Original article

Dental Anomalies and Gender Dimorphism in Tooth Size of Malay Patients

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Abstract:

Objectives: To determine the prevalence of dental anomalies, sexual dimorphism and antimere differences of tooth size of Malay in Malaysia. ***Methods:*** Orthodontic patients for the years 2008-2010 were selected. Among these two hundred patients' were selected based on file records. Their panoramic radiographs were examined.. The prevalence of various dental anomalies was determined. Mesiodistal and buccolingual diameters of the teeth were measured using electronic calipers with accuracy of up to 0.01mm. Analysis was carried out using SPSS statistical package version 18.0 (2009). ***Results:*** In the Malay patients the frequency of hypodontia was 7.5%, followed by hyperdontia (2%), microdontia, dens evaginatus and short root were 1%, respectively. In addition, their macrodontia, germination and dilaceration were 0.5% , while the remaining 86% did not display any dental anomalies. This study demonstrated greater tooth sizes in male compared to female subjects except for buccolingual site of upper canine and lower incisors. Greatest dimorphism in mesiodistal dimension was noted in the lower canine while buccolingual dimension was presented by upper lateral incisor. It was found that there was no significant difference (P>0.05) in tooth measurements for right and left antimeres observed for the majority of tooth classes. ***Conclusion:*** In the Malay subjects, hypodontia was the commonest dental anomaly. The Malay males had greater tooth sizes than their female counterparts. There were almost no significant antimere differences in tooth sizes.

Keywords: Dental anomalies; Gender; Tooth size; Malay

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Introduction:

Dental anomalies are craniofacial abnormalities of function, position of the teeth, bones, and tissues of the jaw and mouth. Dental anomalies arise as a result of abnormalities in differentiation of the dental lamina and tooth germs.[1] Differentiation of the dental lamina and tooth germs is caused by multiple genes and environmental factors during development, known as polygenic or multifactorial inheritance.

It has been observed that some of the children are born with some of the disturbances in the orofacial system and most commonly are supernumerary teeth, missing teeth, fused teeth and peg lateral incisors. Apart from affecting the esthetic appearance of teeth, the anomalies sometimes pose discomfort and dental problems.

Dental anomalies in cleft patients have been shown to occur more frequently than in healthy patients. Recently, it has been found that 40.8 % of normal population attending a dental hospital had a dental anomaly radiographically which was more common in males than in females.[2]

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Measurements of tooth size and dental arch width are required to predict normal occlusion and oral function, and to plan appropriate dental treatment. The gender dimorphism in tooth size has a genetic basis. Canines displayed greater gender dimorphism in crown size than any other tooth class.[3]

Materials and methods:

Study Design and Preparation

This study involved orthodontic patients of Faculty of Dentistry, University Kebangsaan Malaysia from 2008 to 2010. A total of 200 subjects were recruited and written consents were obtained from all the patients. The study was approved by Dental Faculty Research Ethic Committee. The patients were selected based on exclusion and inclusion criteria, The inclusion and exclusion criteria were as follows:

Inclusion criteria:

i. Good quality of panoramic radiograph films.
ii. Malay patients who underwent orthodontic treatment from 2008 to 2010.
iii. Completed clinical file records that describe about patient's details and dental anomalies.
iv. Good condition of study models of the patient

Exclusion criteria:

i. History of extraction prior to study model taken.
ii. Anomalies in deciduous teeth.
iii. Unavailable pretreatment and defects such as study model fracture and bubbles.
iv. Presence of attrition and restoration

Calibration

An interrater reliability analysis using the Kappa statistic was performed on 10% of subjects to determine consistency among raters. Randomly selected study models for both mesiodistal and buccolingual of the teeth were re measured by two dental students (NS and SS). The interrater reliability for the raters was found to be Kappa = 0.70.

Data Collection

Data of the subjects were collected from their file records, panoramic radiographs. Two examiners viewed the panoramic radiograph films using the X-ray viewers in a dark room. All dental anomalies were recorded. From the study models, mesiodistal and buccolingual diameters of each tooth were measured using Mitutoyo electronic dial calipers with accuracy of up to 0.01mm. The study was divided into two parts which were:

Dental Anomalies

From the 200 subjects, patient's records and dental panoramic radiographs were collected to detect the following twelve types of dental anomalies:

a) Hypodontia
b) Hyperdontia
c) Gemination
d) Fusion
e) Concrescence
f) Microdontia
g) Macrodontia
h) Dilacerations
i) Taurodontism
j) Den Invaginatus
k) Dens Evaginatus
l) Short-root anomaly (SRA)

Gender Dimorphism

Pre-treatment dental casts of the 200 subjects were measured for mesiodistal and buccolingual width to compare right and left teeth size. Teeth were measured from 7 to 7. Tooth diameters were taken with a Mitutoyo electronic digital caliper accurate to 0.01 mm. The same caliper was used every time tooth measurements were taken to minimize systematic error.

Methods of measuring mesiodistal diameter of crown

Fig 1: Anterior tooth(crown)

Fig 2: Posterior tooth(crown)

Methods of measuring buccolingual diameter of crown

Fig 3: Diameter of anterior tooth crown

Fig 3: Diameter of anterior tooth crown

Only one site of teeth measurement was used to obtain differences of tooth size between genders. Eighty-two out of two hundreds subjects were selected where forty-one subjects were male and another forty-one subjects were female.

Statistical Analysis

Data were then compiled and analyzed using the Statistical Package for Social Science (SPSS) software version 18.0. The frequencies of dental anomalies were displayed as percentages. Differences between right and left teeth sizes were analysed using paired samples t test. Significance of the mean difference between the genders was analysed using independent samples t test. A *P* value less than 0.05 was considered statistically significant. Mean mesiodistal and buccolingal tooth (computed in two decimal places) for male and female were calculated to obtain sexual dimorphism level. Dimorphism rankings for tooth size were then made in the usual way, allotting rank to 1 to the tooth with higher percentage dimorphism, and rank 14 to the tooth with the lowest percentage dimorphism.

Results:

Frequency of dental anomalies: Figure 1 showed the frequencies of dental abnormalities of the selected subjects. Among these hyypodontia was the most common dental anomaly represented with 7.5 %, followed by hyperdontia (2%). Among this hypodontia cases, we found that mandibular second premolar (2.5%) is the commonest hypodontia and it was followed by mandibular lateral incisor (1.5%).

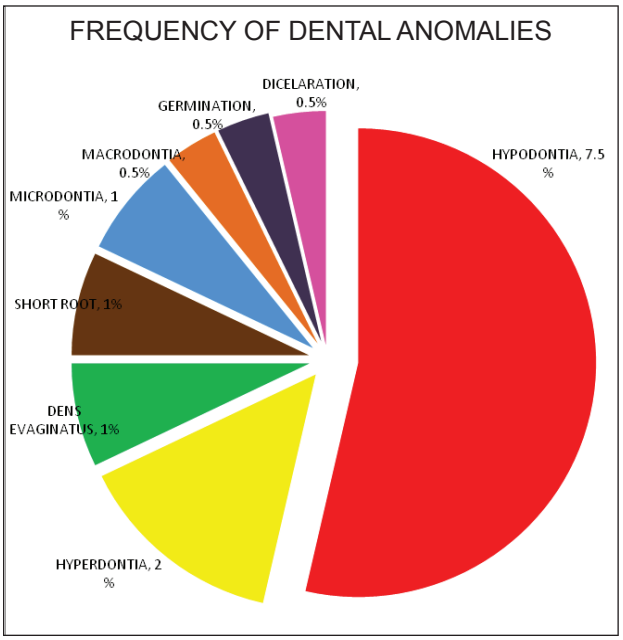

Figure 1: Frequency of dental anomalies

Hyperdontia is the second commonest dental anomalies. Among this supernumerary tooth, paramolar has frequency of 2% followed by mesiodens of 1%. However, 1% of subjects have both. Dens evaginatus and short root was 1% in each. The least common dental anomalies were macrodontia, germination and dilaceration which were 0.5 %. However, we found that, maxillary lateral incisor was the common tooth involved in dilacerations.

Table 1: Differences between right and left teeth size of the selected subjects

	MESIODISTAL, n=200	DIFFERENCE (mm)	BUCCOLINGUAL, n=200	DIFFERENCE (mm)
MAXILLA	Central incisor (I^1)	0.00	I^1	0.04
	Lateral incisor (I^2)	0.02*	I^2	0.05*
	Canine (C)	0.26*	C	0.03*
	1st Pre molar (P^1)	0.15	P^1	0.01
	2nd Pre molar (P^2)	0.02	P^2	0.04
	1st Molar (M^1)	0.07*	M^1	0.00
	2nd Molar (M^2)	0.10*	M^2	0.02*
MANDIBLE	Central incisor (I^1)	0.00	I^1	0.01
	Lateral incisor (I^2)	0.02*	I^2	0.01
	Canine (C)	0.01	C	0.06*
	1st Pre molar (P^1)	0.00	P^1	0.07*
	2nd Pre molar (P^2)	0.00	P^2	0.05*
	1st Molar (M^1)	0.05*	M^1	0.07*
	2nd Molar (M^2)	0.02	M^2	0.00

It was found that there was no significant difference (P>0.05) in majority of tooth measurements for right and left antimeres observed in the subjects.

Table 2: Percentage of gender dimorphism

MESIODISTAL (n=41)				
	MALE	FEMALE		
MAXILLA	MEANS ± SD (mm)	MEANS ± SD (mm)	% DIMORPHISM	RANK
I^1	8.66 ± 0.92	8.54 ± 0.77	0.12	10
I^2	7.24 ± 0.73	7.16 ± 0.60	0.08	11
C	8.20 ± 0.57	8.22 ± 0.41	0.02	14
P^1	7.84 ± 0.68	7.64 ± 0.55	0.20	2
P^2	7.38 ± 0.72	7.23 ± 0.68	0.15	7
M^1	10.43 ± 0.51	10.35 ± 0.43	0.08	13
M^2	10.06 ± 0.92	9.87 ± 0.79	0.19	3
MANDIBLE				
I^1	5.70 ± 0.36	5.54 ± 0.37	0.16	6
I^2	6.21 ± 0.47	6.09 ± 0.43	0.12	9
C	7.16 ± 0.46	6.98 ± 0.40	0.18	5
P^1	7.63 ± 0.35	7.51 ± 0.26	0.12	11
P^2	7.52 ± 0.59	7.34 ± 0.40	0.18	4
M^1	11.44 ± 0.59	11.18 ± 0.54	0.26*	1
M^2	10.67 ± 0.79	10.53 ± 0.75	0.14	8

BUCCOLINGUAL (n=41)				
	MALE	FEMALE		
MAXILLA	MEANS ± SD (mm)	MEANS ± SD (mm)	% DIMORPHISM	RANK
I^1	6.38 ± 0.95	6.34 ± 0.63	0.63	12
I^2	5.70 ± 0.91	5.82 ± 0.59	2.06	6
C	7.58 ± 0.93	7.71 ± 0.88	1.69	8
P^1	9.94 ± 0.54	9.72 ± 0.63	2.26	4
P^2	9.67 ± 0.50	9.50 ± 0.55	1.79	7
M^1	11.27 ± 0.63	11.02 ± 0.61	2.27	3
M^2	10.98 ± 0.64	10.69 ± 0.49	2.71*	2
MANDIBLE				
I^1	5.48 ± 0.76	5.61 ± 0.58	2.32	5
I^2	5.71 ± 0.71	5.70 ± 0.60	0.18	14
C	6.56 ± 0.71	6.64 ± 0.48	1.21	10
P^1	8.44 ± 0.61	8.14 ± 0.44	3.69*	1
P^2	8.70 ± 0.67	8.64 ± 0.71	0.69	11
M^1	10.56 ± 0.56	10.41 ± 0.39	1.44	9
M^2	10.04 ± 0.61	10.10 ± 0.56	0.59	13

Table 2 demonstrated greater tooth sizes in male compared to female subjects, but not to a statistically significant level. However, it was found that not all mesiodistal and buccolingual diameters of male teeth were greater than female such as at mesiodistal maxillary first incisor and buccolingual maxillary lateral incisor and canine. These teeth also statistically showed no significant differences. The highest percentage dimorphism for mesiodistal measurement was found in lower first molar while for buccolingual was detected in lower first premolar with statistically show significant differences.

Discussion:

Dental anomalies: Although there have been several studies reporting the frequency of various dental anomalies, however, no report on this in Malay patients. Twelve dental anomalies were examined depending on sizes and shapes. However, only eight dental anomalies were detected in this study. Common dental anomalies were dens invaginatus, taurodontism, and fusion. Hypodontia was the most common dental anomaly in the Turkish population, followed by microdontia.[4]

Overall prevalence of hypodontia, excluding the third molars, was 11.3%, and there was no statistically significant association with the type of dental clinic, gender, or malocclusion patterns[4]. The most commonly missing teeth were the mandibular second premolars (44.2%), followed by the mandibular lateral incisors (36.6%), and the maxillary second premolars (34.0%)[4] which support our findings

On other hand, the frequency of microdontia, dens evaginatus and short root were respectively uncommon. Microdontia usually affected maxillary lateral incisors and third molars.[5] The prevalence of this condition ranges from 0.8% to 8.4% in various populations.[6] In our study, we found that dens evaginatus occurs most commonly on premolar teeth. This is relatively rare dental anomaly and primarily affects the premolars but can also occur on molars, canines, and incisors.[7] In premolars and molars, the anomaly is usually seen on the occlusal surface, while in canines and incisors, it arises from the cingulum area of the lingual or palatal surface.[7] In the present study, dens evaginatus comprised 2.85% of the total dental anomalies.[5]

Besides, study of another author [4] pointed that the prevalence of short root anomaly was 1.3%. and mentioned that short-root anomaly (SRA), occurring mostly in maxillary incisors but also involved in maxillary premolars, lateral incisors, and lower second premolars. Furthermore, it was found that macrodontia, germination and dilacerations were the least common dental anomalies among Malay patients with percentage of 0.5%, respectively. This finding

was supported by other authors [8] and concluded that macrodontia, germination and dilacerations were the rarest dental anomalies occurred. Miloglu *et al.*[9] reported that root dilaceration was not detected in maxillary central incisors, mandibular central incisors and mandibular lateral incisors. Their finding differed from results of the present study. A study done by Guttal *et al*. (2010) stated that only one patient in their subjects presented with macrodontia affecting the maxillary central incisors.[10]

Antimere difference of tooth size: Antimere difference was obtained by deducting the mean of right tooth size with left tooth size. Then, paired sample T-Test was used to analyze the differences between right and left teeth size. p value of less than 0.05 was considered significant and marked as asterisk. Values with asterisk indicated that there were significant differences of right and left teeth size.

There were significant antimere difference of tooth size in both mesiodistal and buccolingual measurement. However, majority of tooth size in our samples were symmetrical in sizes. This result was supported by Bishara (1989). He reported that differences between antimere were of small magnitude and of not statistically significant.[11] As there was no significant difference in tooth measurements for the right and left antimeres observed for majority of the tooth class examined (antimeric symmetry), the average values of both sides were accepted to calculate the percentages of gender dimorphism of tooth sizes. Stanley (1967) also used a similar method in their study[12].

Gender dimorphism: Measurement of mesiodistal and buccolingual tooth was done separately for male and female subjects. Mean and standard deviation of mesiodistal and buccolingual measurement values were obtained for each gender. Calculation of percentage dimorphism was done based on the formula below:

Percent Dimorphism[12] calculated as= (M/F)-100

Dimorphism ranking was then made in the usual way, alloting rank 1 to the tooth with the highest percentage dimorphism and rank 14 to the tooth with the lowest percentage dimorphism.[13] Independent t-Test was used to analyze for comparison between genders. *p* value of less than 0.05 was considered significant and marked as asterisk. Values with asterisk indicated that there were significant differences of tooth size between genders.

A study conducted by Dorris *et al.* (1981) concluded that teeth in males were uniformly larger than in females, but not statistically significant .[14] Their study supported our findings. Earlier results indicated a direct growth-promoting effect of the Y chromosone on tooth growth by influencing both enamel formation and, possibly through cell proliferations, growth of dentine. The present results could be considered additional evidence for the presence of the factors within the Y chromosome controlling different growth processes. Tooth size measurements in two males with deletions of the parts of the Y chromosome suggested that there might be a specific growth-promoting gene(s) in the nonfluorescent part of the long arm. The difference in tooth size between males and females was explained by a differential growth-promoting effect of the Y chromosome compared to the X chromosome.[15]

The present study showed that mesiodistally, dimorphism was greatest for mandibular first molar while buccolingually was exhibited by mandibular first premolar. Both show presence of significant differences. However, Kaushal *et al.* (2004) found that amongst all teeth, the mandibular canines were found to exhibit the greatest gender dimorphism. There was also the existence of a statistically significant gender dimorphism in the morphometry of mandibular canines in North Indian Population.[16] In addition, all findings of the present study was totally different from the studies done by previous authors. They study mentioned that, dimorphism ranking, which placed canine dimorphism highest for Ohio subjects of northwestern Europian origin, applied specifically to the mesiodistal diameter.[17] In conclusion, the frequency of dental anomalies in Malay population was highest in hypodontia which is 7.5%. There were almost no significant antimere differences in majority of tooth sizes. Males have greater tooth sizes than their female counterparts. Greatest dimorphism in mesiodistal dimension was noted in the lower first molar while buccolingual dimension was presented by lower first premolar.

Conflict of interest: - None

References:

1. Backman B, and Wahlin YB. Variations in number and morphology of permanent teeth in 7 year old Swedish children. *Int J Paediatr Dent.* 2001; **11**:11-17. doi. org/10.1046/j.1365-263x.2001.00205.
2. Mattew BM, Thomas, Chistrine MG, Liam A. 'Double-veneer'- novel Approach to Treating Macrodontia. Dent Update, 2008; **35**:479-48. doi: 10.1177/016502547800100203. https://doi.org/10.1177/016502547800100203
3. Hattab FNS and Al-Khateeb. Mesiodistal crown diameters of permanent teeth in Jordanians. *Sultan Archives of Oral Biology*. 1996;**41:**641-645. doi: 10.1016/S0003-9969(96)00066-0 https://doi.org/10.1016/S0003-9969(96)00066-0
4. Young, HK. Investigation of Hypodontia as Clinically Related Dental Anomaly: Prevalence and Characteristics. *ISRN Dentistry*.2011. (http://www.ncbi.nlm.nih.gov/pmc/journals/1596(aceesed on April, 26, 2015)
5. Kruthika S, Guttal V G, Naikmasur, Puneet B, Renuka J B. Frequency of Developmental Dental Anomalies in the Indian Population. *European Journal of Dentistry*. 2010; **4**(3): 263–269. PMCID: PMC2897859
6. Neville DW, Damm DD, Allen CM, Bouquot JE. Oral and Maxillofacial Pathology. 2nd ed. Philadelphia, PA: Elsevier; 2005. *Abnormalities of teeth*; pp. 49–89
7. Vasudev SK, Goel BR. Endodontic management of dens evaginatus of maxillary central incisors: A rare case report. *J Endod*. 2005;**31**:67–70. doi: 10.4103/0972-0707-
8. Udom Thongudomporn, Terrence J. Freer. Prevalence of dental anomalies in orthodontic patients. *Australian Dental Journal* 1998;**43**:(6):395-398.doi.org/10.1093/ejo/cjp107
9. Ozkan M , Fatih C , Fatma C , Ahmet-Berhan Y , Fatma D. The prevalence of root dilacerations in a Turkish population. Med Oral Patol *Oral Cir Bucal*. 2010; May 1;15. doi:10.4317/medoral.15.e473 . https://doi.org/10.4317/medoral.15.e473
10. Kruthika S G, Venkatesh G, Naikmasur, Puneet B, Renuka J B. Frequency of Developmental Dental Anomalies in the Indian Population, *Eur J Dent*. 2010;**4**:263-269. PMCID: PMC2897859.
11. Samir E B, Jane R. J, Essam M, Abdallah, Arturo F G. Comparisons of mesiodistal and bnccolingnal crown dimensions of the permanent teeth in three populations from Egypt, Mexico, and the United States. *American Journal of Orthodontics and Dentofacial Orthopedics*.1989**;96** (5):397-404. doi: 10.1016/0889-5406(89)90324-7 https://doi.org/10.1016/0889-5406(89)90324-7
12. Stanley MG, Arthur B, Lewis D R, Swindler, Rose SK. Genetic Control of Sexual Dimorphism in Tooth Size. *Journal of Dental Research.* 1967**; 46**: 963 https://doi.org/10.1177/00220345670460055801
13. Communalities in the Size Differences of Teeth of Brothers and Sisters, *Arch. Oral Biol*. 1967 **12**:575-587. https://doi.org/10.1016/0003-9969(67)90076-3
14. John M. Doris, Brentley W. Bernar, Mladen M. Kuftinec D.Stom. A biometric study of tooth size and dental crowding. *American Journal of Orthodontics*. 1981;**79**(3), 326-336. doi:10.1016/0002-9416(81)90080-4 https://doi.org/10.1016/0002-9416(81)90080-4
15. Lassi A, Erkki T, Panu H. Enamel thickness in 47, XYY males' permanent teeth. *Annals of Human Biolology.* 1985;**12** (5),421-427. doi:10.1080/03014468500007981). https://doi.org/10.1080/03014468500007981
16. Kaushal S,.Patnaik VVG, Sood V, Agnihotri G. Sex Determination in North Indians using Mndibular Canine Index. JIAFM, 2004; 26(2). ISSN 0971-0973 doi : 10.5958/j.0973-9130.7.2.001 .
17. Loring C B, and Alan SR. Sexual dimorphism and human tooth size differences. *Journal of Human Evolution*, 1980;**9(**5):417-435. https://doi.org/10.1016/0047-2484(80)90051-2