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DENTAL DIMORPHISM – AN AID IN FORENSIC IDENTIFICATION

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ABSTRACT
Personal identification for forensic purposes demand maximum possible accuracy especially in mass disasters that may be timely performed in order to avoid loss of evidence and provide relief to traumatized families of individuals concerned. Sex identification is a prerequisite for personal identification. Dimorphism comes from the etymology 'dimorphos' (Latin) and by definition means occurring in two different forms. Sexual dimorphism is the systematic difference between individuals of different sexes in the same species. Teeth form a reliable material in living and non-living populations for anthropological, genetic, odontologic and forensic investigations due to their physical and chemical characteristics which make them highly resistant to post-mortem insult. The aim of this study was to investigate the sexual dimorphism in the buccolingual (BL) and mesiodistal (MD) dimensions of all permanent teeth except third molars in individuals within the age range of 17-25 years.

KEYWORDS: Dental dimorphism, Sexual dimorphism, Forensic odontology, Teeth dimensions.

INTRODUCTION

Sex determination of skeletal remains forms part of archaeological and medico legal examinations. The method may vary and depends on the available bones and their condition[1]. The identification of sex is of significance in cases of mass fatality incidents where bodies are damaged beyond recognition[2,3]. Further, in situations where only fragments of jaw bones with teeth (or teeth alone) are found, then sex determination is possible only with the help of teeth[2]. The study of teeth has been a subject of interest to anthropologists, biologists, palaeontologists and orthodontists. This is because teeth are generally preserved even when the bone structures have been destroyed. The teeth are mineralized tissues that are characterized by structures of extraordinary resistance to putrefaction and the effect of external agents as physical, trauma, heat, chemical or biological that caused the destruction of the soft parts of the body structure[4]. The aim of this study was to investigate the sexual dimorphism in BL & MD dimensions of all permanent teeth except the third molars.

MATERIALS & METHODS

After informed consent the subjects were evaluated for detailed medical and dental history. The general health status and oral examination was carried out.

Selection criteria: Present study included 200 subjects with equal sex distribution within the age range of 17-25 years as this age group showed minimal morphological variations caused due to external factors. Only those individuals with intact and fully erupted permanent dentition were included. All permanent teeth except the third molars were considered. As a part of inclusion criteria, physiologic and/or pathologic wear was permitted, provided it did not involve the maximum convexity of the crown of the tooth in the BL or MD directions. Crowding was permitted, provided it did not obscure access for measurement of the maximum convexity of the crown of the tooth, in the BL or MD directions. Those individuals with calculus deposits, anomalies affecting the shape & size of the crown of the tooth, dental caries, attrition, abrasion, erosion, fracture, restoration in the region of maximum convexity of the tooth, artificial replacement of permanent dentition, clinically missing permanent dentition, fixed orthodontic appliance, and those with poor compliance were excluded from the study. After written consent impression was taken with irreversible hydrocolloid material of the dustless, normal setting variety. Later, dental casts were made using Type III alpha hemihydrate calcium sulphate. The greatest MD dimension was measured from the crest of curvature on the mesial to the distal aspect of the crown with the help of vernier calliper. While the greatest BL dimension was measured from the crest of curvature on the buccal to the lingual aspect of the crown.

RESULTS

The numerical difference between the measurements among males and females indicative for dimorphism was highest for the MD & BL width of canines, first molars & central incisors. The MD dimensions of 15,17,22,27,35,37 and BL dimensions of 12,16,22,24,25,27 showed a tendency towards monomorphism. The MD and BL dimensions were seen to be greater in males when compared to females. None of the 200 samples exhibited reverse dimorphism.

Statistical analysis: The mean MD and BL dimensions of the 28 teeth were analysed for level of dimorphism by the student's independent t-test (See Table 1).

TABLE 1: comparison of mean MD & BL dimensions among males & females

Tooth no.	Dimension	Males		Females		Difference in mean	p - value
		mean	S.D.	mean	S.D.		
11	MD	8.98	0.55	8.37	0.75	0.60	<0.001***
	BL	7.08	0.27	6.90	0.38	0.18	<0.001***
12	MD	7.11	0.47	6.74	0.57	0.36	<0.001***
	BL	6.14	0.22	6.05	0.44	0.09	0.06*
13	MD	7.96	0.56	7.76	0.58	0.19	<0.05**
	BL	7.82	0.39	7.51	0.34	0.31	<0.001***
14	MD	7.24	0.48	7.05	0.44	0.18	<0.05**
	BL	8.66	0.47	8.28	0.65	0.38	<0.001***
15	MD	6.71	0.54	6.61	0.39	0.09	0.12*
	BL	8.71	0.37	8.62	0.53	0.09	0.19*
16	MD	10.56	0.45	9.98	0.54	0.58	<0.001***
	BL	10.81	0.51	10.74	0.67	0.06	0.43*
17	MD	9.90	0.62	9.77	0.94	0.13	0.22*
	BL	10.49	0.47	10.32	0.77	0.17	<0.05**
21	MD	9.02	0.50	8.33	0.90	0.69	<0.001***
	BL	7.15	0.23	6.91	0.34	0.24	<0.001***
22	MD	7.03	0.48	6.92	0.51	0.10	0.16*
	BL	6.14	0.22	6.13	0.34	0.01	0.82*
23	MD	8.01	0.54	7.72	0.66	0.28	<0.05**
	BL	7.94	0.35	7.57	0.38	0.37	<0.001***
24	MD	7.22	0.36	7.05	0.43	0.16	<0.05**
	BL	8.63	0.46	8.60	0.50	0.03	0.58*
25	MD	6.91	0.53	6.65	0.56	0.26	<0.05**
	BL	8.55	0.60	8.50	0.52	0.05	0.59*
26	MD	10.57	0.44	9.8	0.72	0.74	<0.001***
	BL	10.81	0.54	10.47	0.74	0.34	<0.05**
27	MD	9.69	0.59	9.66	0.94	0.03	0.80*
	BL	10.23	0.46	10.18	0.92	0.05	0.60*
31	MD	5.68	0.44	5.31	0.67	0.36	<0.001***
	BL	5.80	0.47	5.60	0.40	0.20	<0.05**
32	MD	6.08	0.46	5.74	0.66	0.34	<0.001***
	BL	6.02	0.54	5.78	0.36	0.24	<0.001***
33	MD	7.25	0.30	7.04	0.45	0.20	<0.001***
	BL	7.61	0.23	7.03	0.41	0.58	<0.001***
34	MD	7.44	0.54	6.98	0.52	0.46	<0.001***
	BL	7.27	0.46	6.77	0.47	0.49	<0.001***
35	MD	7.00	0.50	6.89	0.37	0.10	0.11*
	BL	7.88	0.27	7.47	0.49	0.41	<0.001***
36	MD	10.96	0.54	10.63	0.92	0.33	<0.05**
	BL	10.58	0.41	9.66	0.80	0.91	<0.001***
37	MD	10.19	0.60	10.03	1.01	0.15	0.22*
	BL	10.13	0.22	9.47	0.61	0.65	<0.001***
41	MD	5.68	0.44	5.19	0.48	0.48	<0.001***
	BL	5.80	0.47	5.60	0.40	0.20	<0.05**
42	MD	6.11	0.46	5.82	0.75	0.29	<0.05**
	BL	6.01	0.58	5.79	0.37	0.22	<0.05**
43	MD	7.21	0.28	6.96	0.56	0.24	<0.001***
	BL	7.60	0.24	7.03	0.41	0.57	<0.001***
44	MD	7.41	0.54	7.19	0.64	0.21	<0.05**
	BL	7.28	0.41	6.80	0.40	0.48	<0.001***
45	MD	7.23	0.52	6.88	0.38	0.35	<0.001***
	BL	8.09	0.60	7.44	0.54	0.65	<0.001***
46	MD	10.70	0.43	9.75	0.64	0.26	<0.001***
	BL	10.94	0.46	10.68	0.93	0.95	<0.05**
47	MD	10.33	0.38	9.99	0.75	0.34	<0.001***
	BL	10.24	0.38	9.40	0.68	0.84	<0.001***

***: Highly significant, **: Significant, *: Not significant

DISCUSSION

The human dentition has a complement of 32 teeth; out of which at least a few teeth can be recovered in cases of accidents, mass disasters *etc*. Hence, they are routinely used in comparative identification of human remains. Teeth complete development before skeletal maturation, which makes them a valuable sex indicator, even in young individuals[2]. The accuracy of measurements of tooth dimensions on dental casts had been investigated by Omar A *et al*.[5] and they found that dental casts facilitate the analysis of tooth size, shape, alignment, rotations of the teeth, presence or absence of teeth, arch width, length, form, symmetry and occlusal relationship with high degree of accuracy. Keeping the above fact in mind, stone casts were preferred in the present study instead of direct intraoral measurements. This reduced chair side time, accuracy of the results could be preserved for a longer time, were cost effective & helped to avoid transmission of infection between the subjects. Comparisons of mean values of MD & BL dimensions of maxillary and mandibular first molars were greater for males & were statistically highly significant. These results were in agreement with Sonika V *et al*.[2], Perzigian AJ *et al*.[6], Ghose LJ *et al*.[7], Stroud JL *et al*.[8], Hattab FR *et al*.[9], Rai B *et al*.[10] and Ghodosi A *et al*.[11], in which they observed that the males had larger teeth than females in all the dimensions. We observed that the mean values of the MD & BL dimensions of maxillary and mandibular first molars were greater on the left than on the right. The results were in agreement with Sonika V *et al*.[2] and Rai B *et al*.[10]. Similarly, Zarringhalam M *et al*.[12] too observed for maxillary arch, however, the results were reverse in the mandibular arch. Such right and left differences may be attributed to dental asymmetry; as perfectly bilateral body symmetry is a theoretical concept that seldom exists in the living organisms [2]. In the present study we found that the mean values of MD & BL dimensions of left and right maxillary and mandibular canines were more in males than in females. Hashim and Murshid stated that the canines were the only teeth to exhibit dimorphism & there was no significant difference between the left and a right side suggesting that measurement of teeth on one side is truly representative of the other side[3]. Maxillary & mandibular central incisors showed greater BL & MD dimensions for males than females in our study which were statistically significant whereas Yuen, So, and Tang in a longitudinal study measured mesiodistal crown diameters in both primary and permanent teeth in a Chinese population and observed reverse dimorphism in the mandibular incisors. However, their findings were not statistically significant[3]. The present study emphasizes that dental dimorphism may be used for assessment of the sex of an individual. Further it indicates that the central incisors, canines and first molars are the teeth that exhibit greatest dimorphism.

CONCLUSION

The emerging field of forensic odontology relies a lot on inexpensive and easy means of identification of persons from fragmented jaws and dental remains. It is in such situations that the dentist can be called upon to render expertise in forensic science. A database may be established of dental morphometric measurements of non-attrited teeth with a view to determining the variations amongst large populations that may be beneficial for anthropological, genetic, legal and forensic applications.

From the present study, it can be concluded that mesiodistal & buccolingual width of maxillary as well as mandibular central incisors, canines & molars were greater in males than females in age group 17-25 years which is statistically significant.

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