Original research article

Role of Mesiodistal Dimensions of maxillary Anterior Teeth in determining the gender: prospective observational study

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Abstract
Aim: To Study on Gender Determination Using Mesiodistal Dimensions of Anterior Teeth.
Methods: A prospective observational study was conducted in the Department of Dentistry, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, ffrom1 year.
Total 70 study subjects that were randomly were included in this study. The age of the patients was between 20-30 years with no history or clinical evidence of crown restoration, orthodontic treatment, trauma. After obtaining informed consent, Mesiodistal dimensions of maxillary anterior teeth were measured between anatomical contact points with vernier calliper held parallel to occlusal plane.
Results: The results of the study showed that 13 and 23 showedsexual dimorphism whereas other teeth 11-22 didnot show any statistically significant sexual dimorphism. When the level of accuracy for sex determination wasmeasured using 13 separately for males and females it wasfound that 45 % females were classified correctly and55% males were classified correctly. When the level of accuracy for sex determination wasmeasured using 23 separately for males and females it wasfound that 62% females were classified correctly and 62% males were classified correctly.
Conclusion: The study showed maxillary canines exhibiting significant sexual dimorphism and can be used for sex determination along with other procedures.
Keywords: Anterior teeth, forensics odontology, Mesiodistal dimension, sexual dimorphism

Introduction
Sex determination is one of the important parameters in forensic identification. Teeth being the central component of the masticatory apparatus of the skull are good sources of material for civil and medicolegal identification. Teeth provide resistance to damage in terms of bacterial decomposition and fire when rest of body is damaged beyond recognition which makes them valuable tool in forensic investigation.[1] Sexual dimorphism refers to the systemic difference in the form (either in shape or size) between individuals of different sexes in the same species. Teeth of various species are known to exhibit sexual dimorphism.[2] The dentition in males is larger than in females in contemporary human populations.
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 nonmetric dental traits, like Carabelli's trait of upper molars. Mesiodistal and buccolingual 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.[3] Yuen *et al*. conducted a study on Mesiodistal dimension of deciduous and permanent teeth of the Southern Chinese population and found that none of the primary teeth nor three of the permanent teeth were found to have significant sex differences in size. Percentage sexual dimorphism ranged from 0.06% to 1.97% for the primary teeth and from 0.36% to 5.27% for the permanent teeth.[4]

The most usual way to obtain data is from dental casts using a digital caliper. There are several measures to take into account and their analysis may be performed through direct comparison of measures, statistical analyses, or indexes. Only two previous studies presented potential predictive sex models for Portuguese populations using dental measurements. Pereira et al. (2010)[5], using upper canine-to-canine teeth, rendered a combination of incisors Mesiodistal and canine diagonal distances. As the proposed model was confined to only six teeth, it lacks a complete teeth analysis. On the other hand, Silva et al. (2015)[6] employed the mandibular canine index [1] with a modest success rate of 64.2%, concluding that this index should be restrictively applied to the Portuguese scenario in sex identification.

Material and methods
A prospective observational study was conducted in the Department of Dentistry, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, for 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

Total 70 study subjects that were randomly were included in this study. The age of the patients was between 20-30 years with no history or clinical evidence of crown restoration, orthodontic treatment, trauma. They had complete set of fully erupted teeth. The teeth were non carious, nonattrited and intact teeth as well as peridontally healthy. All maxillary teeth were satisfactorily aligned. After obtaining informed consent, Mesiodistal dimensions of maxillary anterior teeth were measured between anatomic contact points with vernier calliper held parallel to occlusal plane. Each reading was taken up thrice and then average of the three values was obtained to minimize the error. The data collected was subjected to statistical analysis.

Results
Statistical analysis all six anterior permanent maxillaryteeth showed that out chosen 6 teeth only 2 teeth were found to be statistically significant. These teeth were 13 and 23 The results of the study showed that 13 and 23 showedsexual dimorphism whereas other teeth 11,12,21,22 didnot show any statistically significant sexual dimorphism.

The accuracy of gender determination using 13
When the level of accuracy for sex determination wasmeasured using 13 separately for males and females it wasfound that 45 % females were classified correctly and55% males were classified correctly.

The accuracy of determining gender using 23
When the level of accuracy for sex determination wasmeasured using 23 separately for males and females it wasfound that 62% females were classified correctly and 62% males were classified correctly.

The accuracy of determining gender using 13 & 23 When the level of accuracy for sex determination wasmeasured using 13 & 23 together for males and females itwas found that 65% females were classified correctly and50% males were classified correctly.

Percent dimorphism
The percent to which the tooth size of males exceeded thatof females was expressed as the male/female ratio minus

In our study only tooth which showed significantpercent dimorphism are 13 & 23.
Table 1:

Tooth	Mean valuemale	Mean value female	SD male	SD female	p value
11	8.77	8.62	0.855	0.536	0.12
12	6.87	6.85	0.663	0.645	NA
13	7.86	7.54	0.636	0.652	0.05
21	8.26	8.22	0.574	0.529	0.32
22	6.87	6.76	0.687	0.689	0.69
23	7.91	7.84	0.597	0.644	0.02

Discussion

Gender determination in damaged and mutilated dead bodies or from skeletal remains constitutes the foremost step for identification in medico-legal examination and bioarcheology. Whenever it is possible to predict the sex, identification is simplified because then missing persons of only that sex need to be considered.[2] Although the DNA profile gives accurate results yet measurement of linear dimensions such as arthopometric or odontometric parameters can be used for determination of sex in a large population because they are simple, reliable, inexpensive, and easy to measure.

Considering the fact that there are differences in odontometric features in specific populations, even within the same population in the historical and evolutional context, it is necessary to determine specific population values in order to make identification possible on the basis of dental measurements.[3] Thus the study evaluated Mesiodistal dimension of permanent maxillary incisors and canines specific for males and females of the North Indian population.

Doris et al. have indicated that the early permanent dentitions provide the best sample for tooth size measurements because early adulthood dentition has less mutilation and less attrition in most individuals. Consequently, the effect of these factors on the actual Mesiodistal tooth width would be minimum.[7] Thus only subjects in the 20-30 years' age group were included in the study sample.

Various odontometric dimensions have been used for the purpose of sex estimation such as mandibular canine index,[8] buccolingual dimension of teeth,[3] and height of tooth.[9]

Sexual dimorphism refers to the systemic differences in form (size, shape, color) between individuals of different sexes in the same species. Sexual dimorphism refers to those differences in size, stature and appearance between male and female that can be applied to dental identification. (Keisu 1990). It is useful tool to distinguish them especially in forensic investigations. Teeth are extremely durable even when the rest of the body undergoes decomposition and when bodies are damaged beyond recognition. Teeth of various species especially humans are known to exhibit sexual dimorphism. So they are an invaluable additional tool to determine sex on fragmentary adult skeletons. Of all the teeth in the human dentition, the canines are the least frequently extracted teeth possibly because of the relatively decreased incidence of caries and periodontal disease.[8] Canines have been recovered from human remains in extreme conditions such as air disasters and hurricanes. There are different theories but according to Moss, it is because of greater thickness of enamel in males due to long period of amelogenesis as compared to females. Because of the Y chromosome producing slower male maturation.[10,11] In our study, we found that only canines showed statistically significant sexual dimorphism in accordance with the study conducted by Hashim HA and Murshid ZA in 1993.[12]

Conclusion:

The study showed maxillary canines exhibiting significant sexual dimorphism and can be used for sex determination along with other procedures. Canines not only serve as corner stone's of mouth but alsocorner stone's in sex determination in forensic investigations especially where fragmentary remains are encountered. Canines serve as key teeth for personal identification.

Reference

1. Rao NG, Rao NN, Pai ML, Kotian MS. Mandibular canine index - a clue for establishing sex identity. Forensic Sci Int. 1989;42:249–54.
2. Dahberg AA. Dental traits as identification tools. Dent Prog. 1963;3:155–60.
3. Iscan MY, Kedici PS. Sexual variation in bucco-lingual dimensions in Turkish dentition. Forensic Sci Int. 2003;137:160-4.
4. Yuen KK, So LL, Tang EL. Mesiodistal crown diameters of the primary and permanent teeth in Southern Chinese-a longitudinal study. Eur J Orthod. 1997;19:721–31
5. Pereira, C.; Bernardo, M.; Pestana, D.; Santos, J.C.; de Mendonça, M.C. Contribution of teeth in human forensic identification—Discriminant function sexing odontometrical techniques in Portuguese population. J. Forensic Leg. Med. 2010, 17, 105-10.
6. Silva, A.M.; Pereira, M.L.; Gouveia, S.; Tavares, J.N.; Azevedo, Á.; Caldas, I.M. A new approach to sex estimation using the mandibular canine index. Med. Sci. Law. 2016, 56, 7-12
7. Doris JM, Bernard BW, Kuftinec MM, Stom D. A biometric study of tooth size and dental crowding. Am J Orthod. 1981;79:326–36.
8. Kaushal S, Patnaik VV, Sood V, Agnihotri G. Sex determination in north Indians using mandibular canine index. JIAFM. 2004;26:45-9.
9. Vodanović M, Demo Ž, Njemirovskij V, Keros J, Brkić H. Odontometrics: A useful method for sex determination in an archaeological skeletal population? J Archaeol Sci. 2007;34:905-13.
10. Vito CD,Sauders SR. A Discriminant function analysis of deciduous teeth to determine sex.J.Forensic Sci1990:35:845-58
11. Acharya BA, Mainali S. Univariate sex dimorphism inthe Nepalese dentition and use of discriminant functions ingender assessment. Forensic Sci Int 2007:173:47-56
12. Hashim MA,Murshid ZA :mesiodistal tooth width :a comparision between saudi males and females, part1. Egypt Dent 1993;39;343-46