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Forensic Odontology: Awareness from the Scratch

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Abstract---Forensic dentistry (odontology) deals with the examination, handling and presentation of dental evidence for the legal system. The aim of the study was to evaluate the knowledge, attitude and practice of dental graduates towards forensic odontology and its future as a profession. A cross-sectional institution-based study was conducted among 60 interns and dental graduates of Government Dental College and Hospital, Srinagar through an online questionnaire-based study during the COVID pandemic in the month of February 2022 and the results were tabulated. 100% dentists were aware about forensic odontology being a branch of dentistry but only 93% had studied it during their curriculum. The study concluded that more and more information related to forensic odontology is required by dentists, especially pedodontists when dealing with evidence in criminal cases, such as child abuse or sexual assaults or when identifying multiple victims.

Keywords---child abuse, forensic odontology, pedodontist, victim.

Introduction

Forensic odontology as defined by Federation Dentaire Internationale and Keiser-Nielsen in 1968 is a subdiscipline branch of dentistry which in the interest of justice deals with proper handling and examination of dental evidence and

presentation of dental findings .¹ Presently in modern day investigations dentist play small yet significant role in identification of bodies in mass disasters and accidents where bodies cannot be identified visually. Many a times in forensic cases, the remains of the deceased may suffer incineration, trauma, decomposition, or immersion in the sea and teeth being the hardest tissue in the body often remains intact after death which makes them useful for forensic identification .²

Forensic dentistry has utilization in diagnostic and therapeutic examination and evaluation of injuries to jaws, teeth, and oral soft tissues , facial reconstruction cases, identification of individuals who are mostly casualties in criminal investigations and/or mass disasters and in sexual abuse cases for identification, examination, and evaluation of bite marks, in child abuse cases, and in personal defense situations.³ For any forensic study age estimation forms an integral part mostly when the chronological age of the person is unavailable and plays a significant role mostly in medicolegal issues like illegal immigrants, employment (child /adult), assigning legal punishments etc. where children have to be dealt on more humanitarian grounds.⁴

Globally Forensic odontology has taken giant strides in the various technical advancements like Oral Autopsy, Photogrammetry and Surface Scanning, Post mortem Computed Tomography Angiography, Forensic Facial Reconstruction ,Craniofacial Imaging and Reconstruction. So this study was conducted on dental graduates and interns with the aim that there is increased need to have good knowledge about forensic odontology as it is useful in the identification of an individual during disasters, to detect abuse among all ages and need to be accepted as a profession in India like globally .

Materials and Methodology

A cross-sectional institution-based study was conducted among 60 interns doing rotational postings and dental graduates of Government Dental College and Hospital, Srinagar .The age group of the participants was 23-26 years. Each participant was given an online Questionnaire which consisted of a set of 10 questions (Table 1). Both yes or no and multiple choice questions were present. The questionnaire was divided into three parts: knowledge, attitude , and practice towards forensic odontology in their day to day practice. The questionnaire was customised based on previous published studies through a survey app called SURVEY MONKEY and send to the respondents online during COVID 19 pandemic in the month of February 2022. Ethical clearance was taken from said institution under number GDC/Pedo /2022. The responses were received , tabulated (Table 2) and statistically analysed. The data received were categorized as nominal data.

Table 1
Questionnaire for the survey

QUESTION	A	B	C	D	E
1.Are you aware about the branch of dentistry called	Yes	No	Yes	No	Yes
	Yes	No	No	Yes	

forensic odontology and did you study it in your curriculum ?					
2.What is the first step taken for identification of unclaimed bodies?	Finger printing	Physical and anthropological examination	Visual examination	Serological and genetic DNA comparison	Don't know
3.Can enamel/dentin be used as an aid for identification of age?	Agree	Disagree	Don't know		
4 Which of the following can be used as an aid for identification of age?	Visual inspection	Serological comparison	Finger prints	DNA comparison	Physical anthropological examination of bones and teeth
5 Are you aware of different Bite mark patterns of teeth ?	Yes	No			
6. Can teeth serve as a source of DNA information?	Agree	Disagree	Don't know		
7. Are you aware that dentist can present dental records and evidence in court after they maintain them?	Agree	Disagree	Don't know		
8 Are you aware that forensic odontology can be used in mass disasters for identification purposes ?	Agree	Disagree	Don't know		
9 Are you aware in undergoing formal training in forensic odontology and do you feel a scope in future ?	Agree	Disagree	Don't know		
10 What do you do when you come across a child with signs and symptoms of abuse?	Inform police	Inform NGOS	Inform parents		

Results

60 dental graduates and interns participated in the study and none of them skipped any question. 100 percent of the participants were aware of the branch in dentistry called forensic odontology and 93% agreed that they had studied forensic odontology separately in their curriculum (Figure 1).

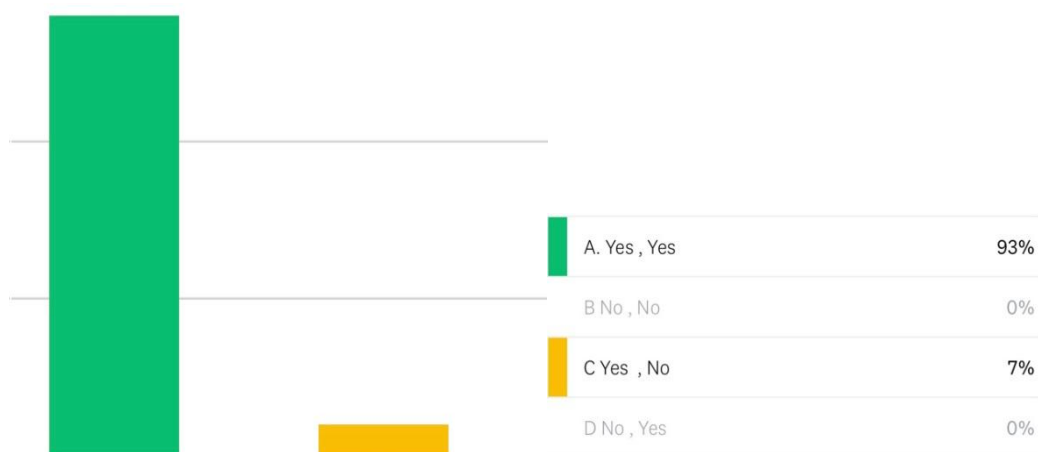


Figure 1. Graph representing respondents awareness related to Forensic dentistry and had it in dental curriculum

Knowledge about forensic odontology

57% of respondents stated visual examination as the first step taken for identification of unclaimed bodies whereas 13% stated finger printing and 13% agreed physical/anthropological examination as first steps taken to claim unidentified bodies during disasters (Figure 2).

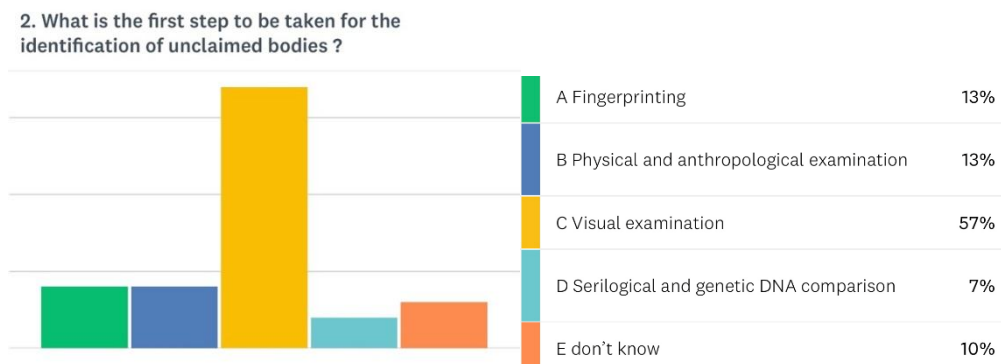


Figure 2. Graph representing the response to first step to be taken for identification of unclaimed bodies according to respondents.

97% Percent of respondents agreed to the statement that enamel/dentin can be used as an aid for identification of age (Figure 3,q3).

3. Can enamel dentin be used as an aid for identification of age ?

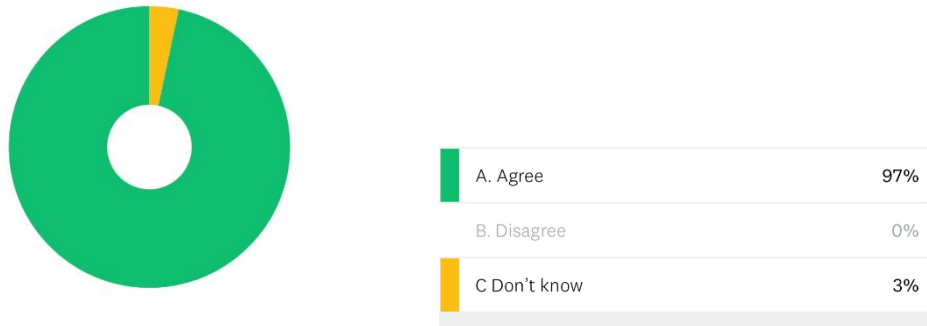


Figure 3. Pie diagram representing respondents response for the question can enamel/dentin be used as an aid for identification of age.

Attitude about forensic odontology

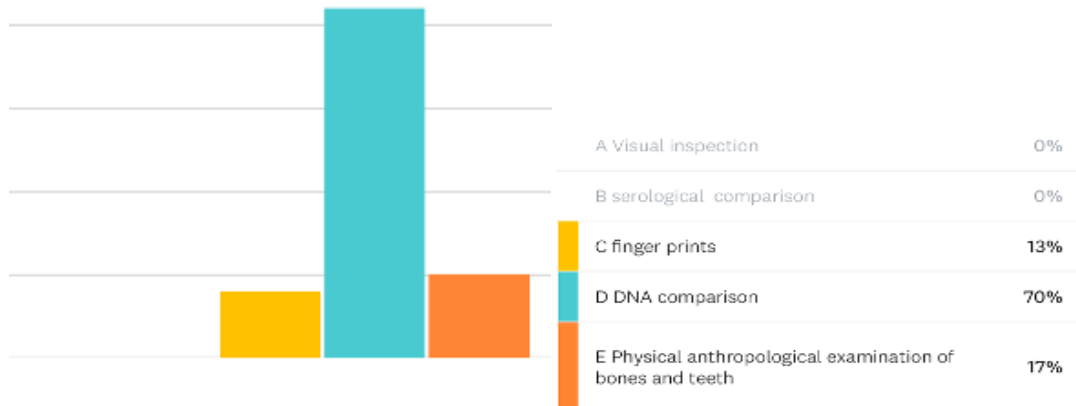


Figure 4. Graph representing the most accurate and sensitive method for identifying an individual

70% Of respondents stated DNA comparison as the most accurate and sensitive method to identify an individual during disasters(Figure 4, Q4).

100% of respondents were aware of different bite mark patterns of teeth (q5). 90% of respondents agreed that teeth can serve as source of DNA information whereas 7% disagreed to the statement (Figure 5).

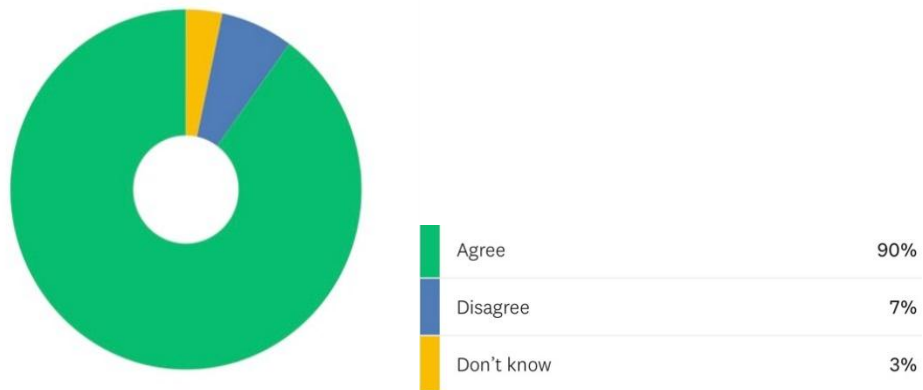


Figure 5. Pie diagram representing can teeth serve as a source of DNA information

93% (n=56) knew that dentist can present dental records and evidence in court and they can maintain them whereas 7% didn't know (Figure 6, Table 2).

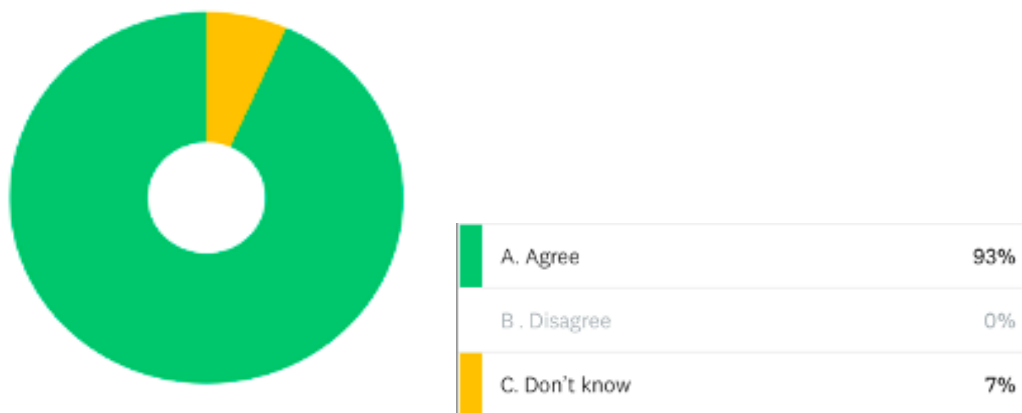


Figure 6. Pie diagram representing whether dentist knew they can present dental records and evidence in courts

97% (n=58) agreed that forensic odontology can be used in mass disasters for identification purposes (q8, Table 2).

Practice of forensic odontology

80% (n=48) agreed in undergoing formal training in forensic odontology and felt a scope in future whereas 17% don't know about the scope of forensic dentistry (Figure 7, Table 2).

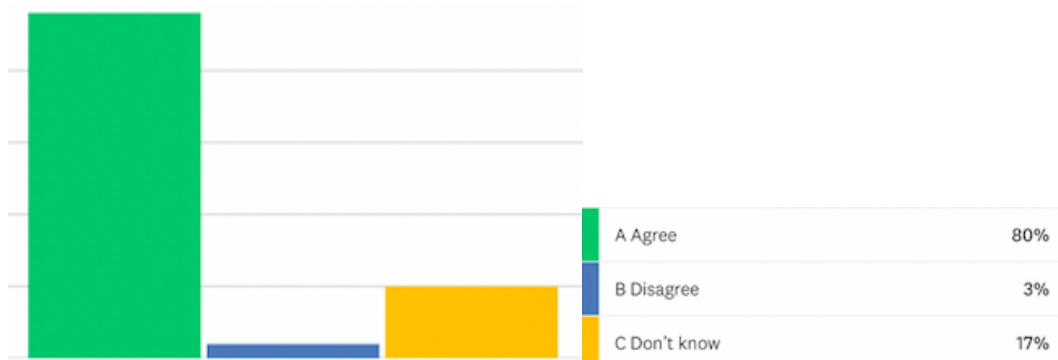


Figure 7. Graph representing the dental respondents who agreed about scope of forensic dentistry.

10. When you come across a child with signs and symptoms of abuse what do you do ?

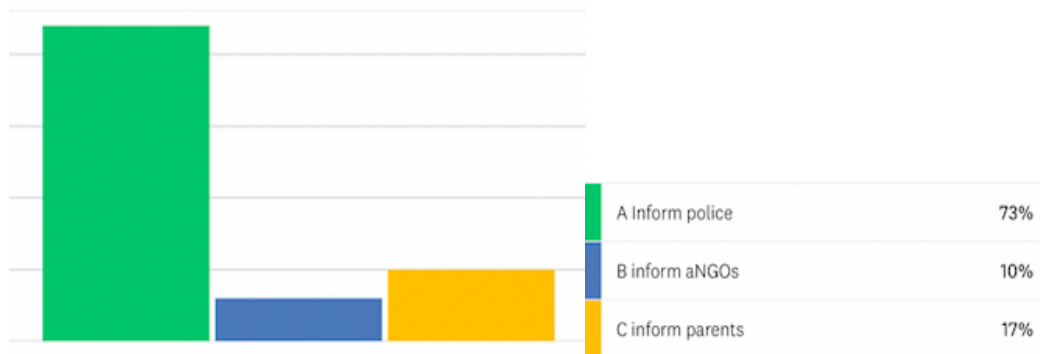


Figure 8. Graph representing practice of respondents to report child abuse case

73 % (n=44) of the respondents inform police when they spot a child with signs and symptoms of abuse whereas 10% (n=6) inform NGOs and 17% just informed the parent (Figure 8, q10, Table 2).

Table 2
Representation of answers for the questionnaire

Question	Option A % (n)	Option B % (n)	Option C % (n)	Option D % (n)	Option E % (n)	Skipped
1	93(56)	0(0)	7(4)	0(0)		0
2	13(8)	13(8)	57(34)	7(4)	10(6)	0
3	97(58)	0(0)	3(2)			0
4	0(0)	0(0)	13(8)	70(42)	17(10)	0
5	100(60)	0				0
6	90 (54)	7 (4)	3(2)			0
7	93 (56)	0(0)	7(4)			0
8	97 (58)	0 (0)	3(2)			0
9	80 (48)	3 (2)	17 (10)			0
10	73 (44)	10 (6)	17 (10)			0

Discussion

Dentist plays a role in identifying deceased in mass catastrophes thus aid in issuing death certificates which helps in claiming the insurance, settlement of property, facilitate remarriage of a surviving spouse, and allows last ritual of the body as the displaced/rotated teeth, restorations, carious tooth, missing teeth, occupational or habit created wear facets, fractured teeth, diastema, prosthodontic appliances, and extent of shoveling of the maxillary incisors, presence, and angulation of impacted teeth, dental anomalies, intrinsic staining and bone level present as an identifying aid. ⁵

In soft and hard dental components DNA is found in vascular pulp, odontoblastic process, accessory canals, and cellular cementum and from dental pulp blood group determination can be done from highly decomposed remains .So the DNA from the teeth not only acts for primary identification but it can also be used as reference sample to relate the other tissue fragments.^{6,7} The identification of sex of a person can be done by finding Barr bodies and Y-chromosomes in dental pulp.

Saliva can be a major source of DNA and in Polymerase chain reaction (PCR) technology, Streptococcal DNA sequence provides a means to identify the bacterial composition from bite marks to be matched exclusively to those from the teeth responsible .⁸ For high accuracy in sex determination DNA is preferred to non-metric and metric measurements and the various molecular indicators based on PCR analysis, included amelogenin, SRY, DXYS156, and TSPY.⁹ A forensic science called Cheiloscopy which deals with identification of human based on lip traces where the wrinkle pattern of lip has individual characteristics same as finger prints . In 1967 Santos was the first person to classify lip grooves as Straight line, Curved line, Angled line and Sine shaped line.¹⁰

The present study was conducted to evaluate dental interns and graduates knowledge, attitude and practice towards forensic dentistry and need of more awareness and knowledge is required on forensic odontology. 100% of the respondents in the study were aware of the branch in dentistry called forensic odontology but only 93% agreed studying it in dental curriculum ,so increase in crimes, natural calamities and occurrence of accidents focuses on the need of considering forensic odontology as separate subject at undergraduate level itself . In this study, 93% of the participants were aware that a dentist can present forensic dental records as evidence in court.

In 1950 Gustafson developed a method of age estimation from a single tooth way back by utilizing various stages of regressive changes in the teeth such as occlusal attrition, coronal secondary dentine formation, the loss of periodontal attachment, cementum apposition, amount of apical resorption and the transparency of the root . Johnson brought some improvements in the technique described by Gustafson which is now mostly used by forensic scientists for estimation of age in adults and Kvaal *et al.* estimated age measuring the size of the pulp from periapical radiographs of the teeth dependent upon the sex of the individual.^{11,12,13}

93 percent of participants were aware that forensic odontology can be used for identification in mass disaster . 90 % of respondents were aware that teeth can serve as a source of DNA in our study and results were similar to Sahni A et al in 2016 who stated 95% of respondents were aware of the fact that teeth act as an accurate source of DNA material where the main sources of DNA are pulp, dentine, cementum, and periodontal ligament fibers.¹⁴ Tooth is a reliable tool for age estimation which anthropologists, archaeologists, and forensic odontologists use for age estimation which mainly include incremental lines of enamel/dentin remain in fossils , neonatal lines, dentinal translucency and degree of formation of crown, and root. ¹⁴ 97% percent of the respondents in our study were aware that enamel / dentin can act as an aid for identification of age.

Clinically while sharing an electronic record a legend of the symbols and colours used in the pictorial dental chart is helpful and dental records should include all radiographs, casts, photographs and any other information that may be relevant such as letters of referral. Dental casts of individuals can also be an excellent resource for identification as the body or casts of the victim can be compared to the AM models .¹⁵ In our study 93% agreed that dentist can present dental records in courts whereas Preethi S et al in 2011stated the significance of maintaining dental records in identifying the deceased and crime suspects was not known to 17% of dental practitioners.

Conclusion

Forensic dentistry or odontology is a challenging and fascinating branch of forensic science which is used for identification of deceased individuals through the comparison of ante- and post-mortem records thus playing a pivotal role in medicolegal cases. In India dental graduates need to be sensitized towards the specialty and in future be a part of investigation and identification teams thus helping in establishing forensic odontology as a separate specialty under dental sciences. In future virtual autopsy is a new development in the field of investigations of death, however its acceptability in the court of law is yet to be proven.

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