Original Article

Indian Journal of Forensic Odontology
Volume 17 Number 2, July - December 2024
DOI: http://dx.doi.org/10.21088/ijfo.0974.505X.17124.1

Assessment of Knowledge Awareness and Practice of Forensic Odontology among Dental Students

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How to cite this article:
Arichetty Anusha, G. Firoz Kamal, Vandana Raghunath *et al*. Assessment of Knowledge Awareness and Practice of Forensic Odontology Among Dental Students. Ind J Forensic Odontol 2024;17(1):43-51.

Abstract

Aims & objectives: This study's objective was to assess understanding, and attitude/ practices of forensic odontology among students of dentistry.

Material & methods: An institution based cross sectional survey, was carried out among 309 students of Narayana Dental College Nellore, AP, India, belonging to III, IV BDS, Internship & post-graduation, from Feb to May 2023. Questionnaire forms which included 22 open & closed end questions on knowledge & awareness (19 questions) & attitude/practice (03 questions) towards forensic odontology, were distributed and were collected with their answers. These were further analyzed statistically based on percentages and association with age, gender and year of the study.

Results: Our study showed that 94.5% students knew about Forensic odontology as a specialty and 69.3% were aware about its recognition as a subject. 60-70% of students agreed upon the having the knowledge that bite marks, lip prints, rugae patterns, dental radiographs etc. are helpful in the age & gender determination, and which in turn could also aid in the detection of crimes. Only 49% of participants knew about training programs in forensic odontology & 76% were interested in joining the same. More than 90% agreed that maintaining dental records could help forensic experts in their investigations. In our study, all the participants had adequate knowledge/awareness. Interns displayed more knowledge & awareness when compared to undergraduates and even to postgraduates in few instances.

Conclusion: With increasing knowledge & awareness about forensic odontology and students showing keen interest in pursuing the subject more opportunities should be made available. This can be made possible by recognizing this subject as a separate specialty and establishing well equipped training centers. Thus, the scope of forensic odontology in various fields and especially in that of crime investigation & individual identification in different situations gets boosted.

Keywords: Nellore; Dental; Knowledge; Awareness; Forensic odontology.

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Received on: 06.05.2024

Accepted on: 03.07.2024

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INTRODUCTION

The Federation Dentaire International has described forensic odontology as the area

of dentistry that practices proper handling, examination, and evaluation of dental evidence as well as the preservation of dental discoveries in the interest of justice which has enormous importance in mass catastrophes, abuse, or organized crime.[1] The Latin word "forensic" means "scientific analysis of physical evidence" in the court of law.[2]

Dental identification has been essential for identifying deceased people from AD 66; the first case was recognized by the law in 1849. Since tooth is highly resistant to destruction in the most un-favorable environmental conditions it is considered as the best identification tool for identifying individuals in natural or manmade mass disasters, criminal cases. Forensic odontology also deals with bite patterns, rugae patterns, lip prints which are very much helpful in many abusive crimes, assault cases. It is exhausting to identify victims or modes of crime in today's crime ridden world especially when crime rates are at their highest.[3,4] The awareness on utilizing tooth which can act as long-standing physical evidence that confirms/strengthens key suspension by the means of extracting DNA through it and also in various identification scenarios, should be widely encouraged & followed along with other means of identification to cope up with present highest crime rate society.

Thus, forensic dentistry is becoming a vital / integral part of forensic medicine year by year. The job of dentist is not only to examine and treat the oral diseases but also to assist the legal authorities by means of its branch forensic odontology.[5] Although forensic odontology has advanced dramatically worldwide, India is still miles behind in this regard. The knowledge and importance of dental tissues in terms of supporting judicial system is the key part in advancing the current low pace scenario of utilizing forensic odontology. Hence the need for awareness and good knowledge of forensic odontology among dental students is important to reach the global advancement and encouragement towards this specialty.[6]

METHODOLOGY

A cross-sectional study was conducted from Feb – May 2023 through questionnaire forms. 309 participants belonging to third & final years of under graduation (UGs), Internees and postgraduate (PGs) students at Narayana dental college were included in the study. The form included the demographic details like gender, year of study with 22 questions on knowledge/awareness about Forensic odontology and attitude related questions. The participants were to fill the forms which were distributed after assembling them in classrooms section wise. The collected data from the forms were then tabulated and analyzed statistically.

RESULTS

In this study 49.5% were undergraduates (UGs), 28.5% were Interns and 22% were postgraduates (PGs). (Fig.1). 69.3 % of the students recognized forensic odontology as a branch of dentistry and a subject recognized by DCI. 54% of the students admitted that they had gained information about forensic odontology by attending lectures, seminars, reading journals & via electronic media. 84.5% displayed knowledge about teeth as a source of DNA could provide information regarding genetic origin, and help in sex, and age determination. 91.9% of participants agreed that by maintaining proper dental records, the dentists could help forensic experts in the comparison process of ante mortem and postmortem records. 82.5% of participants knew about cheiloscopy, 85.4% about significance of palatal rugae & 88.3% about bite mark patterns. 76.7% of the students are aware that age estimation was possible through radiography & 80.6% are aware about the other possibilities of age estimation like eruption patterns & calcifications. Dentist's role in mass disasters was recognized by 66% of them. 83.5% of the students knew that forensic odontology helped in sexual abuse cases & 66.3% of them had an idea of dentist's role in child neglect with only 54.4% agreeing that they would inform the police when they come across child abuse cases. Majority of the participants i.e.76.1% were interested in undergoing forensic training & 66.3% were aware of their role as expert witness in court through dental evidence. However, 50% were unaware about different courses dealing with forensics offered in India. (Table 1) (Fig: 1-5)

Even though all the students displayed adequate knowledge & awareness, it was the internees who outsmarted in higher numbers compared to Postgraduates & undergraduates. Few questions pertaining to teeth acting as a DNA source & estimating age by enamel & dentin were well accepted by the postgraduates (PGs) than the undergraduates (UGs) & interns.

Table 1: Percentages of answers to the survey questions between different study groups & their statistical relevance

Questions		Total N(%)	UGN (%)	Internees N(%)	PGN (%)	Statistical significance
1. Do u know about Forensic odontology?	No	17(5.5)	11(7.2)	6(6.8)	0(0)	0.078 (NS)
	Yes	292(94.5)	142(92.8)	82(93.2)	68(100)	
2. What is the source of information regarding forensic odontology	Lectures, seminars, journals etc.	167(54)	88(57.5)	45(51.1)	34(50)	0(0)
	Lectures, seminars, jour nals etc.	31(10)	2(1.3)	4(4.5)	25(36.8)	
	Both	102(33)	60(39.2)	33(37.5)	9(13.2)	
	Other sources	9(2.9)	3(2)	6(6.8)	0(0)	
3. Do you know Forensic odontology is subject recognized by DCI	I don't know	52(16.8)	15(9.8)	15(17)	22(32.4)	0(0)
	No	43(13.9)	30(19.6)	3(3.4)	10(14.7)	
	Yes	214(69.2)	108(70.6)	70(79.5)	36(52.9)	
4. Acc. to DCI norms Forensic odontology is taught to BDS students in which year	3rd bds	221(71.5)	124(81)	65(73.9)	32(47)	0(0)
	Final yr BDS	43(13.9)	8(5.2)	11(12.5)	24(35)	
	After BDS	45(14.5)	21(13.7)	12(13.6)	12(17.6)	
5. Do you know the name of any formal forensic courses in India	I dont know	74(23.9)	31(20.3)	17(19.3)	26(38.2)	0.01*
	No	153(49.5)	73(48.4)	51(58)	29(42.6)	
	Yes	82(26.5)	48(31.4)	20(22.7)	14(19.2)	
6. Teeth which are found in skeletal remains provide information of which of the following	Genetic	12(3.8)	8(5.2)	4(4.5)	0(0)	0.002*
	Sex	2(0.6)	1(0.7)	0(0)	1(1.5)	
	Age	34(11)	15(9.8)	3(3.4)	16(23.5)	
	All the above	261(84.4)	129(84.3)	81(92)	51(75)	
7. Teeth serve as a source of DNA	I dont know	52(16.8)	36(23.5)	9(10.2)	7(10.3)	0.14*
	No	32(10.3)	16(10.5)	12(13.6)	4(5.9)	
	Yes	225(72.8)	101(66)	67(76.1)	57(83.8)	
8. Enamel & dentin act as an aid for identification of age	I dont know	24(7.7)	16(10.5)	4(4.5)	4(5.9)	0.13(NS)
	No	9(2.9)	7(4.6)	2(2.3)	0(0)	
	Yes	276(89.3)	130(85)	82(93.2)	64(94.1)	
9. As a dentist we can help forensic experts by maintaining dental records	I dont know	12(3.8)	6(3.9)	1(1.1)	5(7.4)	0.000*
	No	13(4.2)	3(2.0)	0(0)	10(14.7)	
	Yes	284(91.9)	144(94.1)	87(98.9)	53(77.9)	
10. What is the study of lip prints in forensic dentistry called	Cheiloscopy	255(82.5)	128(83.7)	77(87.5)	50(73.5)	0.089(NS)
	dermatoglyphics	5(1.6)	2(1.3)	2(2.3)	1(1.5)	
	Don't know	18(5.8)	8(5.2)	6(6.8)	4(5.9)	
	Lipology	31(10.1)	15(9.8)	3(3.4)	13(19.1)	
11. Do you know the significance of bite mark patterns of teeth?	I dont know	12(3.8)	8(5.2)	1(1.1)	3(4.4)	0.000*
	No	24(7.7)	9(5.9)	1(1.1)	14(20.6)	
	Yes	273(88.3)	136(88.9)	86(97.7)	51(75)	
12. Palatal rugae can be used as a marker in forensic identification.	I dont know	32(10.3)	13(8.5)	8(9.1)	11(16.2)	0.000*
	No	13(4.2)	1(0.7)	0(0)	12(17.6)	
	Yes	264(85.4)	139(90.8)	80(90.9)	45(66.2)	

13. As a dentist do you know any role of forensic odontology in mass disaster?	I dont know	49(15.8)	31(20.3)	8(9.1)	10(14.7)	
	No	56(18)	32(20.9)	15(17)	9(13.2)	0.08 (NS)
	Yes	204(66)	90(58.8)	65(73.9)	49(72.1)	
14. Each individual has unique lipprint& dental patterns	I dont know	17(5.5)	11(7.2)	2(2.3)	4(5.9)	
	No	17(5.5)	4(2.6)	2(2.3)	11(16.2)	0.000*
	Yes	275(88.9)	138(90.2)	84(95.5)	53(77.9)	
15. Forensic odontology can help confirm child neglect	I dont know	72(23.3)	47(30.7)	9(10.2)	16(23.5)	
	No	32(10.3)	12(7.8)	4(4.5)	16(23.5)	0.000*
	Yes	205(66.3)	94(61.4)	75(85.2)	36(52.9)	
16. What would you do if you identify signs/ symptoms of child abuse	Inform parents	90(29)	38(24.8)	26(29.5)	26(38.2)	
	Inform police	168(54)	98(64.1)	43(48.9)	27(39.7)	0.001*
	Inform NGO	43(13.9)	14(9.2)	19(21.6)	10(14.7)	
	Take no action	8(2.5)	3(2)	0(0)	5(7.4)	
17. Forensic odontology can help in the investigating sexual abuse	I don't know	31(10)	15(9.8)	6(6.8)	10(14.7)	
	No	20(6.4)	9(5.9)	2(2.3)	9(13.2)	0.02*
	Yes	258(83.4)	129(84.3)	80(90.9)	49(72.1)	
18. An individual dental age can be estimated by radiography	I dont know	30(9.7)	17(11.1)	6(6.8)	7(10.3)	
	No	42(13.5)	17(11.1)	8(9.1)	17(25)	0.02*
	Yes	237(76.6)	119(77.8)	74(84.1)	44(64.7)	
19. How do you identify the dental age in children and adults	Biochemical methods	17(5.5)	5(3.3)	2(2.3)	10(14.7)	
	Don't know	21(6.7)	11(7.2)	2(2.3)	8(11.8)	.000*
	Eruption patterns and calcification	249(80)	131(85.6)	81(92)	37(54.4)	
	Histological methods	22(7.1)	6(3.9)	3(3.4)	13(19.1)	
20. What is the full form of IAFO	Indian Academy of Forensic Odontology	23(7.4)	8(5.2)	9(10.2)	6(8.8)	
	Indian Association of Forensic Odontology	199(64.4)	85(55.6)	65(73.9)	49(72.1)	0.001*
	International Academy of Forensic Odontology	87(28.1)	60(39.2)	14(15.9)	13(19.1)	
21. Are you aware that you can testify as an expert witness in the court to present forensic dental evidence	I dont know	50(16.1)	21(13.7)	16(18.2)	13(19.1)	
	No	54(17.4)	21(13.7)	12(13.6)	21(30.9)	0.008*
	Yes	205(66.3)	111(72.5)	60(68.2)	34(50)	
22. If u given a choice, would you like to undergo any such training	I dont know	27(8.7)	13(8.5)	4(4.5)	10(14.7)	
	No	47(15.2)	9(5.9)	7(8)	31(45.6)	0000*
	Yes	235(76)	131(85.6)	77(87.5)	27(39.7)	

DISCUSSION

Forensic odontology, a branch of dentistry has always been an integral part of forensic science. It involves the application of dental knowledge in the identification of a person in mass disasters or in identifying a suspect during a crime investigation. It is essential for the dental students to have a greater knowledge and awareness about forensic odontology in the current scenario so that they can play a pivotal role in establishing a person's identity.

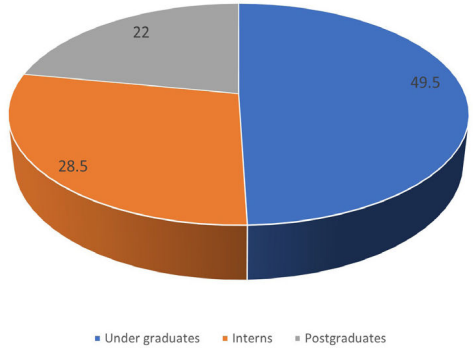


Fig. 1: Distribution of the study participants

Hence, educating the future dental practitioners and evaluating their knowledge about the fundamental or basics about forensics in routine dental practice and imparting the significance of archiving dental records is very much essential. Keeping this as a background a survey was conducted in our dental institution where undergraduates, Internees, and postgraduate students participated in this questionnaire study on forensic odontology. Results showed that, 94% of the participants knew about forensic odontology (p 0.78; NS) among which were all PGs (100%), 93.2% internees, followed by 92.8% UGs. (Fig. 2) More than 50% of participants were aware that the tooth played an important role in many a forensic situation such as mass disasters, crimes, etc. (Fig. 3). It is well established that teeth remain intact for longer periods of time while all the soft tissue and skeletal tissues get decomposed following an individual`s death.1 Internees (92%) displayed adequate knowledge about teeth being an invaluable source for age, sex & genetic estimation while only 84.3% of UGs & 75% of PGs (p 0.02; SS) were aware of it. (Fig. 2)

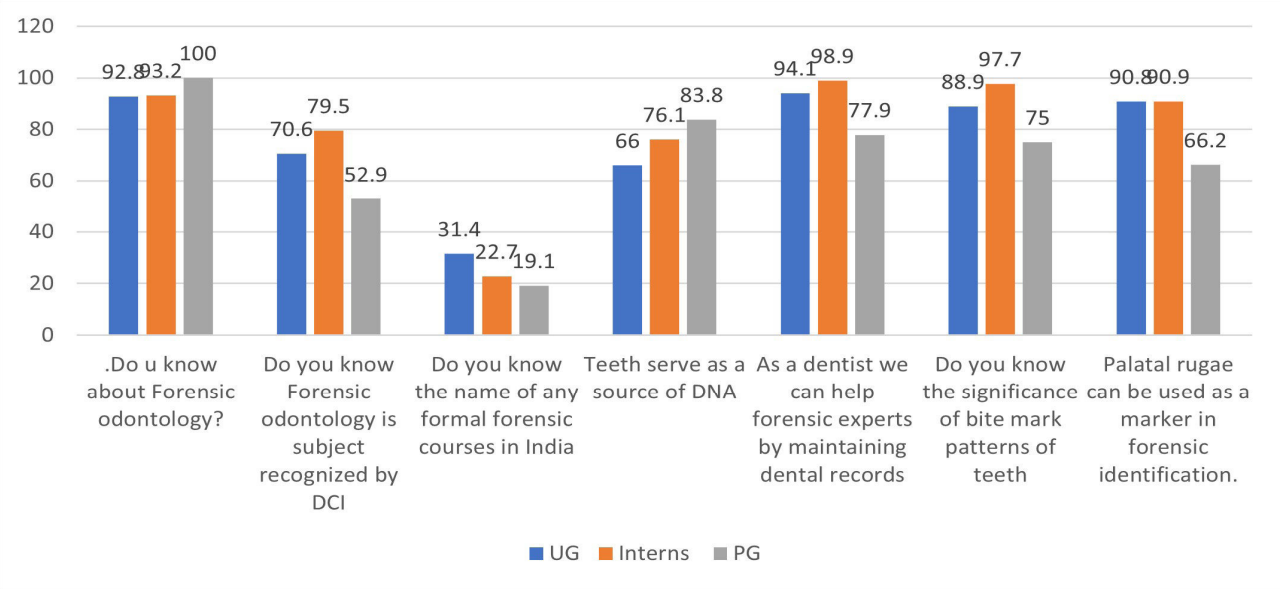


Fig. 2: Comparison based on year of study

Only 69.3% were aware that Forensic odontology is recognized as a separate branch by DCI (p 0.0; SS), among which 79.5% were internees, 70.6% were UGs & only 52.9% were PGs (Fig. 2) which was less when compared to similar studies done in Chennai and Saudi 2, 6. Around 68% of participants stated that Forensic odontology chapter was included in the 3rd BDS curriculum by DCI out of which 30.9% were PGs which was less compared to 73.9% interns & 81% UGs with significant association between groups. Only 26.2% were aware about forensic odontology courses in India out of which 31% were UGs followed by 22% interns & with least percentage of 19%, being PGs (Fig. 2). This established very clearly the lack of awareness about different courses on forensic odontology and the significance of pursuing forensics as a career option.

Determining age is essential for establishing an individual's uniqueness because human tooth development progresses in a consistent sequence starting around 4 months in the womb and continuing until the appearance of third molars, typically in the second or third decade of life.8 The use of Enamel & Dentin tissues for age estimation was well recognized by 80% of participants among which 94% were PGs, followed by interns (93%) & UGs (85%), the values not yielding statistically significant differences. More than 70% knew about radiography as a tool for age estimation which resembled the study done in Saudi Arabia6 and awareness about this fact was more in Internees (84%) followed by UGs (77.8%) & PGs (64%) (Fig. 3).

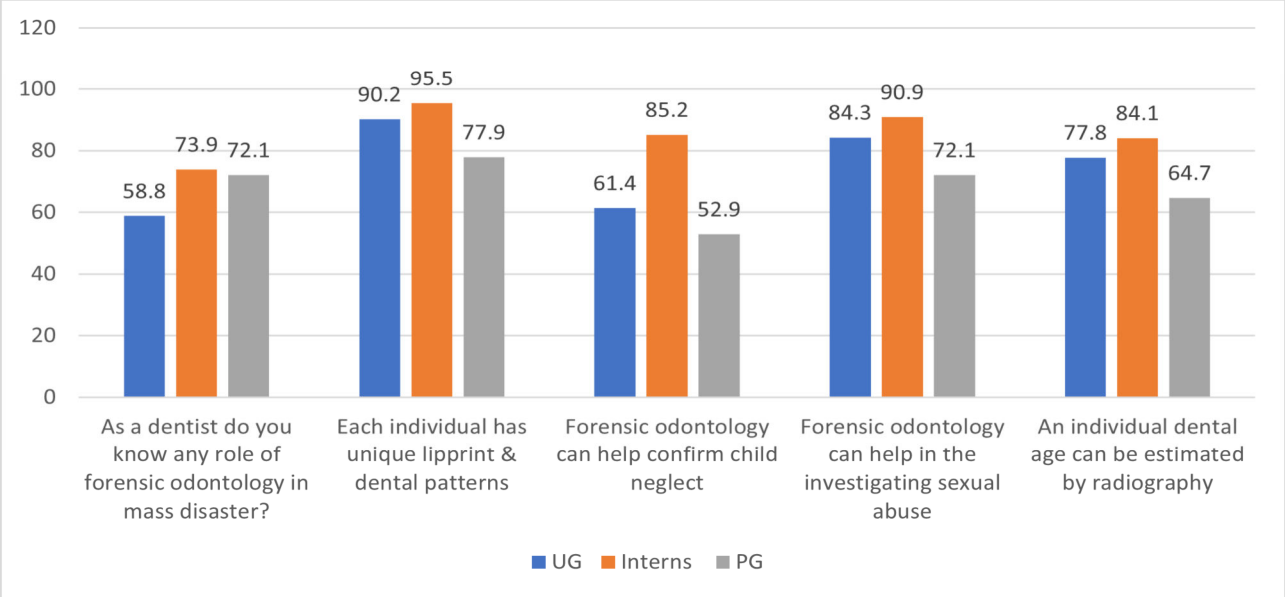


Fig. 3: Comparison based on year of study

Pertaining to different methods of dental age estimation the percentages were 80.6% for Eruption pattern & mineralization, 7.1% for histological methods and only 5.5% opined for biochemical methods. UGs (85.6%, 3, 9%, 5.3%) & internees (92%,3.4%,2.3%) responded in a likewise manner but very few PGs (54.4%, 19.1%, 14.7%) responded yielding a statistical significance with p value 0.0. Apart from this, there were various other methods of dental age estimation mentioned which included dentin transparency, role of third molar and biochemical method like aspartic acid racemization in dentin 18.

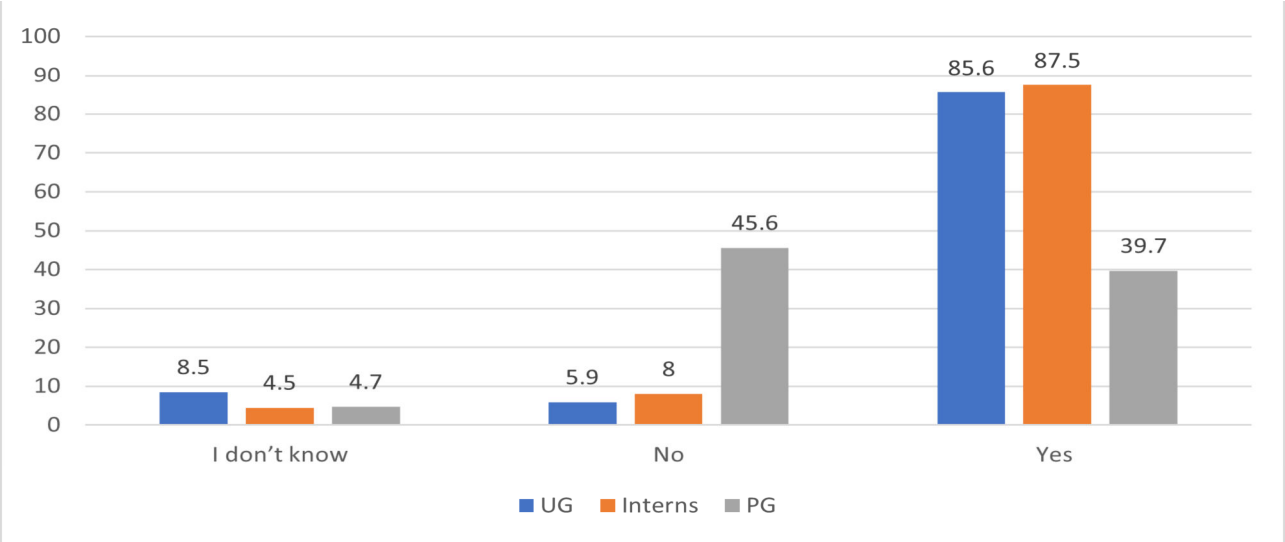


Fig. 4: Comparison based on year of study

82% & 64% of participants in our study which included more number of internees were aware about the terminologies like Chelioscopy 21 and IAFO when compared to other groups, with p-value of 0.89 & 0.01 respectively.

Nearly 85-89% of participants were aware about the uniqueness of palatal rugae, lip prints and bite marks in our study with equal responses from internees & UGs but very few from PGs (Fig. 2) with a statistical significance (p value 0.00). Sulci labiorum, or the grooves on human lips, are distinctive to each individual and can be used to determine identity, as much how fingerprints are used in human identification.[3] All incidences of child abuse, which are on the rise, should be reported as soon as possible. The teeth can also be used as a weapon, and depending on the situation, they might reveal the identity of the person who bit them. 66% of participants knew that Dental health professionals must remain vigilant regarding a range of physical and behavioral signs to identify potential child abuse (Fig. 3). If a dentist suspects

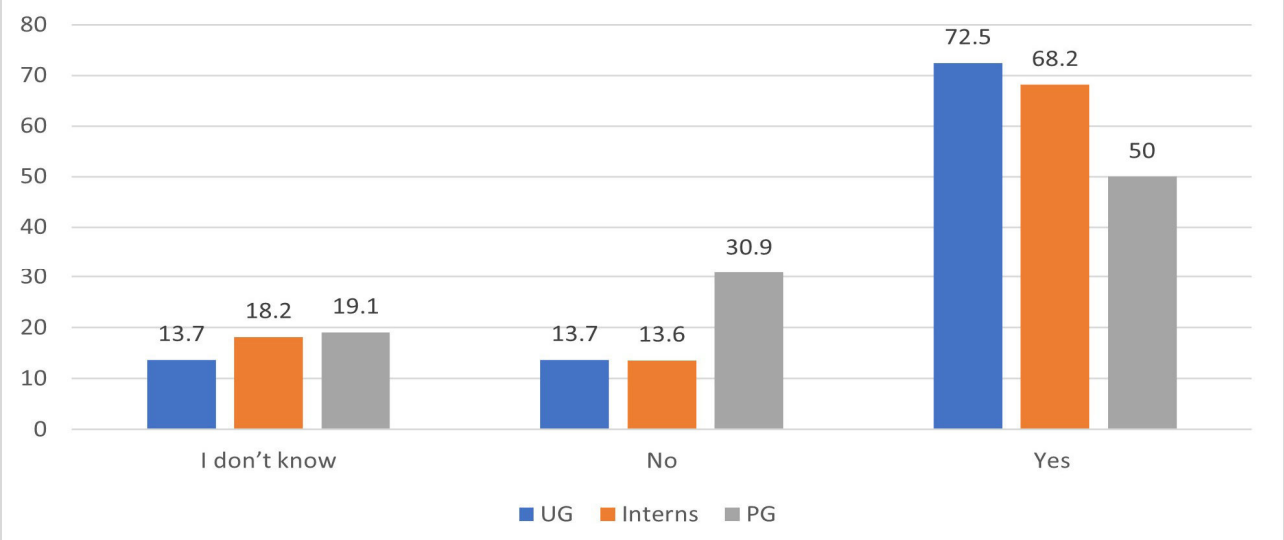


Fig. 5: Comparison based on year of study

physical abuse in a child or young patient, it is advisable to have another dental staff member witness the injuries and assist in documenting them[4]. Additionally, informing the police can provide greater clarity and support in handling the situation effectively 15, which majority of them had chosen in our study (54.4%). One of the main duties of a forensic dentist is to analyze bite marks & to spot possible child abuse for which dental health practitioners must be aware of a range of physical and behavioral clues. Dentist should witness the injuries and help with the recording if he/she suspects physical abuse of a young child[5]. Regarding role of dentistry in child abuse UGs & PGs had adequate knowledge but UGs displayed a slightly higher percentage (Fig. 3).

Overall, 72% students knew that teeth can act as source of DNA among which higher percentage were PGs (83%), followed by internees (76%) & UGs (66%) (Fig. 2). Pulp tissue, dentin, cementum, periodontal ligament, and alveolar bone can all be used to harvest DNA. The teeth's strong tissues can withstand a variety of environmental stresses, including decomposition, trauma, immersion, and burning. In these circumstances, pulp tissue may be utilized as a DNA source. Most of the approaches employ nuclear DNA, however when nuclear DNA is not enough, mitochondrial (mt) DNA, which is more prevalent in tissues, is used[12].

Forensic odontologists can actively participate in a multidisciplinary crisis management team that includes the police, army, and national guards during natural catastrophes, conflicts, or yearly pilgrimages. Among majority of the studies, dentists acknowledged that dental pattern analysis and DNA are the two most accurate identification methods, respectively[10]. As a result, a group of proficient and knowledgeable forensic odontologists should always be available.[13]

Dental records must be kept in an official and professional manner to prevent any medico-legal actions against the dentist. Archival & maintenance of such records is essential to safeguard against any potential medico-legal litigations[6]. Many Indian dentists are not aware & are not well-informed

about record maintainence[20]. An analysis of studies carried out in different Indian cities revealed that though undergraduate education provided sufficient exposure to forensic odontology, it was not enough to generate interest or awareness about the kinds of dental records required to support forensic work in legal cases.[17,18] In our study, around 91.9% participants agreed that dental record maintenance was helpful for many a forensic identification & crime solving purposes, in which majority were internees (98.9%), followed by UGs (94%) & PGs (77%) (Fig. 2) which was similar to the study done in Chennai city.[19]

Forensic dentists involved in identifying deceased individuals and investigating crimes are often called upon to testify in court as expert witnesses[16]. 66.3% of the participants, among which were 72.5% UGs, followed by interns (68.2%) & PGs (50%) were aware that dentist could become an expert witness during court testimonial trials which thus widened career planning opportunities in dentistry (Fig. 5).

The least percentages of awareness & practice towards forensic odontology among the PGs (Fig. 4) could be explained on the basis that they were more focused upon their subjects which they had already chosen for their postgraduation and thus remained less knowledgeable about forensic dentistry.

More than half of the study population were interested in pursuing Forensic courses while comparative analysis of research conducted in different Indian cities revealed that though undergraduate education provided sufficient exposure to forensic odontology it was not enough to stimulate or spark interest in students to pursue career options in forensic to support the importance of forensic work in legal cases[11]. Thus, lack of sufficient formal training in forensic dentistry, limited exposure to the subject, minimal emphasis in undergraduate curriculum, and inadequate practical experience with forensic cases are among the plethora of reasons for minimal utilization of forensic odontology in India.[6,7]

CONCLUSION

Our study thus concluded that with that more than 70% of participants were interested in undertaking training in forensics and almost all students did possess adequate knowledge about teeth & its uniqueness in structure which helped in crime solving situations. Majority of them were aware about lip prints, palatal rugae & bitemark analysis. All this knowledge was sought through a single window system that is learning forensics as an insignificant part of other subject in their undergraduate curriculum. This clearly shows the need to emphasize, expand, and multiply the learning platforms & create futuristic goals about inculcating forensics compulsory in dentistry and also create opportunities to utilize the knowledge thus gained.

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