The use of maxillary first molar as forensic aid in racial and sexual dimorphism of Kurdish population in Sulaimani city

SDJ

Sulaimani Dental Journal

Azhar Ghanim Ahmed*

Abstract

Objectives: To find out the utility of using permanent maxillary first molar as a forensic tool for sex determination, and to compare tooth size for both side in the same sex in Kurdish people.

Materials and methods: The study sample comprised 120 casts of Kurdish peoples (67 females and 53 males) from Sulaimani city - Iraq, with age ranging from 13-33 years. The bucco-lingual (B-L) and mesio-distal (M-D) linear measurements of the maxillary first molars were calculated using digital vernier calipers. Percentage of sexual dimorphism was calculated.

Results: The mean values of B-L and M-D parameters were greater in males than females and greater on right side compared to with left side. The mean values of B-L parameters showed statistically significant differences between males and females with $p < 0.05$. The differences in B-L and M-D parameters between the right and the left side were statistically significant in males.

Sexual dimorphism amounted to 3.48%, 2.83% for the right and left bucco-lingual diameter respectively as compared to 1%, 0.91 % for right and left mesio-distal diameters of the maxillary first molars respectively.

Conclusion: The result of the study showed that the bucco-lingual diameters of permanent maxillary first molars exhibiting significant sexual dimorphism in Kurdish sample and can be used as adjunct in sex determination.

Introduction

Teeth are known to be unique organs made of the most enduring mineralized tissues in the human body [1]. Teeth, being the hardest and chemically the most stable tissue in the body are an excellent material in living and non-living populations for anthropological, genetic, odontologic and forensic investigations [2].

Variation in tooth size is influenced by genetic and environmental factors. Several studies have reported tooth size variation between and within different racial groups[3].

Sexual dimorphism refers to those differences in size, stature and appearance between male and female that can be applied to dental identification because no two mouths are alike [4].

Sex assessment of skeletal remains is an important step in building the biological profile of unidentified skeletons recovered in forensic contexts. It enables a more focused search of missing person files, with the potential of recovering antemortem records for comparison and establishing identity. This will decrease getting the number of wanted individuals to a probability of (50%), which can results in a more accurate way of identifying the person sought. The sexual difference in the human skeleton has been well studied in many populations [5]. Numerous studies show that the tooth size standards based on odontometric investigations are population specific and can be used in age and sex determination [6]. Sex determination using dental features is primarily based upon the comparison of tooth dimensions in males and females or upon the comparison of frequencies of non-metric dental traits like Carabelli's trait of upper molars, deflecting wrinkle of the lower first molars, distal accessory ridge of the upper and lower canines or shoveling of the upper central incisors [7]. In metric analysis, apart from mandibular canine, maxillary central incisors and maxillary first molar exhibit sexual dimorphism. Being early in eruption and less impacted when compared to mandibular canine, maxillary first molar serve as a good odontometric tool[8]. Mesio-distal (M-D) and bucco-lingual (B-L) diameters of the permanent tooth crown are the two most commonly used and researched features used in determining sex on the basis of dental measurements [9].

The aims of study are to find out the utility of using permanent maxillary first molar as a forensic tool for sex determination, and to compare tooth size for both side in the same sex in Kurdish people.

*Assist. Lecturer in Dept. of Oral Diagnosis- School of Dentistry, Faculty of Medical Sciences, University of Sulaimani.
 Author contact: azhar7ortho@yahoo.com

Materials and methods

The study sample includes 120 casts of Kurdish population from Sulaimani city of Iraq with age ranging from 13-33 years who attended the dental clinic for orthodontics treatment, or night guard appliances construction (private dental clinic and dental clinic of school of dentistry of Sulaimani University). The research has been accepted and approved by the ethical committee of Faculty of Medical Sciences, University of Sulaimani.

The inclusion criteria were; casts with the presence of bilateral maxillary first molars, intact mesiodistal and bucco-lingual surfaces of the crown, not affected by any attrition, caries lesions, restorations, proximal stripping, or serious health problems.

The measurements include:
1. Bucco-lingual measurement (B-L) of the maxillary first molars on the study cast on either sides of upper jaw using digital vernier of resolution 0.01 mm. This measurement is the greatest distance between both buccal and lingual surfaces of crown of tooth estimate. Figures [1].
2. Mesio-distal (M-D) measurement between the contact points of maxillary first molars, on either side of upper jaw using the same digital vernier. This measurement is the largest mesiodistal dimension[3,4]. Figures (2).

All measurements were performed by a single examiner to eliminate intra-observer error; the descriptive statistics calculate (mean and standard deviation), and analysis significant (t-test) were performed using the SPSS 16 for Windows, the level of statistical significance set up at p<0.05.

The sexual dimorphism (the percent by which the tooth size of males exceeds that of females) (10). are calculate following this equation:

Percentage of sexual dimorphism = $[(X_m/X_f)-1] \times 100$

Where X_m = mean male tooth dimension; X_f = mean female tooth dimension.

Fig. 1. B-L dimenssion estimate

Fig. 2. M-D dimenssion estimate

Results

From table (1), the present study showed that the mean values of B-L and M-D for both right and left sides parameters were greater in males than females; also the mean values of B-L and M-D parameters were greater in the right side for both sexes in comparing with their left side. The comparison of mean values of B-L parameters showed statistically significant differences between males and females but non-significant differences of sexual dimorphism in right and left sides on mean values of M-D diameters.

The present study showed significant differences in B-L and M-D parameters between the right and the left side in males, where as there

Table(1):Mean values of linear measurements for B-L and M-D dimensions of maxillary first molar in both sexes at both sides and percentage of sexual dimorphism .

Trim	Side	Gender	No.	Mean (mm)	S.D	t-value	P-value	%Sexual dimorphism
Bucco-lingual	Right	Male	53	11.55	0.619	3.74	0*	3.48
		Female	67	11.16	0.488			
	Left	Male	53	11.46	0.611	3.01	0.003	2.83
		Female	67	11.15	0.517			
Mesio-distal	Right	Male	53	10.54	0.522	1.09	0.278	1
		Female	67	10.43	0.528			
	Left	Male	53	10.49	0.536	0.98	0.328	0.9
		Female	67	10.39	0.511			

*P-value is significant at p < 0.05; S.D is the standard deviation; No. is the number

Table (2) : Comparison of mean values of B-L and M-D parameters between the right and the left side for each sex.

Sex	No.	Parameter	Side	Mean(mm)	S.D	t-value	p-value
Male	53	Bucco-lingual	Right	11.55	0.619	4.69	0*
			Left	11.46	0.611		
		Mesio-distal	Right	10.54	0.522	2.13	0.038
			Left	10.49	0.536		
Female	67	Bucco-lingual	Right	11.16	0.488	0.63	0.529
			Left	11.15	0.517		
		Mesio-distal	Right	10.43	0.528	1.73	0.089
			Left	10.39	0.511		

*P-value is significant at $p < 0.05$; S.D is the standard deviation; No. is the number

was non- significant differences in females, table (2).

The sexual dimorphism in this study accounted to 3.48%, 2.83% for the right and left B-L diameter respectively, as compared to 1%, 0.91 % for right and left M-D diameter of the same teeth.

Discussion

Several studies [11-18] revealed that mean values of B-L and M-D parameters were greater in male than female, that agree with the present study; this difference in dimensions of the teeth can be attributed to sex chromosomes that are known to cause different effects on tooth size. The 'Y' chromosome influences the timing and rate of body development, thus producing slower male maturation, and acts additively and to a greater extent than the 'X' chromosome [19]; while other study indicated to the difference in size has been attributed to differently balanced, hormonal production between the sexes consequent to the differentiation of either male or female gonads during the sixth or seventh week of embryogenesis rather than any direct effect of sex chromosome themselves [20].

When comparing both sides, mean values of B-L and M-D parameters were greater on the right side, these results were in agreement with previous studies [17,18,19] while these results were in disagreement with Sonika et al[4] and Zarringhalam M [21] who found that dimensions of all permanent teeth were greater on the left side than the right side in upper jaw.

The right-left differences may be attributed to dental asymmetry; as perfectly bilateral body symmetry is a theoretical concept that seldom exists in the living organisms [4],this came in agreement with the result of the present study which revealed the differences in B-L and M-D parameters between the right and the left side were statistically significant in males.

The mean values of B-L and M-D parameters on the right and the left sides of upper first molars in both sex of Kurdish population were greater than other previous population studies(Haryana population in India,Croatians population and Urhobos population in Nigeria) [4,7,18], in addition to that Mahmood concluded Kurdish males and females had larger tooth size and dental arch dimensions in comparison to their Arabic counterpart [22].

Statistically, this study is in agreement with those reported in other population groups [4,5,17,18] that showed significant of sexual dimorphism in right and left sides of mean values of B-L diameter of upper first molars, but discordances with those of Croatians population in Vodanovic et al study [7] that showed statistically significant with upper canine only; also sexual dimorphism in left and right sides for mean values of M-D diameters for the last study showed no statistically significant, this agree statistically results with Kurdish population in Sulaimani sample in the present study, and disagree with Sonika et al [4] and Narang R et al [17] while Deo [18] showed no statistically significant on M-D width of left side and statistically significant on the right side.

The percentages of sexual dimorphism of Kurdish people differed in comparing with other population as in Urhobos people in Nigeria that showed sexual dimorphism for M-D wide and B-L wide of maxillary first molar were3.0% in all parameters except left maxillary mesio-distal width (1.0%) [18] while in Haryana population in Indian Sexual dimorphism amounted to 5.44% and 5.54% for right and left bucco-lingual dimensions of maxillary first molars respectively as compared to 4.74% and 4.84% for right and left mesiodistal dimensions of the same teeth measured on study casts [4].

Conclusion

The study showed the bucco-lingual (B-L) diameters of the maxillary first molars exhibiting

significant sexual dimorphism in Kurdish people and can be used as adjunct in sex determination. The study also showed significant differences in B-L and M-D parameters between the right and the left side in males.

References

1. Gloria S and Venera B. Sexual dimorphism in permanent maxillary canines. Int J Pharm Bio Sci . 2013; 4: 927 –32.

2. Kaushal S, Patnaik VVG, Agnihotri G. Mandibular canines in sex determination. J Anat Soc India. 2003; 52:119-24.

3. Khan S, Hassan G, Rafique T, Hasan N, Russell S. Mesiodistal crown dimensions of permanent teeth in Bangladeshi population. BSMMU J. 2011; 4: 81-87.

4. Sonika V, Harshaminder K, Madhushankari G.S, Sri Kennath J.A. Sexual dimorphism in the permanent maxillary first molar: a study of the Haryana population (India). J Forensic Odontostomatol. 2011; 29:37-43.

5. Sittiporn R, Suda R, Montip T, Peerapong S. Sex determination from teeth size in Thais. 6th Central Institute of Forensic Science Thailand (CIFS) Academic Day. September 14-15, 2011. At Muang Thong Thani.

6. Joseph A, Harish R.K, Mohammed P, Kumar V: How reliable is sex differentiation from teeth measurements.Oral Maxillofacial path J. 2013; 4:289-92.

7. Vodanovic M, Demo Z, Njemirovskij V, Keros J, Brkic H. Odontometrics a useful method for sex determination in an archaeological skeletal population. J. of Archaeological Sci. 2007; 34:905-13.

8. Girija K, Ambika M. Permanent maxillary first molars: Role in gender determination (Morphometric analysis). J. Forensic Dent Sci. 2012; 4: 101-102.

9. Işcan MY, Kedici PS. Sexual variation in bucco-lingual dimensions in Turkish dentition. Forensic Sci Int. 2003; 137:160-64.

10. Rani P, Mahima VG, Pati K . Bucco-lingual dimension of teeth- An aid in sex determination. J Forensic Dent Sci .2009; 1:88-92.

11. Perzigian AJ. The dentition of the Indian Knoll skeletal population: odontometrics and cup number. Am J Phys Anthropol. 1976; 44:113-21.

12. Ghose LJ, Baghdady V. Analysis of the Iraqi dentition: mesiodistal crown diameters of permanent teeth. J Dent Res.1979; 58:1047-54.

13. Stroud JL, Buschang PH, Goaz PW. Sexual dimorphism in mesiodistal dentin and enamel thickness. Dentomaxillofac Radiol. 1994; 23:169-71.

14. Hattab FN, Al-Khateeb S, Sultan I. Mesiodistal crown diameters of permanent teeth in Jordanians. Arch Oral Biol. 1996; 41:641-5.

15. Rai B, Dhattarwal SK, Anand SC. Sex determination from tooth. Medico-legal update 2008; 8:3-5.

16. Ghodosi A, Mosharraf R, Nia FF. Sexual variation in bucco-lingual dimensions in Iranian dentition. Inter J Dental Anthropol.2008; 12:1-7.

17. Narang R, Manchanda A , Arora P , Kaur G. Sexual dimorphism in permanent 1st molar: a forensic tool. Indian J Comp Dent Care. 2012. 2 : 224-227.

18. Deo E. A dimorphic study of maxillary first molar crown dimensions of urhobos in Abraka, South-Southern Nigeria. J. Morphol. Sci. 2012, 29: 96-100.

19. Acharya BA, Mainali S. Univariate sex dimorphism in the Nepalese dentition and the use of discriminant functions in gender assessment. Forensic Sci Inter. 2007; 173:47-56.

20. Kalia S. Study of permanent maxillary and mandibular canines and inter-canine arch widths among males and females. Dissertation submitted to the Rajiv Gandhi University of Health Sciences, Karnataka, and Bangalore: 2006.

21. Zarringhalam M. A comparison on the mesiodistal width of right and left side teeth in people with normal occlusion. J Dent Med. 2004; 17:5-11.

22. Mahmood AD. A Comparative study of tooth size and dental arch dimensions between Iraqi Arabs and Kurds with class I normal occlusion. Al–Rafidain Dent J. 2012; 12: 71-79.