have used the non-contact methods, which include standard photographs/[6] photocopies,[7] sophisticated occlusograms8 and laser holograms of the occlusal aspects of the teeth.[9] Recently, computerized methods for collecting information from photographs and photocopies have also been described, saving considerable time and effort.[10,11]

Various terms have been used to define the tooth width, and there is a difference of opinion as to what constitutes the tooth width and how best to measure it. 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,[12] has been variously defined as diameter,[13,14] breadtn[15,16] and width.[17] According to Moorrees[14] the term crown length used by some investigators, as synonymous with mesiodlstal teeth diameter, is not appropriate. Neither length nor breadth are completely satisfactory substitutes for this term. Although there is a general consensus with regard to the use of landmarks for this dimension (mesiodistal tooth diameter or width), investigators have used different landmarks for the purpose. The anatomic contact points between individual teeth are agreed upon in defining mesiodistal limits of a tooth. It should be borne in mind that the distance between the contact points may not be the widest dimension of a tooth crown. The latter, very often, is not accessible for measurement on dental casts and is more suitable for extracted teeth or teeth on dried skulls. However some idea of the maximum tooth width may be obtained by measuring the width of their labial or buccal surfaces from inter-proximal aspects.

Some anthropologists have used the marginal ridges for measurement of mesiodistal tooth width.[18] These ridges have also been recommended by the Federation Dentaire Internationale (FDI). McCanne19 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.

The intent of this study was to establish the maximum mesiodistal tooth width in a sample of Saudi patients since 45there is no recorded values yet, and also to be able to compare tooth widths for Saudis with other racial groups. The establishment of tooth width for Saudi population will enable further studies to help in predicting crowding in mixed dentition analyses in future.

Materials and Methods

Thirty pairs of pre-treatment orthodontic study casts with equal distribution of the two sexes were selected randomly from the clinical material in the Division of Orthodontics at King Saud University College of Dentistry in Riyadh. The criteria for selection of the subjects were:

1. Age ranged from 13 to 20 years.
2. Presence and complete eruption of all permanent teeth, excluding third molars.
3. No conservative treatment other than Class I occlusal restorations.
4. No evidence of airblows or fractured teeth.
5. No history of previous measurement.

The sample was found to exhibit different types of malocclusion with varying degrees of arch crowding and spacing. The study casts were numbered for ease of identification. Measurement of mesiodistal width was obtained from each dental cast using the electronic digital caliper* calibrated to the nearest 0.01 mm [Fig. 1]. The measurements were made as carefully as possible to avoid any damage on beaks contact. The caliper beaks were sharpened on their outer surfaces to improve the access interproximaly. The maximum mesiodistal width was measured. The caliper beaks were inserted and held occlusally parallel to the long axis of the tooth. The beaks were then closed until gentle contact with the tooth was felt. The measurements included all permanent teeth from central incisors through first molars in all four quadrants. All measurements were taken under natural and neon light.

To study the error of the method between a first and a second measurement, five pairs of dental casts were selected randomly to study the differences. All measurements were performed by one author. Each tooth was measured by using the electronic digital caliper. This procedure was

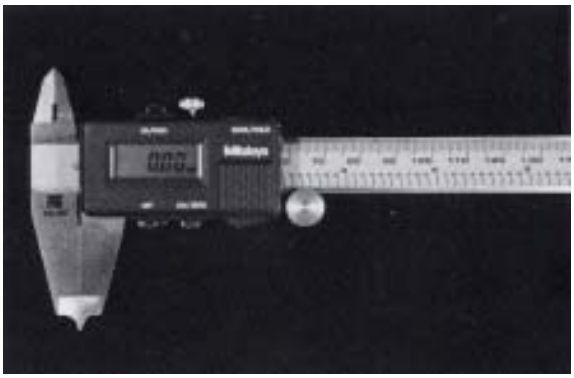

Figure 1. The electronic digital caliper with sharpened beaks to improve access interproximally.

'Electronic Digital Caliper, Mitutoyo, Japan

repeated after one month. The error of the method was calculated by means of double determination (Table 1). The reproducibility of the caliper measurements was done by measuring a known length of stainless steel rod twice a day for 30 days and was found reproducibile to ± 0.065 mm.

Table 1. Error of the method by double determination.

Tooth	Upperarch right	Upperarch left	Lowerarch right	Lowerarch left
Central incisor	0.12	0.09	0.02	0.05
Lateral incisor	0.15	0.12	0.10	0.10
Canine	0.25	0.08	0.14	0.07
First premolar	0.12	0.08	0.10	0.24
Second premolar	0.14	0.08	0.30	0.10
First molar	0.23	0.18	0.16	0.09

Table 2. Means, standard deviations, standard errors of the mean, minimum and maximum values of the individual tooth widths for both sexes (values in millimeters).

	Tooth	n	mean	s.d.	s.e.m	min.	max.
			Upper Arch				
	11	30	8.66	0.57	0.10	7.59	9.58
	12	30	6.68	0.54	0.10	5.77	8.29
R	C	30	7.61	0.48	0.09	6.68	8.68
	PM1	30	6.95	0.44	0.08	6.17	8.21
	PM2	30	6.62	0.36	0.07	6.14	7.38
	M1	30	10.59	0.53	0.10	9.56	11.34
	1|1	30	8.61	0.57	0.10	7.79	9.97
	12	30	6.68	0.51	0.09	5.95	8.37
L	C	30	7.58	0.52	0.10	6.67	8.79
	PM1	30	6.92	0.45	0.08	6.12	8.11
	PM2	30	6.59	0.38	0.07	5.82	7.30
	M1	30	10.53	0.51	0.09	9.55	11.70
			Lower Arch				
	l1	30	5.45	0.64	0.11	4.80	8.46
	l2	30	5.96	0.44	0.08	5.05	6.75
R	C	30	6.67	0.48	0.09	5.81	7.60
	PM1	30	6.86	0.51	0.09	5.85	8.42
	PM2	30	7.07	0.45	0.82	6.00	8.34
	M1	30	10.90	0.53	0.10	9.77	11.74
	l1	30	5.45	0.63	0.11	4.82	8.38
	l2	30	6.00	0.51	0.09	5.01	6.81
L	C	30	6.68	0.45	0.08	5.83	7.43
	PM1	30	6.94	0.53	0.10	5.92	8.51
	PM2	30	7.08	0.40	0.07	6.17	8.20
	M1	30	10.95	0.62	0.11	9.41	12.03

Results

Table 1 demonstrates the error of the method by double determination. It was found that the lower right central incisor exhibited the lowest error measurement (0.02) while the lower right second premolar exhibited the highest (0.30).

Table 2 shows the mean mesiodistal tooth width values for all teeth in both upper and lower arches for both sexes. The result showed that the values in the right side in the upper arch were relatively greater than those in the left side. This was not true in the lower arch.

Table 3 exhibits the tooth variability in upper and lower arches. It was observed that the first molars in both arches showed the least tooth variability while the central and lateral incisors showed the most.

Discussion

Of all the measurements considered, the estimation of individual mesiodistal tooth width poses the most methodological problem. These tooth widths are generally obtained from contact points which may not coincide with the points of maximum mesiodistal convexity. Further, these contact points are not always accessible even with calipers, and are frequently obscured on an occlusal view. However, most investigators used plaster casts of dentition for tooth measurements while few of them did measurements on natural teeth. This could give rise to errors due to distortion

Table 3. Coefficient of variation of individual tooth width.

Tooth	n	upperarch	iowerarch
Right			
l1	30	6.60	11.68
l2	30	8.02	7.34
C	30	6.35	7.15
PM1	30	6.32	7.42
PM2	30	5.46	6.42
M1	30	4.96	4.88
Left			
l1	30	6.56	11.53
l2	30	7.56	8.46
C	30	6.84	6.72
PM1	30	6.52	7.66
PM2	30	5.71	5.68
M1	30	4.83	5.62

in the impression material during making of the impression, due to dimensional changes in the impression material during setting, and due to changes during setting of the cast material.

Because of the variability in tooth morphology, the measurement errors of different teeth, are not the same. Hunter and Priest[4] found that measurements on casts were on an average of 0.1 mm larger than those of the actual teeth. They explained that due to the difficulty encountered in establishing the greatest mesiodistal diameter, particularly in the maxilla, they did not mention whether this difference is significant or not. However, Lundstrom[20] recorded measurements of six anterior teeth by a direct method. He claimed that no significant differences were observed between the direct and indirect methods. This could be explained by the fact that Lundstrom[20] did not measure the posterior teeth which are difficult to measure due to inaccessibility.

There was some indication that the order of errors for different teeth varied between the different methods. For example, by the direct method (Caliper, Divider) the molars, particularly the upper, were the least accurately measured followed by the upper laterals and then the lower second premolar.[20] By the photographic method the upper lateral incisors were the least well measured teeth.[20] In this study the order of errors for different teeth showed that the lower second premolar was the least accurately measured followed by the upper right canine and lower left first premolar.

Errors of the individual tooth width have been reported in other studies. The errors found by Lundstrom[20] a re in the range of 0.06 mm — 0.25 mm and those by Murshid[21] are 0.06 mm - 0.21 mm while in this study they varied from 0.02 mm to 0.30 mm. This disagreement could be due to methodological problems. Moorrees and Reed[23] have provided the average error of only 0.09 mm in all teeth combined. Lysell[24] found the average error to be 0.13 mm. It appears that the error of the present study (0.13 mm) is similar to what Lysell[24] found and greater than Moorrees and Reed.[23]

Consideration of the errors of the individual tooth measurements obtained by other investigators revealed that some errors are greater (0.38 Robinson[25], 0.51 Miethke and Menthel26) while others are smaller 0.05 - 0.11 (Sanin & Savara,[27] 0.09 -0.18, Townsend & Brown[28]) than that of the present study.

Variability in size of the teeth was studied by means of coefficient of variation. The coefficient of variation in this study ranged from 4.83 for the mean mesiodistal tooth width of maxillary first molar to 11.68 for mean mesiodistal tooth width of the mandibular central incisor. The maxillary right lateral incisor and the mandibular right central incisor showed the greatest coefficient of variation while the first molar in both jaws showed the lowest. This result is in agreement with the results obtained by other investigators. Lundstrom[29] noticed the greatest coefficient of variation in the maxillary lateral incisor. Lunt[30] stated that in general the first molars of both jaws were the teeth in which the lowest coefficients of variation were most frequently to be found. He also stated that the third molar and lateral incisor of both jaws showed the greatest degree of variability in size. Barrett *et al*[31] observed that the third molar and the lateral incisor in Australian aborigines showed the greatest variability, while the first molar gave the lowest values. Recently, Axelsson and Kirveskari[32] noticed that the lateral incisor showed the greatest variability in the maxilla, the central incisor in the mandible, while the first molars showed greatest stability in crown form. In the present study, the third molars were not included. On the other hand, Hunter and Priest[4] observed in their measurements that the molars and the lower second premolar showed the most variability, and the upper canines, and the upper and lower incisors showed the least. This contradicts with the results of the current study whereby samples of the types of malocclusion were not separated. However, a study carried out by Crosby and Alexander[33] showed that there was no significant statistical difference between the different malocclusion classes.

The results of the mesiodistal tooth width obtained could be of help to the clinical orthodontist for space assessment and of importance to anthropologists. Further, the present study may be used as a basis for future studies where a normal occlusion sample is considered.

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