Evaluation of Incisor Index as a Forensic Tool in Gendural Dimorphism – A Study in South Indian Population

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Abstract

Introduction: Forensic odontology plays a vital role in investigation and presenting the dental evidences to the court of law. The challenges that are encountered by the forensic odontologist are identifying the individual which includes certain characteristic features to define an individual. Gendural dimorphism means systemic difference in form (shape or size) between individual of different genders in the same species. Teeth being considered as one of the stable part which can withstand any environmental changes even after death of an individual in situations where there are minimal supporting evidences. Odontometrics is the field involving measurements of a tooth.

Aim and Objective: This study aims in determining the sex of an individual using incisor index of maxillary and mandibular arches as a tool in forensic investigation with brief review on literature.

Material and Method: A total of 1200 permanent maxillary and mandibular teeth from 150 study models with an age range of 18 – 25 yrs were measured using manual divider and scale. The Incisor index (Ii) was analysed by using the formula as given by Aitchison (1964). The values were noted separately for maxillary and mandibular dental arches with regards to central and lateral incisor and these data were subjected for statistical analysis.

Result: Maximum mesio-distal dimension of the all the incisors (maxillary and mandibular) were higher in males than females. Incisor index of maxilla was higher in female when compared to male which was not statistically significant. The Incisor index of mandible was higher in male when compared to females which was also statistically non-significant.

Key words: *Incisor index, forensic odontology, Gendural dimorphism,odontometrics*

Introduction

Forensic odontology is that branch of dentistry which deals with application of dental findings in legal situations. Dental evidence can be preserved for indefinite period and can be presentedbefore the justice.[1] Tooth can be analysed and recorded during ante-mortem and post-mortem. Major problem in acquiring and interpreting the ante-mortem records are due to poor record maintenance and variation with time duration.[2]

Dental remainswill be the sole identification when there is no information about the deceased and remains one of the important and crucialevidence in the analysis.[3] Teeth are the important component of the masticatory apparatus of skull which are considered as good source of aid for civil and medico legal identification. As they are resistant to bacterial decomposition, fire, to some

extent in acid attacks they serve a valuable source of information in forensic investigation.[4]

Gender identification is one of the most crucial step in the forensic investigation.Sex determination is the first and foremost challenge for a forensic expert in identifying the mutilated bodies beyond recognition in mass disasters, chemical and nuclear bomb explosions.[2]The systemic difference which are seen with regards to shape or size between individuals of different genders within the same species are known as Genderual dimorphism. This dimorphism is greatly appreciated with regards to tooth.[5]

Numerous articles were published in the literature regarding dimorphism with respect to tooth size. Among these, very few publications were related to incisors. Present study aimed in determining the gender of an individual employing incisal index as the forensic tool in a South Indian population and to determine the percentage of sexual dimorphism.

Materials and Methods

The study was carried out in Department of Oral and Maxillofacial Pathology, Tagore Dental College and Hospital, Vandalur, Chennai during the period between 2019 – 2020.A total of approximately 1200 permanent maxillary and mandibular teeth from 150 study models with an age range of 18 – 25 yrs were measured. Patient who have teeth that were periodontally weak, affected with dental caries, fracture, restored with crown, spacing, diastema and previous orthodontic treatment were excluded from the study.Maximum Mesio-distal diameter of the lateral incisor (MDI2) and central incisor (MDI1) was measured using divider and scale. The Incisor index (Ii) was analysed by using the formula as given by Aitchison (1964):Ii = [MDI2/MDI1] × 100

The values were noted separately for maxillary and mandibular dental arches with regards to central and lateral incisor and these data were subjected for statistical analysis.

Results

Maximum mesio-distal dimension of the all the incisors (maxillary and mandibular) were higher in males than females. Mesio-distal dimension of maxillary central incisor (male = 8.63±0.859, female =8.33±0.763) and mandibular lateral incisor incisor (male = 5.84±0.624, female =5.54±0.609) showed a statistically significant difference between males and females with a p value of 0.029 and 0.008 respectively. (Table 1)

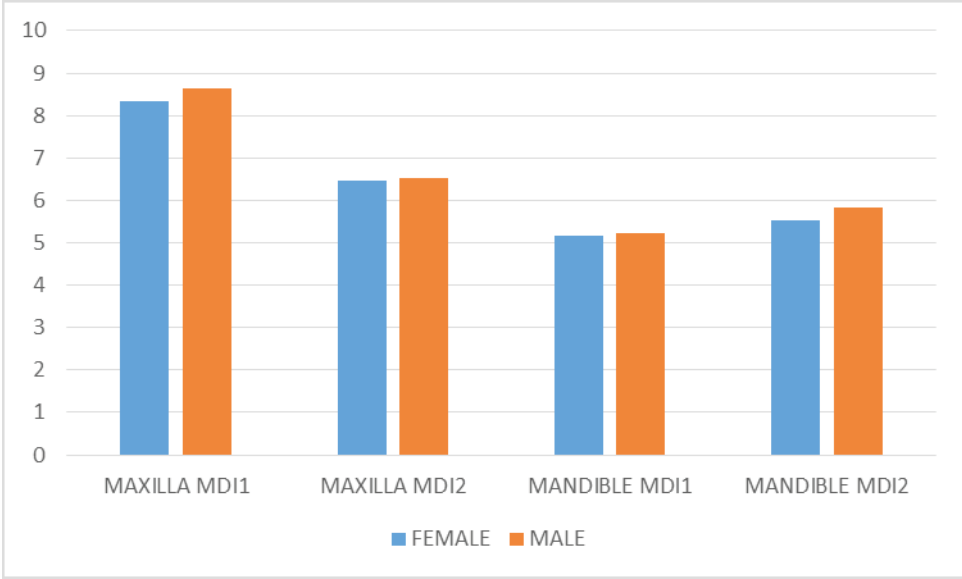
Incisor index of maxilla was higher in female compared to male with a t value of 1.537 and is statistically non-significant. While Incisor index of mandible is higher in male when compared to females with a t value of -1.879 which is also statistically non-significant. (table 2)

Table 1: Independent T test for comparison of the gender for maxillary and mandibular incisors

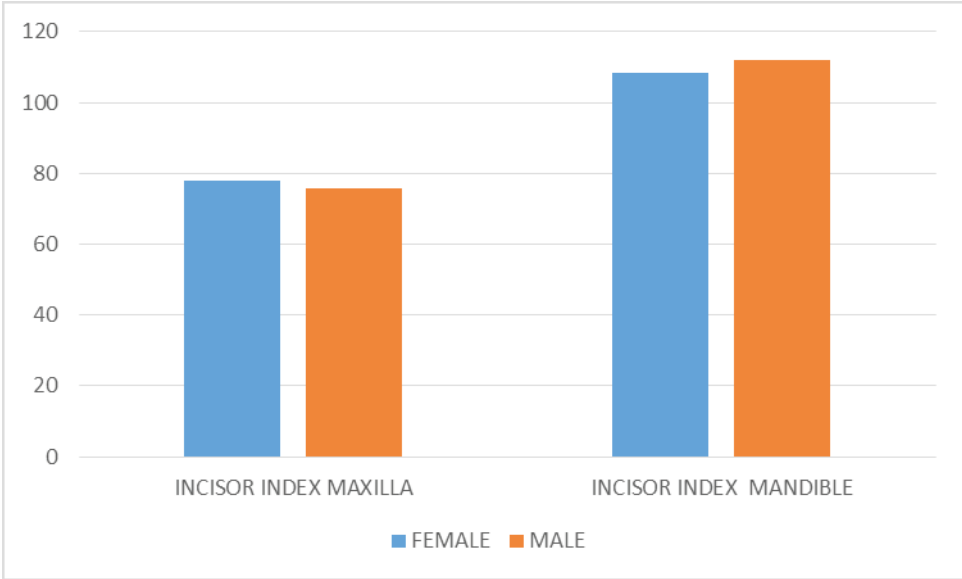
	GENDER	N	Mean	Std. Deviation	t	Df	P VALUE
MAXILLA MDI1	FEMALE	101	8.33	0.763	-2.21	148	0.029
	MALE	49	8.63	0.859			
MAXILLA MDI2	FEMALE	101	6.47	0.715	-0.332	148	0.741
	MALE	49	6.51	0.893			
MANDIBLE MDI1	FEMALE	101	5.16	0.596	-0.653	148	0.515
	MALE	49	5.22	0.55			
MANDIBLE MDI2	FEMALE	101	5.54	0.609	-2.711	93.02	0.008
	MALE	49	5.84	0.624			

Table 2: Independent T test for comparison of the gender for Incisor index in maxilla and mandible

	GENDER	N	Mean	Std. Deviation	t	Df	P VALUE
INCISOR INDEX MAXILLA	FEMALE	101	77.94555	8.68208	1.537	148	0.126
	MALE	49	75.57755	9.189334			
INCISOR INDEX MANDIBLE	FEMALE	101	108.419	13.7836	-1.879	127.18	0.063
	MALE	49	112.114	9.868			



(Graph 1: Independent T test for comparison of the gender for maxillary and mandibular incisors)



(Graph 2: Independent T test for comparison of the gender for Incisor index in maxilla and mandible)

Discussion

Tooth shows coronal completion at the early stages of tooth development and the dimensions are unaltered during further growth and development, except in situations like disorders in functionality, pathology and nutrition which can alter the dimensions of the crown. Hence odontometricscan be used in situations where osseous features are not yet defined.[6]

Sexual dimorphism in humans are a result of survival strategy which is a balancing action between high degree of biological variation within species and narrow range of variation in females whose physical structure focuses on supporting an infant prenatally and postnatally.[7]

So these variations are mirroring the on-going events happening in the evolution process and the genetic background has been explained which is put forth by the polygenic model of inheritance and there by this forms the reason behind the sexual dimorphism in the morphological and metric attributes of males and females.[4]

The results of our study regarding mesio-distal dimension of the maxillary central incisors higher in males than females which is statistically significant with p value 0.029. Our results where inaccordance with those of Mohammed Nahidh (2014)[4], Khangura RK et al (2011)[8], Bakkannavar SM et al (2012)[9], Kalia S (2006)[10], Al-RifaiyMQ(1997)[11]in contrarySandipamuThabitha Rani (2017)[12] showed a similar mean value as that of our study but with a statistically non significant values.

The results regarding mesio-distal dimension of the maxillary lateral incisors higher in males than females which was not statistically significant with p value 0.741 as that of SandipamuThabitha Rani (2017)[12]with a p –value (0.222). Our results where similar with that of Islam et al(2012)[13] but their p value was statistically significant.

The mesio –distal dimensions of the mandibular central incisors were higher in males than females with statistically nonsignificantvalue and 0.515 p value, similar to that of SandipamuThabitha Rani (2017)[12] whose p-value was 0.645. Our results were same as that of Islam et al(2012)[13] but there p value was significant statistically.

The mesio –distal dimensions of the mandibular lateral incisors were higher in males than females which was statistically significant with a p value of 0.008. Our results were in accordance with that of Islam et al(2012)[13]but SandipamuThabitha Rani (2017)[12] showed a similar mean value with a statistically non-significant p- value (0.098).

Tooth proportions are considered for gender assessment, so Aitchison (1964)[14] have given the Incisor index (Ii) which tends to be higher in males than females. With regards to our study, the incisor index in maxilla, females have a higher index value than males which was not in agreement with Aitchison (1964)[14] and no supporting article was found on through literature search. The present study results can be because of lesser mesiodistal width of lateral incisors in males which is not inaccordance with SchrantzDT(1963)[15] who reported that females have smaller lateral incisor than central incisor.

Our study results regarding incisor index in mandible, males had a higher incisor index value than females. Our study results were in accordance with ST Rani et al (2017)[12], Cristiana Pereira (2010)[16],Aitchison (1964) [14].

Conclusion

Forensic odontology is important branch which will help in victim identification in a situation where it is difficult to identify. Out of various modalities insex determination, incisor index is considered as a valuable tool. The present study shows that incisor index is high in females with regard to maxilla and higher in males with regard to mandible.

To further validate the accuracy of this forensic tool, future studies can be carried out with more study subjects, different geographic locations, population and other parameters for consideration of study samples .

References

1. Gupta B, Gupta M. Sex identification in forensic odontology- a review of various methodology. Int J Forensic Odontol2016;1:9-13.
2. Sopher IM. Forensic Dentistry. Indian Journal of Forensic Medicine and Pathology: Vol. 04. Charles Thompson Co.; 2011. p. 156.
3. NishanthanaMurali, Thenmozhi M S,Sex determination using maxillary central incisors, Drug Invention Today , 10(11)., 2018, 2327 – 9.
4. Rao NG, Rao NN, Pai ML, Kotian MS. Mandibular canine index - a clue for establishing gender identity. Forensic SciInt 1989; 42(3): 249–54.
5. Mohammed Nahidh,The Value of Maxillary Central Incisors and Canines in Gender Determination as an Aid in Forensic Dentistry, Iraqi Dental Journal, 36(1),2014; 8-12.
6. Teschler-Nicola M, Prossinger H. Sex determination using tooth dimensions. In: Alt KW, Ro¨sing FW, Teschler-Nicola M (eds). Dental Anthropology, fundamentals, limits and prospects. 1st ed. Wienna: Springer-Verlag; 1998. pp. 479-501.
7. Vito CD, Sauders SR. A discriminant function analysis of deciduous teeth to determine sex. J Forensic Sci 1990; 35(4): 845–58.
8. Khangura RK, Sircar K, Singh S, Rastogi V. Gender determination using mesio-distal dimension of permanent maxillary incisors and canines. J Forensic Dent Sci 2011; 3(2): 81–5. (IVSL).
9. Bakkannavar SM, Monteiro FNP, Arun M, Kumar GP. Mesio-distal width of canines: a tool for gender determination. Med Sci Law 2012; 52(1): 22–6.
10. Kalia S. A study of permanent maxillary and mandibular canines and inter-canine arch widths among males and females. A master thesis. Department of Oral Medicine and Radiology, Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore, 2006.
11. Al-Rifaiy MQ, Abdullah MA, Ashraf I, Khan N. Dimorphism of mandibular and maxillary canine teeth in establishing gender identity. Saudi Dent J 1997; 9(1): 17-20.
12. SandipamuThabitha Rani, Applicability of odontometric dimensions and indices in sexual dimorphism among Nalgonda population, J Forensic Dent Sci. 2017 Sep-Dec; 9(3): 175.
13. Islam.M.S, Hossain.M.Z. Influence of the size of incisors on the occurrence of crowding.Ban J Ortho and Dentofac Ortho, October 2012, 3(1), 24-9.
14. Aitchison J. Sex differences in teeth, jaws and skulls. Dent Pract 1964; 14:52-7.
15. Schrantz DT, Bartha M. Sexing from Medicine 1963;54:10-5.
16. Cristiana Pereira et al, Contribution of teeth in human forensic identification - Discriminant function sexing odontometrical techniques in Portuguese population , Journal of Forensic and Legal Medicine 17 (2010) 105-110.