International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 03, 2020
ISSN: 1475-7192

KNOWLEDGE AND AWARENESS ON GENDER DETERMINATION USING SKULL MORPHOMETRICS IN FORENSICS AMONG DENTAL STUDENTS

Kirthick Kumaran[1], Archana Santhanam[2]

Abstract

INTRODUCTION: *Sex determination from skeletons is a step in the analysis of forensic anthropology. The relationship between morphological characteristics and the gender of the skull is of great importance in forensic anthropology. The aim of the present study is to evaluate the knowledge and awareness on skull morphology for gender determination among dental students*

MATERIALS AND METHODS*: A descriptive cross sectional survey was conducted among undergraduate dental college students aged 18-25 years from march -april 2020 to assess their knowledge and awareness on skull morphology for gender determination in forensic odontology. A total of 100 participants were involved in the study. Self administered questionnaire of close ended questions was prepared and it was distributed among undergraduate dental college students through the online survey "google forms". The responses were collected, tabulated in excel sheet and analysed using SPSS software. Chi square test was used to analyze the level of education of students and their knowledge on skull morphology for gender determination in forensic odontology with statistical significance of p< 0.05.*

RESULTS: *79% of the dental students were aware that remains of a deceased person can be used for forensic identification and first year undergraduate dental students. 74% of the study participants were aware that skeleton remains are used for gender determination*

CONCLUSION: *From the present study, it is evident that undergraduates students had very good knowledge on skull morphology for gender determination. Among the undergraduate dental students, first year students had good knowledge on the importance of skull morphology in gender determination.*

KEYWORDS: *Skull morphology; forensic odontology; gender; knowledge.*

Introduction

The term "forensic" is derived from the Latin word forensic, which means, which means "court of law". Odontology refers to the study of teeth. Forensic odontology has been defined as that branch of dentistry, which in the interest of justice, deals with the proper handling and examination of dental evidence and the proper evaluation and preservation of dental findings [1]. The forensic odontology include identification of human remains through dental records and assisting at the scene of crime; child or adult abuse through bite marks or physical injuries, determination of age and gender of the living or deceased and to testify as an expert witness in the court with forensic dental evidences. [2]

[1] Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai -77, India, Email: 151901098.sdc@saveetha.com
[2] Corresponding Author: Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India, Email : archana.sdc@saveetha.com

The general dentist apart from having a broad background knowledge of general dentistry, should possess knowledge of the role of the forensic pathologist, methods used in autopsy, the role of a dentist in the identification of a person, and the importance of maintaining dental records of all patients.[3] In India, qualified forensic odontologists are very few.[4]This is probably due to the lack of proper awareness [5]. In scenarios of mass fatality, DNA analysis helps in disaster victim identification. Bone and teeth are resistant to any type of decomposition and hence is the prime choice for extracting and performing DNA analysis.

Sex determination from skeletons is a step in the analysis of forensic investigation. However, not all cases of forensic anthropology have complete skeleton. Sex identification through the skull becomes the core content of forensic anthropology, and it also is the first step in craniofacial reconstruction [4]. The common investigations of sex classification include morphology discriminant method and measurement discriminant method. Morphology discriminant method relies mainly on expert's understanding of the morphology characteristic differences between the male skull and the female skull. The subjectivity of the expert's understanding about the skull's morphology characteristics has an important influence in sexing identification. [[6]]

Previously our team had conducted numerous original studies [7–13] and surveys [14–21] over the past 5 years. Now we are focussing on epidemiological surveys.The idea for this survey stemmed from the current interest in our community.The aim of the present study is to assess the knowledge and awareness on skull morphology for gender determination.

MATERIALS AND METHODS

This cross sectional study was conducted among 100 undergraduate dental students from march - april 2020. A simple random sampling was used to select the study participants. Among 100 participants, 40 participants belong to first year, 25 participants belong to second year, 27 participants belong to third year, 5 participants belong to fourth year and 3 participants belong to interns. All undergraduate dental college students of private dental institutions who were willing to participate were included in the study. Ethical approval for the study is obtained from the Institutional Review Board (IRB).

Self administered questionnaire of 10 close ended questions was prepared and it was distributed among undergraduate dental college students of private dental institutions through the online survey "GOOGLE FORMS". The collected data were checked regularly for clarity, competence, consistency, accuracy and validity. Demographic details were also included in the questionnaire.

Data was analysed with SPSS version (22.0). Descriptive statistics as percent were calculated to summarise qualitative data. Chi square test was used to analyze and compare the education level of students and their knowledge on skull morphology for gender determination. The confidence level was 95% and of statistical significance $P < 0.05$. Finally, the result was presented by using bar charts and frequency tables.

RESULTS:

Among 100 participants, 35% were males and 65% were females. Among the dental undergraduates college students, 40% of the participants belong to first year, 25% of the participants belong to second year, 27% of the participants belong to third year, 5% of the participants belong to fourth year and 3% of the participants belong to interns. [Table 1].

Table 1: Depicts the percentage distribution of responses on knowledge and awareness on skull morphology for gender determination among undergraduate dental students.

S.NO	QUESTIONS	CHOICE	RESPONSE.
1.	Gender	Male Female Others	35% 65%

2.	Year of study	First year Second year Third year Fourth year Intern	40% 25% 27% 5% 3%
3.	Are the remains of the deceased person is of forensic significance	Yes No	79% 21%
4.	Can skeleton remain be used for forensic significance	Yes No	76% 24%
5.	Can skeleton remains be used for gender determination	Yes No	74% 26%
6.	Do you think there is a difference in the skull pattern and skull trait of two sexes?	Yes No	77% 23%
7.	The zygomatic bone is more prominent in males compared to females	Yes No	72% 28%
8.	Does shape of the mandible differ in males and females	Yes No	79% 21%
9.	Is the morphology of the ramus the best parameter for the sex determination.	Yes No	70% 30%
10.	Can structure of a deceased person affect the skeleton characteristics	Yes No	69% 31%
11.	Can morphology of the teeth be used for gender determination	Yes No	67% 33%
12.	Do you feel there is any significance difference between male and female genial angle.	Yes No	83% 17%

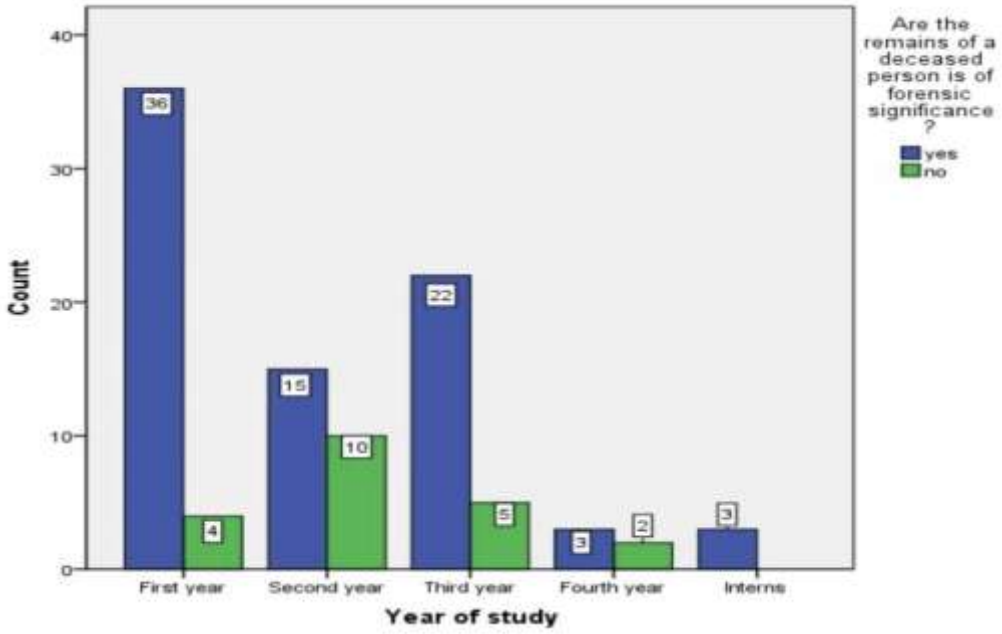

Figure 1 - Bar graph representing comparison of responses between different educational levels of undergraduate dental students and knowledge on remains of a deceased person in forensic significance, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. Majority of the first year undergraduate dental students (36) were aware that the remains of a deceased person are of forensic significance and the difference was statistically significant. Chi square test, P value = 0.035(<0.05) - statistically significant.

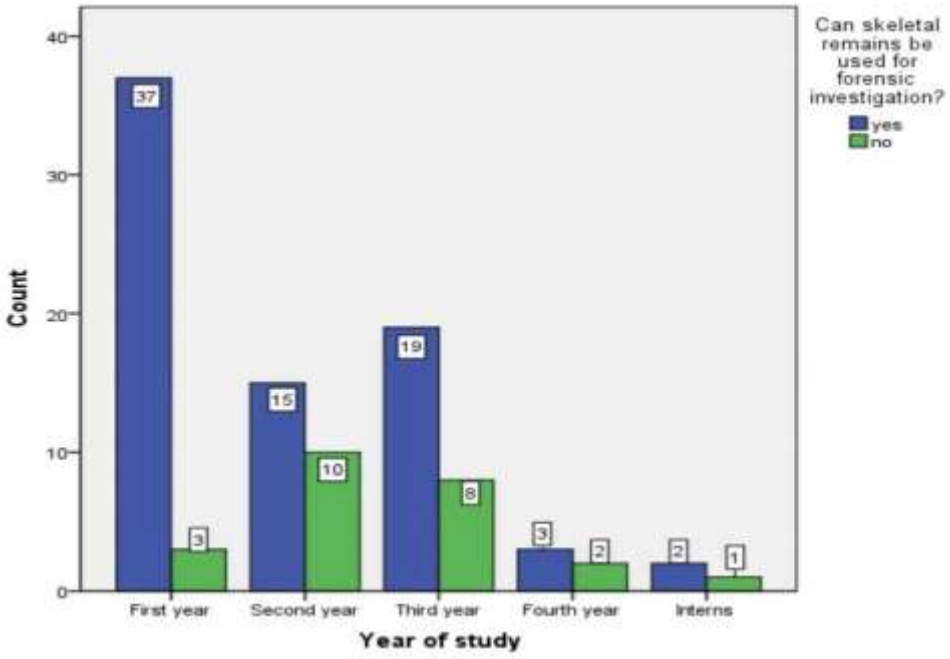

Figure 2: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and skeletal remains used for forensic investigation, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. Majority of the first year undergraduate dental students (37) were aware that skeletal remains can be used in forensic investigation. However the difference was statistically not significant. Chi square test, P value = 0.089(>0.05) -statistically not significant.

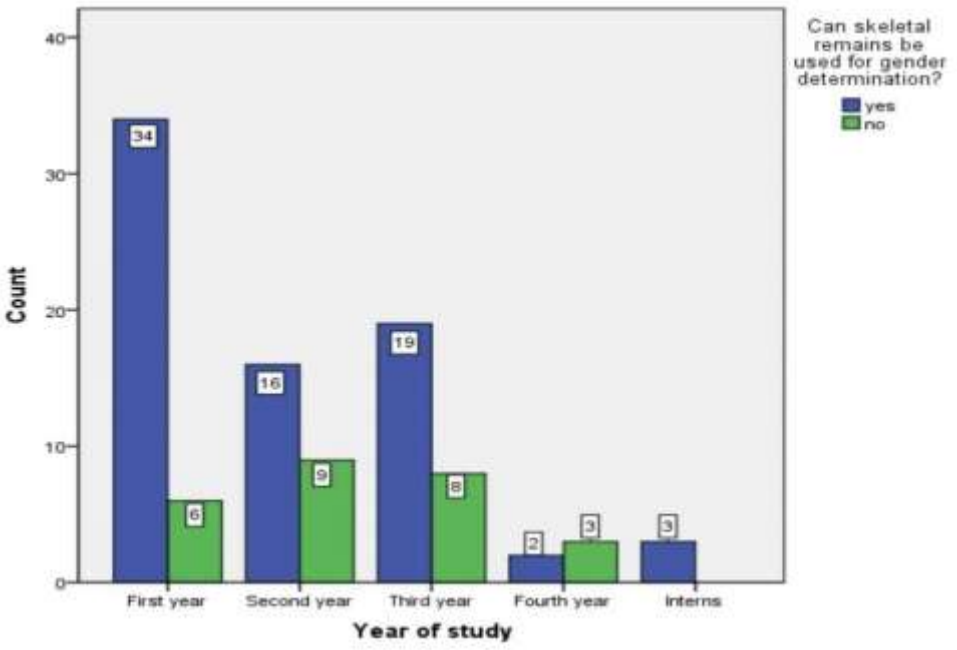

Figure 3: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and awareness on significance of skeletal remains in gender determination, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. Majority of the first year undergraduate dental students (34) were aware that skeletal remains can be used for gender determination. However the difference was statistically not significant. Chi square test, P value = 0.089(>0.05) - statistically not significant.

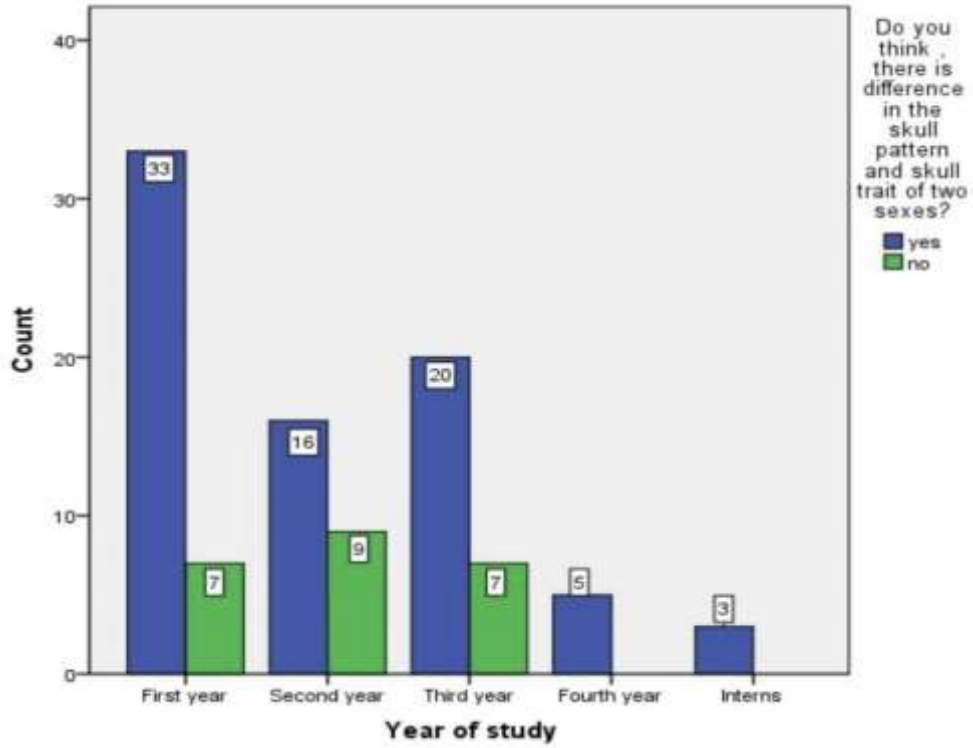

Figure 4: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and awareness of skull pattern and skull trait of two sexes, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. First year undergraduate dental students (33) had more knowledge on skull patterns and skull traits which can be

used for gender determination. However the difference was statistically not significant. Chi square test, P value = 0.232(>0.05) - statistically not significant

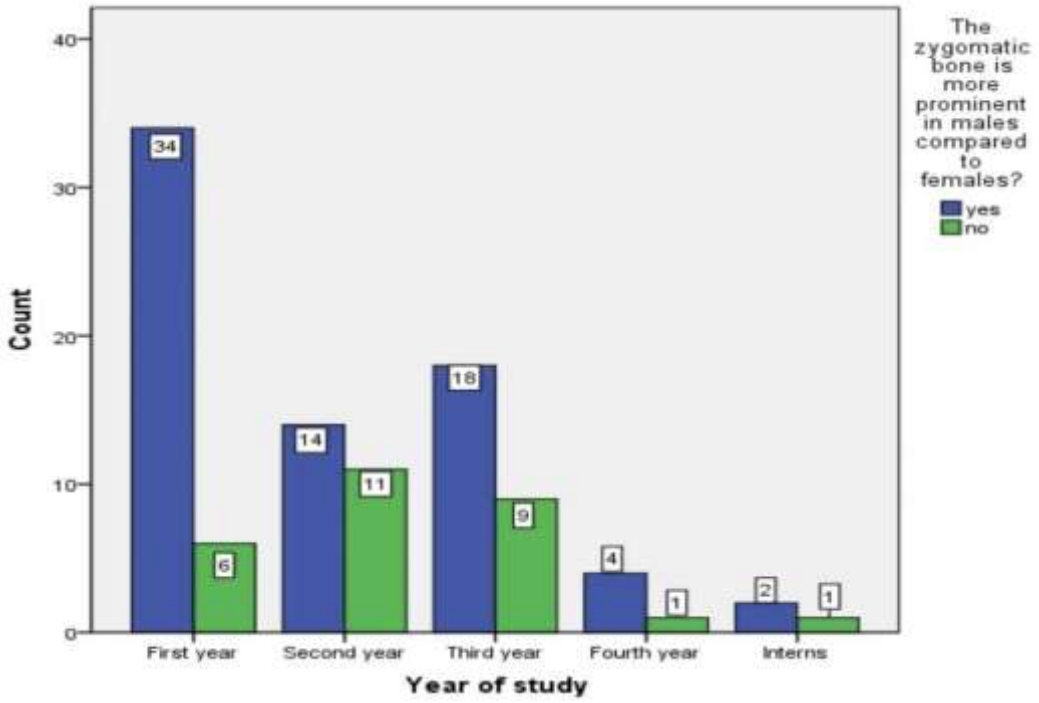

Figure 5: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and knowledge on differences in the zygomatic bone between males and females, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. More first year undergraduate dental students (34) were aware that the zygomatic bone is more prominent in males compared to females. However the difference was statistically not significant. Chi square test, P value = 0.130(>0.05) - statistically not significant.

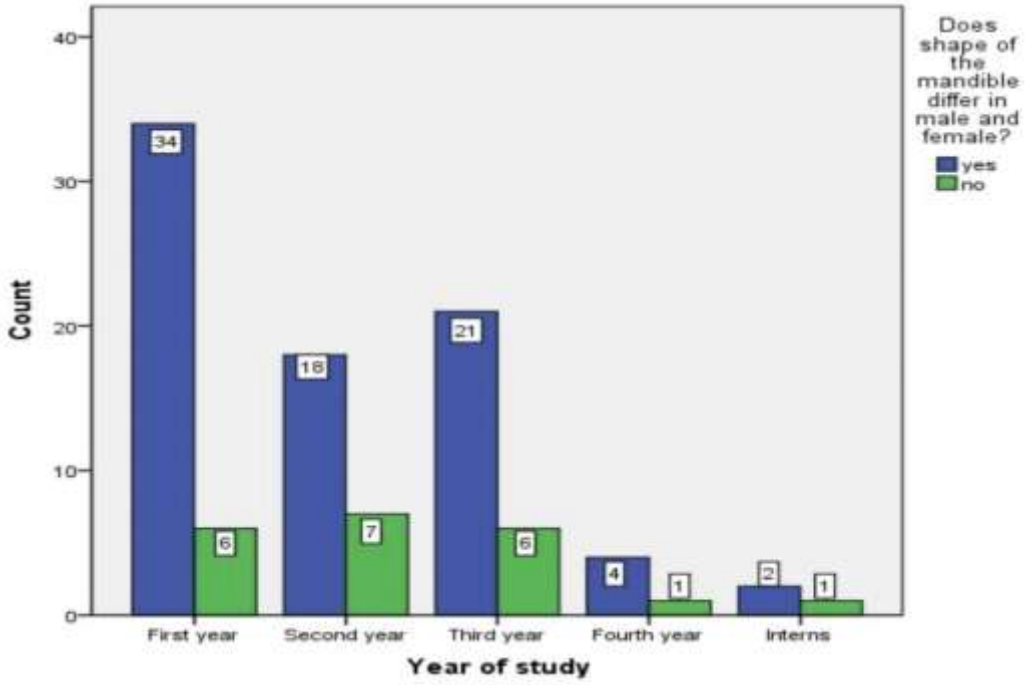

Figure 6- Bar graph representing comparison of responses between different educational levels of undergraduate dental students and knowledge on the shape of the mandible, where blue denotes yes and green denotes no. X

axis represents educational levels and Y axis represents the number of dental students. First year undergraduate dental students (34) were aware that the shape of the mandible differs in males and females compared to other students. However the difference was statistically not significant. Chi square test, P value = 0.753(>0.05) - statistically not significant.

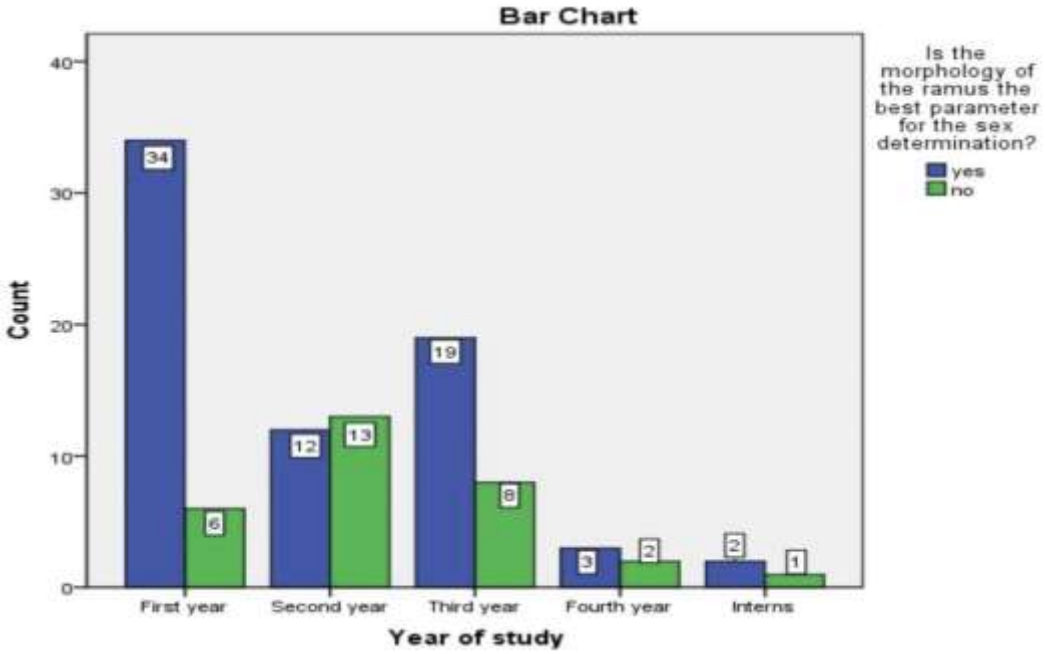

Figure 7: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and awareness on the morphology of the ramus in sex determination, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. First year undergraduate dental students (34) have more knowledge on morphology of the ramus which can be used for sex determination and the difference was statistically significant. Chi square test, P value = 0.036(>0.05) - statistically not significant.

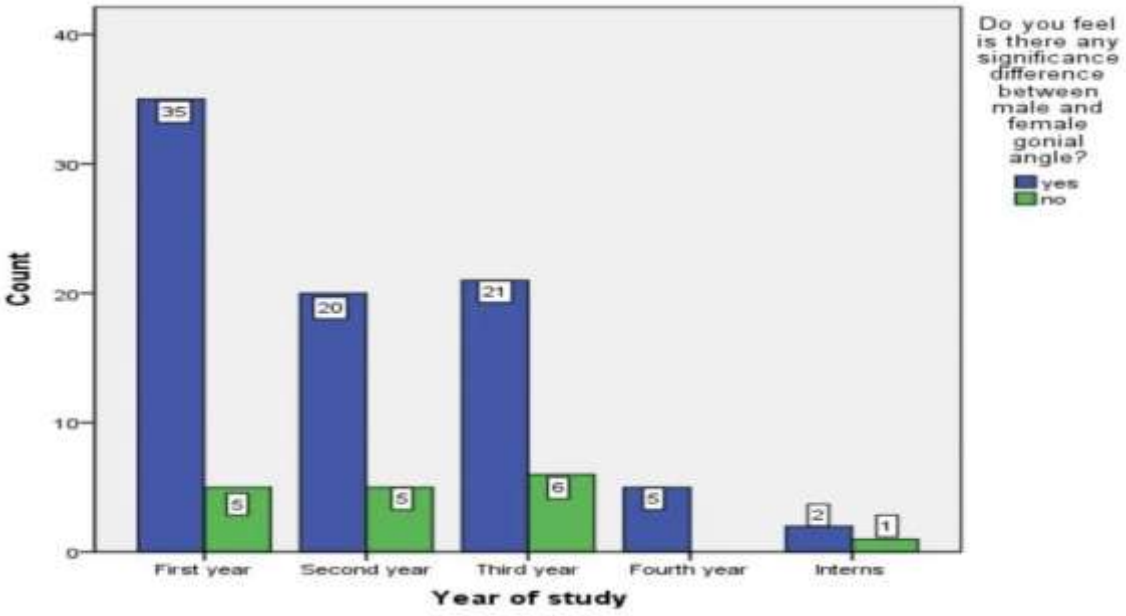

Figure 8: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and knowledge on difference between male and female gonial angle, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. First year undergraduate dental students (35) had more knowledge on the morphological difference between male and

female gonial angle. However the difference was statistically not significant. Chi square test, P value = 0.584(>0.05) - statistically not significant.

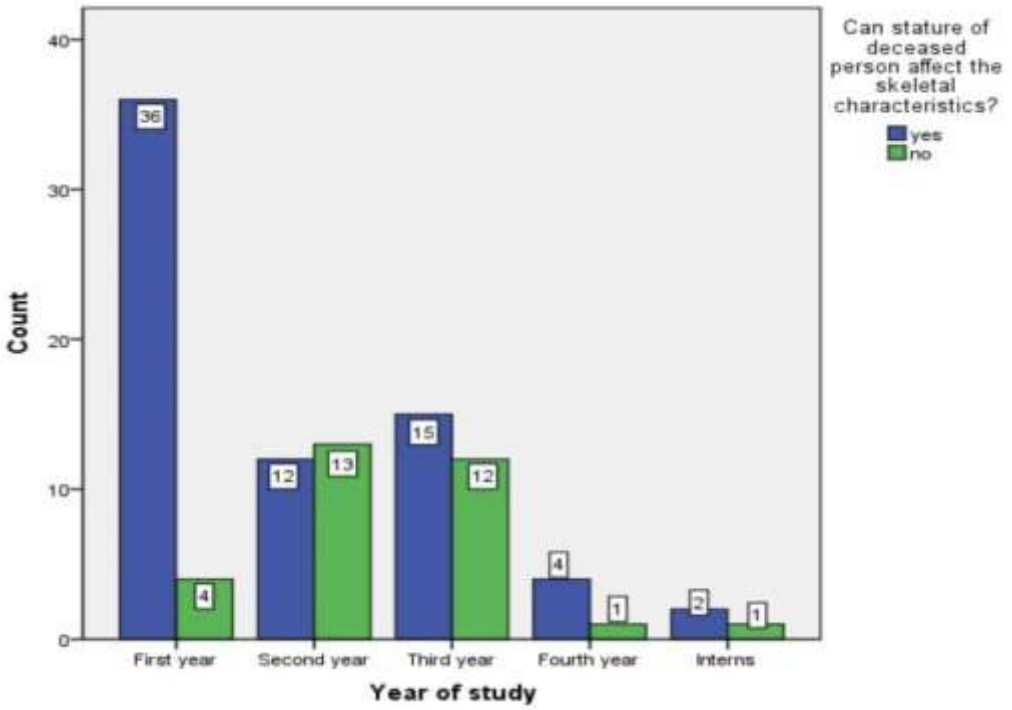

Figure 9: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and stature of deceased persons affect skeletal characteristics, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. More first year undergraduate dental students (36) were aware that the stature of a deceased person can affect the skeletal characteristics and the difference was statistically significant. Chi square test, P value = 0.003(<0.05) - statistically significant.

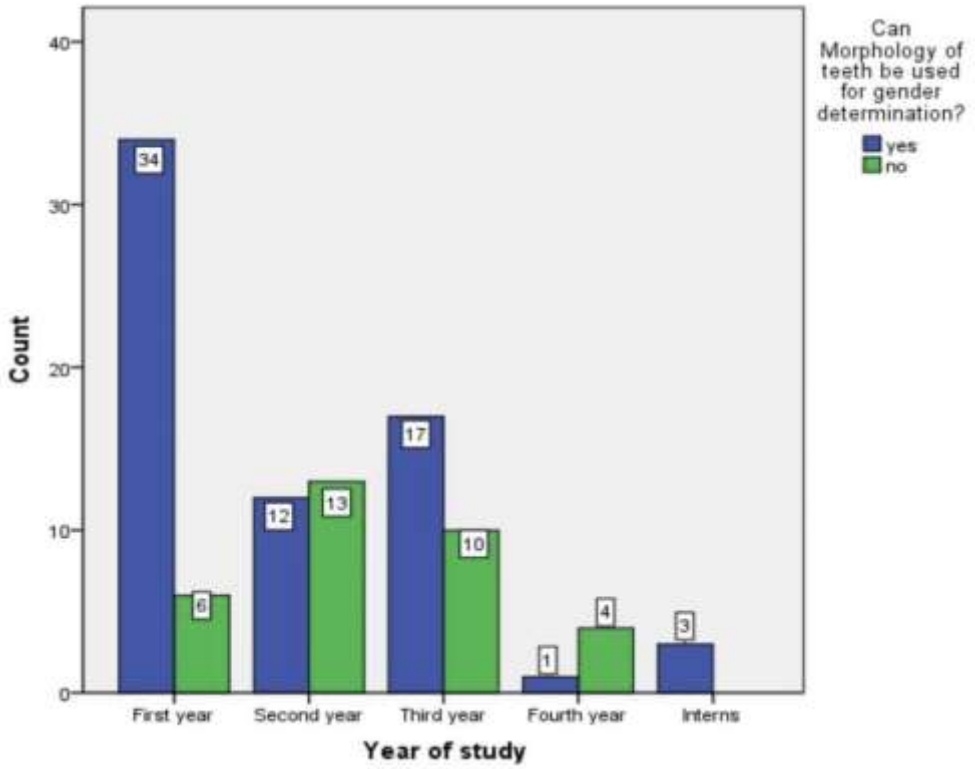

Figure 10: Bar graph representing comparison of responses between different educational levels of undergraduate dental students and morphology of teeth in gender determination, where blue denotes yes and green denotes no. X axis represents educational levels and Y axis represents the number of dental students. First year undergraduate dental students (34) were more aware that the morphology of teeth can be used in gender discrimination and the difference was statistically significant. Chi square test, P value = 0.002(<0.05) - statistically significant.

In the present study, 79% of the dental students were aware that remains of a deceased person can be used for forensic identification and first year undergraduate dental students (36) were aware that skeletal remains can be used in forensic investigation [Figure1]. 76% of the participants were aware that skeleton remains are used for forensic investigation and first year undergraduate dental students (37) were aware that skeletal remains can be used in forensic investigation. Chi square test, P value = 0.089(>0.05) -statistically not significant [Figure 2]. 74% of the study participants were aware that skeleton remains are used for gender determination and first year undergraduate dental students (34) were aware that skeletal remains were significant in gender determination. Chi square test, P value = 0.089(>0.05) - statistically not significant [figure 3]. 77% of the study participants were aware that there is a difference in skull pattern and skull trait of two sexes and First year undergraduate dental students (33) had more knowledge on skull patterns and skull traits which can be used for gender determination. However the difference was statistically not significant.P value = 0.232(>0.05) [figure4]. 72% of the dental population were aware that zygomatic bone is more prominent in males compared to females. First year undergraduate dental students (34) were aware that the zygomatic bone is more prominent in males compared to females. Chi square test, P value = 0.130(>0.05) - statistically not significant [Figure 5]

79% of the study participants were aware that mandibles differ in male and female.More first year undergraduate dental students (34) were aware that the shape of the mandible differs in males and females. P value = 0.753(>0.05) - statistically not significant [Figure 6] Among the dental students,70% of the study participants were aware that ramus is the best parameter for the sex determination and majority of first year undergraduate dental students (34) were aware that the morphology of the ramus is the best parameter for sex determination and the difference was statistically significant P value = 0.036(>0.05) [Figure7].

83% of the study participants were aware that there is a difference between male and female gonial angle and First year undergraduate dental students (35) were aware of the same, p value = 0.584 (>0.05) [Figure 8]. 69% of the study participants were aware that stature of deceased persons affect the skeletal characteristics and 36 first year undergraduate dental students were aware of the same and the difference was statistically significant p value = 0.003 [Figure 9]. 67% of the study participants were aware that morphology of the teeth is used for gender determination.First year undergraduate dental students (34) were more aware that the morphology of teeth can be used in gender discrimination and the difference was statistically significant (p value = 0.002) [Figure10]

DISCUSSION:

Determining the sex, of unknown human remains is the second step in the triad of building a dental profile. Forensic odontology plays a role in establishing the sex of the deceased person bodies mutilated beyond recognition due to major mass disaster. Sex can be determined based on data from morphology of skull and mandible, metric features, as well as by DNA analyses of teeth.

79% of the dental students were aware that remains of a deceased person can be used for forensic identification. Among the dental students, it was found that 36 1st year undergraduate dental students were aware that skeletal remains are of forensic significance. 76% of the study participants were aware that skeleton remains are used for forensic investigation. The use of morphological features of the skull and mandible is a common approach used by anthropologists in gender determination. A number of features are known to show variation between the sexes. [22]

77% of the study participants were aware that there is a difference in skull pattern and skull trait of two sexes. 72% of the dental population were aware that zygomatic bone is more prominent in males compared to females.Williams and Rogers got 96% success in determining the sex using different features of the skull and the mandible using a constant 6 traits – mastoid, supraorbital ridge, size and architecture of skull, zygomatic extension, nasal aperture and mandibular gonial angle – the accuracy was 94%. This indicates that craniofacial morphology can be used to determine sex of skeletal specimen with a high precision. [23]

79% of the study participants were aware that mandible differ in male and female.70% of the study participants were aware that ramus is the best parameter for the sex determination. 83% of the study participants were aware that there is a significant difference between male and female gonial angle. The mandible is the largest facial bone and retains its shape better than other bones in the forensic and anthropologic field. In the mandible, bigonial breadth was the most dimorphic of the measurements taken. [24]

69% of the dental students were aware that stature of deceased persons affects the skeletal characteristics.67% of the dental students were aware that morphology of the teeth is used for gender determination. Teeth may be used for differentiating sex by uring mesiodistal (MD) and buccolingual (BL) dimensions. Lund and Mornstad stated that it is of special importance in young individuals where skeletal secondary sexual characters have not yet developed.[25]

Determination of sex using skeletal remains poses a great problem to forensic experts when only fragments of the body are recovered. Forensic dentists can assist other experts to determine the sex of remains by using teeth and skull. The study is first of its kind with no existing previous literature. Limitation of the study is less sample size.In future an extensive study with large sample size and varied population can be used to to assess the awareness and knowledge on skull morphology for gender determination in forensic odontology.

CONCLUSION:

From the present study, it is evident that undergraduates students had very good knowledge on skull morphology for gender determination. Among the undergraduate dental students, first year students had good knowledge on the importance of skull morphology in gender determination.

ACKNOWLEDGEMENT:

The author would like to thank the study participants for their participation and kind cooperation throughout the study.

AUTHOR CONTRIBUTION:

Kirthick kumaran.A.S: Literature search,survey,data collection,analysis,manuscript writing

Dr.Archana Santhanam:Study design, data collection, data verification, manuscript drafting.

CONFLICTS OF INTEREST:

The author declared that there were no conflicts of interest in the present study.

REFERENCES:

1. Sivapathasundharam B. Forensic odontology in India [Internet]. Vol. 1, Journal of Forensic Dental Sciences. 2009. p. 55. Available from: http://dx.doi.org/10.4103/0974-2948.60373

2. Namrata Harchandani, Swati Marathe, Manjula Hebbale, Shams Ul Nisa, Darshan Hiremutt. Awareness of forensic odontology among general dental practitioners in Pune-A cross-sectional study. 2014;

3. Kumar S, Dagli N. Forensic Odontology- An area unexplored. J Int Oral Health [Internet]. 2014 Feb;6(1):i. Available from: https://www.ncbi.nlm.nih.gov/pubmed/24653619

4. Sheikh S, Pallagatti S, Singla I, Gupta R, Aggarwal A, Singh R, et al. Survey of dental radiographical practice in States of Punjab and Haryana in India [Internet]. Vol. 5, Journal of Investigative and Clinical Dentistry. 2014. p. 72–7. Available from: http://dx.doi.org/10.1111/jicd.12016

5. Shamim T. The relationship of forensic odontology with various dental specialties in the articles published in the Journal of Forensic odonto-stomatology from 2005 to 2012. Indian J Dent Res [Internet]. 2015 Apr;6(2):75–80. Available from: http://dx.doi.org/10.4103/0975-962X.155888

6. Luo L, Chang L, Liu R, Duan F. Morphological Investigations of Skulls for Sex Determination Based on Sparse Principal Component Analysis [Internet]. Biometric Recognition. 2013. p. 449–56. Available from: http://dx.doi.org/10.1007/978-3-319-02961-0_56

7. Shree KH, Hema Shree K, Ramani P, Herald Sherlin, Sukumaran G, Jeyaraj G, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma – a Systematic Review with Meta Analysis [Internet]. Vol. 25, Pathology & Oncology Research. 2019. p. 447–53. Available from: http://dx.doi.org/10.1007/s12253-019-00588-2

8. Abitha T, Santhanam A. Correlation between bizygomatic and maxillary central incisor width for gender identification [Internet]. Vol. 22, Brazilian Dental Science. 2019. p. 458–66. Available from: http://dx.doi.org/10.14295/bds.2019.v22i4.1775

9. Krishnan RP, Ramani P, Sherlin HJ, Sukumaran G, Ramasubramanian A, Jayaraj G, et al. Surgical Specimen Handover from Operation Theater to Laboratory: A Survey. Ann Maxillofac Surg [Internet]. 2018 Jul;8(2):234–8. Available from: http://dx.doi.org/10.4103/ams.ams_51_18

10. Palati S, Ramani P, Herald. J. Sherlin, Gheena S, Don KR, Jayaraj G, et al. Age Estimation of an Individual Using Olze's Method in Indian Population-A Cross-Sectional Study [Internet]. Vol. 13, Indian Journal of Forensic Medicine & Toxicology. 2019. p. 121. Available from: http://dx.doi.org/10.5958/0973-9130.2019.00179.8

11. Sarbeen JI, Insira Sarbeen J, Gheena S. Microbial variation in climatic change and its effect on human health [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1777. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00359.0

12. Harrita S, Santhanam A. Determination of Physical Height Using Clinical Crown Height of Deciduous Teeth [Internet]. Vol. 13, Indian Journal of Forensic Medicine & Toxicology. 2019. p. 23. Available from: http://dx.doi.org/10.5958/0973-9130.2019.00255.x

13. Padavala S, Sukumaran G. Molar Incisor Hypomineralization and Its Prevalence. Contemp Clin Dent

[Internet]. 2018 Sep;9(Suppl 2):S246–50. Available from: http://dx.doi.org/10.4103/ccd.ccd_161_18

14. Palati S, Ramani P, Shrelin HJ, Sukumaran G, Ramasubramanian A, Don KR, et al. Knowledge, Attitude and practice survey on the perspective of oral lesions and dental health in geriatric patients residing in old age homes. Indian J Dent Res [Internet]. 2020 Jan;31(1):22–5. Available from: http://dx.doi.org/10.4103/ijdr.IJDR_195_18

15. Prasanna GE, Gheena S. A study of empathy across students from 4 health disciplines among 1st years and Final years [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1472. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00286.9

16. Hannah R, Ramani P, Herald. J. Sherlin, Ranjith G, Ramasubramanian A, Jayaraj G, et al. Awareness about the use, Ethics and Scope of Dental Photography among Undergraduate Dental Students Dentist Behind the lens [Internet]. Vol. 11, Research Journal of Pharmacy and Technology. 2018. p. 1012. Available from: http://dx.doi.org/10.5958/0974-360x.2018.00189.0

17. Gunasekaran G, Abilasha R. TOOTH SENSITIVITY AMONG RESIDENTIAL UNIVERSITY STUDENTS IN CHENNAI [Internet]. Asian Journal of Pharmaceutical and Clinical Research. 2016. p. 63. Available from: http://dx.doi.org/10.22159/ajpcr.2016.v9s2.13228

18. Ahad M, Gheena S. Awareness, attitude and knowledge about evidence based dentistry among the dental practitioner in Chennai city [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1863. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00380.2

19. Manohar J, Abilasha R. A Study on the Knowledge of Causes and Prevalance of Pigmentation of Gingiva among Dental Students [Internet]. Vol. 10, Indian Journal of Public Health Research & Development. 2019. p. 95. Available from: http://dx.doi.org/10.5958/0976-5506.2019.01859.x

20. Sheriff KAH, Ahmed Hilal Sheriff K, Santhanam A. Knowledge and Awareness towards Oral Biopsy among Students of Saveetha Dental College [Internet]. Vol. 11, Research Journal of Pharmacy and Technology. 2018. p. 543. Available from: http://dx.doi.org/10.5958/0974-360x.2018.00101.4

21. Uma PK, Ramani P, Herald. J. Sherlin, Gheena S, Jayaraj G, Don KR, et al. Knowledge about Legal Aspects of Medical Negligence in India among Dentists– A Questionnaire Survey. Medico Legal Update [Internet]. 2020 Apr 9 [cited 2020 Jun 5];20(1):111–5. Available from: http://ijop.net/index.php/mlu/article/view/337

22. Sweet D, Pretty IA. A look at forensic dentistry – Part 2: Teeth as weapons of violence – identification of bitemark perpetrators [Internet]. Vol. 190, British Dental Journal. 2001. p. 415–8. Available from: http://dx.doi.org/10.1038/sj.bdj.4800990

23. Rajendran R. Shafer'S Textbook Of Oral Pathology (6Th Edition) [Internet]. Elsevier India; 2009. 963 p. Available from: https://books.google.com/books/about/Shafer_S_Textbook_Of_Oral_Pathology_6Th.html?hl=&id=Spk0V6TrCggC

24. Steyn M, Yaşar İşcan M. Sexual dimorphism in the crania and mandibles of South African whites [Internet]. Vol. 98, Forensic Science International. 1998. p. 9–16. Available from: http://dx.doi.org/10.1016/s0379-0738(98)00120-0

25. Hemanth M, Vidya M, Nandaprasad, Karkera BV. Sex determination using dental tissue. Medico-Legal Update [Internet]. 2008 [cited 2020 Jun 22];8(2):13–5. Available from: https://www.indianjournals.com/ijor.aspx?target=ijor:mlu&volume=8&issue=2&article=006

26. Farhat Yaasmeen Sadique Basha, Rajeshkumar S, Lakshmi T, Anti-inflammatory activity of Myristica fragrans extract . Int. J. Res. Pharm. Sci., 2019 ;10(4), 3118-3120 DOI: https://doi.org/10.26452/ijrps.v10i4.1607