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Assessment of knowledge, attitude and practice about forensic odontology among dental students in Shivamogga city: A cross-sectional study

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Abstract

Introduction: Forensic odontology aids crime-solving, collaborating with law enforcement, pathology, and anthropology. It uses radiography and bite mark analysis, solving cold cases and aiding court proceedings, crucial during mass disasters. Yet, its global prevalence was minimal compared to forensic medicine. India lacks forensic odontology courses, discouraging potential candidates and fostering negative perception. Objective: To assess the knowledge and attitude and practice among dental students in Shivamogga city, on forensic odontology. Methodology: A Questionnaire-based study was conducted among 318, 3rd, 4th, internship and postgraduate's dental students across 2 colleges in Shivamogga city. 15 questions were formulated and circulated through google forms. Statistical analysis was done using Kendall's tau and Chi-Square tests. The predetermined significance level was set as $p < 0.05$. Result: Out of 318 responses, 24.5% were 3rd-year students, 28.6% were 4th-year students, 25.8% were in an internship, and 21.1% were postgraduates. The survey question regarding the study of lip prints in forensic dentistry, and the inquiry about knowledge and awareness of forensic odontology, were statistically significant in biological sex, age group, and year of study. The remaining 13 questions were significant in one or two variables. Conclusion: In Shivamogga, there was an absence of exposure to the field of forensic odontology, primarily due to its exclusion from the undergraduate curriculum and the absence of workshops, seminars, and continuing education programs for postgraduates. This suggests a clear need for formal training to raise awareness among dental professionals about the significance of forensic odontology in society.

Keywords: Forensic odontology, crime-solving, radiography, bite mark analysis, mass disasters

Introduction

Forensic odontology, derived from the Latin term "forensis," which refers to the "court of law" or forum, was a specialized branch of dentistry concerned with the legal aspects of dental evidence. According to the Federation Dentaire International, forensic odontology aims to promote justice by meticulously managing and analyzing dental data while preserving it for legal investigations [1]. The discipline encompasses various applications, including criminal cases, insurance disputes, marital conflicts, impersonation, and the identification of missing persons [2]. Dental features, like fingerprints, were nearly unique to each individual, making them critical in forensic identification processes [3]. The resilience of dental tissues, capable of withstanding temperatures as high as 1600°C, ensures their viability in identifying remains long after death, utilizing indicators like decay, missing teeth, and dental fillings according to the DMF (Decayed, Missing, Filled) Teeth criteria [4]. Despite global advancements in forensic dentistry, the field remains underdeveloped in India, with limited studies contributing to a significant gap in literature and slower progress [5]. The field of forensic identification was inherently multidisciplinary, requiring collaboration between law enforcement, forensic odontologists, anthropologists, pathologists, and other specialists for accurate results [6]. Notable instances of forensic dental identification included the use of DNA from toothbrushes to identify victims of the 9/11 World Trade Center attacks and the identification of Saddam Hussein's sons through dental evidence [7]. In India, the first recorded dental identification occurred in 1191 when M. Raja Jayachandra Rathore was recognized by his false anterior teeth [7]. While India offers diploma and postgraduate programs in forensic odontology, only three institutions provide a Master of Dental Surgery, limiting student access and hindering the field's nationwide expansion [8].

Materials and Methods

Ethical consideration: This studied was conducted after obtaining written institutional approval from Institutional Ethical Committee, Subbaiah Institute of Dental Sciences, Shivamogga (SIDS/IEC/0038). Written informed consent was taken from the participants.

Study design: This was a cross sectional studied conducted at Subbaiah Institution of Dental Sciences, Shivamogga and Sharavathi dental college and hospital Shivamogga. It was carried out between January 2024 to April 2024 for 2 months.

Sample size: The convenience sample of 318 participants, these many participants were participated in this study.

Inclusion Criteria

- Study includes only 3rd year, 4th year, internship and postgraduates' dental students.

Exclusion Criteria

- Students who were not interested in the study.
- Study excludes all first years, second years dental students.

Materials

- Question are in Google Forms
- Data Collection Tool
- Data collection was carried out over a period of three

months.

- The questionnaire would be distributed via an online survey platform to facilitate greater participation.
- These questionnaires utilized in this studied were adapted from Giannakopoulos *et al*, Kostis *et al*. to ensure that the selected questions were relevant and applicable, capturing insights specific to the context of the Shivamogga dental institutions.

Statistical Analysis

The data was entered in Microsoft excel sheet.

- The data was analyzed using the statistical software SPSS version 23
- Descriptive statistics of the data was expressed in terms of frequency and percentage, mean and standard deviation also calculated.
- Correlation was performed using Kendall's Tau test, depending on the type of variables.
- The significance of the difference between two proportions would be assessed with chi-squares test.

Results

A total of 318 dental students completed the questionnaire, out of 522 which included 169undergraduates, 82 interns and 67postgraduates. Males (123 [39%]) and females (195 [61%]) aged between 19 and 29 years were included. The demographic characteristics of the respondents were presented in Graph 1, Table 1 Frequency of age groups with year of study.

Table 1: Frequency of age groups with year of studied

Sr. no.	Year of study	Age groups	N (%)
1.	3 rd years	19 - 21	78 (24%)
2.	4 th years	20 - 23	91 (29%)
3.	Interns	20 - 29	82 (26%)
4.	Post graduates	21 - 29	67 (21%)

p < 0.05(considered as statistically significant)

Table 2: The answers of students (n=318) to the survey questions were presented.

Q. no.	Survey questions	Answers	Participants [N (%)]
Q1	Are you aware that the forensic odontology is a branch of dentistry?	Yes	298 (93.7%)
		No	20 (6.3%)
Q2	Can teeth serve as a source of DNA?	Yes	252 (79.2%)
		No	46 (14.5%)
		I don't know	20 (6.3%)
Q3	How do you identify the dental age in children and adult?	Eruption pattern and calcification	229 (72%)
		Histological method	38 (11.9%)
		Biochemical method	42 (13.2%)
		I don't know	9 (2.8%)
Q4	How will you identify a deceased person's age and gender in mass disasters?	Reconstruct the fragmented deceased body	87 (27.4%)
		Dental records	149 (46.9%)
		Fingerprints	55 (17.3%)
		I do not know	27 (8.5%)
Q5	Is forensic dentistry useful in identifying the criminals and dead people?	Yes	253 (79.6%)
		No	47 (14.8%)
		I do not know	18 (5.7%)
Q6	What is the study of lip prints in forensic dentistry?	Lipology	31 (9.7%)
		Cheiloscopy	215 (67.6%)
		Dermatoglyphics	37 (11.6%)
		I do not know	35 (11%)
Q7	Are you aware of the significance of bite mark pattern of teeth?	Yes	283 (89%)
		No	35 (11%)
Q8	What is the source of your knowledge about forensic dentistry?	Book	66 (20.8%)
		Internet	67 (21.1%)
		Workshops, seminars, lectures	170 (53.5%)

		I do not have knowledge	15 (4.7%)
Q9	Do you think your knowledge and awareness about forensic odontology is enough?	Yes	132 (41.5%)
		No	168 (52.8%)
		I do not know	18 (5.7%)
Q10	Are you interested to participate in workshops and seminars in forensic odontology?	Yes	263 (82.7%)
		No	55 (17.3%)
Q11	Are you aware of your institution maintain dental records?	Yes	195 (61.3%)
		No	106 (33.3%)
		N/A	17 (5.3%)
Q12	Do you think meticulous dental record keeping is a significant component of quality patient care?	Yes	244 (76.7%)
		No	45 (14.2%)
		Maybe	29 (9.1%)
Q13	How will you identify physical neglected/sexual/psychological abuse of a child?	Physical injuries	8 (2.5%)
		Behavioral changes	14 (4.4%)
		Clothing	5 (1.6%)
		Any scar	13 (4.1%)
		All of the above	271 (86.2%)
		I do not know	7 (2.2%)
Q14	What action would you take if you identify child abuse?	Inform police	140 (44%)
		Inform parents	167 (52.5%)
		Take no action	11 (3.5%)
Q15	Are you aware that you can testify as an expert witness in the court to present forensic dental evidence?	Yes	220 (69.2%)
		No	78 (24.5%)
		N/A	20 (6.3%)

$p < 0.05$ (considered as statistically significant)

Table 2 summarizes the survey results from 3rd-year, 4th-year, Intern, and Postgraduate students. Of the participants, 93.7% were aware that forensic odontology was a branch of dentistry, and 79.2% recognized that teeth could provide DNA. For dental age identification, 72% rely on eruption patterns, 11.9% use histological methods, and 13.2% use biochemical methods. In mass disaster cases, 46.9% would use dental records, 27.4% would reconstruct fragmented bodies, and 17.3% would rely on fingerprints. Forensic dentistry's role in identifying criminals and deceased was acknowledged by 79.6% of respondents.

Cheiloscopy was correctly identified by 67.6%, and 89% understand the importance of bite mark patterns. Information was mostly gained from workshops (53.5%), while only 41.5% feel their knowledge was adequate, though 82.7% want more training. In institutional practices, 61.3% know their institution maintains dental records, and 76.7% believe good record-keeping was vital for quality care. For child abuse identification, 86.2% would look for physical or behavioral signs, and 52.5% would inform parents, while 44% would go to the police. Lastly, 69.2% know they could testify as expert witnesses in court.

Table 3: Correlations of student's answers to survey questions with demographic characteristics.

Q. no.	Survey questions	Biological sex	Age group	Year of study
Q1	Are you aware that the forensic odontology is a branch of dentistry?	tau = 0.020 p = 0.727	tau = -0.011 p = 0.822	tau = -0.063 p = 0.222
Q2	Can teeth serve as a source of DNA?	tau = -0.059 p = 0.280	tau = -0.109* p = 0.025	tau = -0.165** p = 0.001
Q3	How do you identify the dental age in children and adult?	tau = -0.115* p = 0.033	tau = -0.022 p = 0.651	tau = -0.026 p = 0.573
Q4	How will you identify a deceased person's age and gender in mass disasters?	tau = 0.073 p = 0.164	tau = -0.136** p = 0.003	tau = -0.142** p = 0.003
Q5	Is forensic dentistry useful in identifying the criminals and dead people?	tau = -0.039 p = 0.478	tau = -0.022 p = 0.658	tau = -0.081 p = 0.106
Q6	What is the study of lip prints in forensic dentistry?	tau = 0.029 p = 0.585	tau = -0.096* p = 0.043	tau = -0.110* p = 0.024
Q7	Are you aware of the significance of bite mark pattern of teeth?	tau = -0.071 p = 0.203	tau = -0.205** p = 0.000	tau = -0.252** p = 0.000
Q8	What is the source of your knowledge about forensic dentistry?	tau = -0.035 p = 0.513	tau = -0.003 p = 0.948	tau = -0.083 p = 0.085
Q9	Do you think your knowledge and awareness about forensic odontology is enough?	tau = 0.155** p = 0.005	tau = -0.193** p = 0.000	tau = -0.151** p = 0.003
Q10	Are you interested to participate in workshops and seminars in forensic odontology?	tau = -0.029 p = 0.600	tau = -0.041 p = 0.411	tau = -0.050 p = 0.330
Q11	Are you aware of your institution maintain dental records?	tau = -0.097 p = 0.078	tau = -0.100* p = 0.040	tau = -0.146** p = 0.004
Q12	Do you think meticulous dental record keeping is a significant component of quality patient care?	tau = -0.021 p = 0.703	tau = -0.131** p = 0.007	tau = -0.158** p = 0.002
Q13	How will you identify physical neglected/sexual/psychological abuse of a child?	tau = 0.102 p = 0.061	tau = 0.021 p = 0.662	tau = 0.048 p = 0.332
Q14	What action would you take if you identify child abuse?	tau = 0.017 p = 0.756	tau = -0.035 p = 0.470	tau = -0.097 p = 0.056
Q15	Are you aware that you can testify as an expert witness in the court to present forensic dental evidence?	tau = -0.032 p = 0.560	tau = -0.191** p = 0.000	tau = -0.236** p = 0.000

* Questions allowing single answers only. Statistically significant p-values in bold.

Positive, weak, and statistically significant correlations were found between students' biological sex and their responses to questions like "How did you identify the dental age in children and adults?" and "Is your knowledge of forensic odontology sufficient?" A negative, weak, and statistically significant relationship was noted between biological sex and awareness of forensic odontology as a branch of dentistry. Students' age groups also showed negative, weak,

and statistically significant correlations with questions about child abuse actions and the importance of dental record-keeping. Additionally, year of studied exhibited negative, weak, and statistically significant correlations with questions on knowledge sources, awareness of forensic odontology, age identification methods, and interest in workshops (Table 3).

Table 4: Statistical significance difference levels of the Chi-square test associations of student answers to survey questions with demographic characteristics

Q. no	Survey questions	Biological sex	Age group	Year of study
Q1	Are you aware that the forensic odontology is a branch of dentistry?	0.727	0.210	0.389
Q2	Can teeth serve as a source of DNA?	0.105	0.022	0.000
Q3	How do you identify the dental age in children and adult?	0.058	0.194	0.050
Q4	How will you identify a deceased person's age and gender in mass disasters?	0.009	0.073	0.004
Q5	Is forensic dentistry useful in identifying the criminals and dead people?	0.435	0.512	0.254
Q6	What is the study of lip prints in forensic dentistry?	0.043	0.009	0.000
Q7	Are you aware of the significance of bite mark pattern of teeth?	0.203	0.006	0.000
Q8	What is the source of your knowledge about forensic dentistry?	0.495	0.000	0.000
Q9	Do you think your knowledge and awareness about forensic odontology is enough?	0.002	0.000	0.000
Q10	Are you interested to participate in workshops and seminars in forensic odontology?	0.599	0.333	0.467
Q11	Are you aware of your institution maintain dental records?	0.209	0.458	0.009
Q12	Do you think meticulous dental record keeping is a significant component of quality patient care?	0.104	0.033	0.011
Q13	How will you identify physical neglected/sexual/psychological abuse of a child?	0.008	0.933	0.089
Q14	What action would you take if you identify child abuse?	0.784	0.343	0.217
Q15	Are you aware that you can testify as an expert witness in the court to present forensic dental evidence?	0.353	0.056	0.000

Statistically significant *p* - values in bold italics.

The chi-square test showed significant associations between age group, mean age, academic year, and students' survey responses. A statistically significant link was found between biological sex and responses to questions like "What was the source of your knowledge about forensic dentistry?" and "Is your knowledge of forensic odontology sufficient?" Similarly, biological sex was significantly associated with responses on identifying child abuse. Year of studied was also significantly associated with questions about DNA in teeth, the studied of lip prints, the significance of bite mark patterns, knowledge sufficiency, and testifying as an expert witness. Questions on lip prints and knowledge sufficiency were statistically significant across all age groups, mean age, and academic year (Table 4).

Discussion

Dentists, like other healthcare professionals, play a key role in identifying signs of abuse, such as child, elder, or spousal abuse, especially when dealing with unusual oral injuries. Abuse-related injuries could include fractured or missing teeth, jaw fractures, labial frenum lacerations, and bruises on the lips, face, or neck. Kenney and Clark report that 50% of child abuse injuries involve the oral and perioral areas. Bite mark analysis was valuable in forensics, aiding in matching suspects to crimes¹⁴. Dental records serve not only forensic purposes but also legal and insurance functions, yet many practitioners fail to keep complete records or meet the legal requirement to retain them for 7-10 years¹⁵.

Our study, conducted at Subbaiah and Sharavathi Institutes of Dental Sciences in Shivamogga, assessed awareness, knowledge, attitudes, and practices regarding forensic odontology among undergraduate and postgraduate students. We found gaps in knowledge and training, indicating a need for better education in forensic odontology¹³. In India, forensic odontology training was

limited, with few institutions offering it, few workshops or conferences available, and inadequate laboratory facilities. Many studies were reported about forensic odontology. The studied aimed to assessed dental professionals' awareness and aptitude in forensic odontology. A questionnaire was distributed, covering topics like dental record maintenance and forensic knowledge. Results showed 93.5% had studied forensic odontology basics, 75.3% recognized signs of physical abuse in pediatric patients, and 56.3% could document bite marks. However, 78.4% were unaware of dental record preservation for forensic use. The studied concluded a lack of knowledge and formal training in forensic odontology among dental practitioners in India ^[4].

This studied aimed to assess the knowledge, attitude, and practice of forensic odontology among dental students at Riyadh Elm University, Saudi Arabia. A survey of 400 students showed that 75% of postgraduates, 42% of graduates, and 40.9% of undergraduates knew teeth could serve as a DNA source. Most participants (95%) understood the role of forensic dentistry in investigations, but 62.73% of undergraduates were unaware of job opportunities in the field, and 97.5% said forensic dentistry wasn't part of their curriculum. The studied concluded that undergraduates and graduates had less knowledge and practice in forensic odontology than postgraduates ^[13].

This studied aimed to assessed the knowledge and attitude of senior dental students in Chennai regarding forensic odontology. A survey of 400 students revealed that while most received formal education, they felt their knowledge was inadequate due to limited exposure. The students suggested that increased emphasis on forensic odontology could expand its potential in India, where the field remains underdeveloped compared to other countries ^[9].

This studied assessed the knowledge, attitude, and practice of forensic odontology among 322 dental practitioners in

Chennai. Results showed that 21% did not maintained dental records, 93% lacked formal training, and many were unaware of key forensic practices such as dental age estimation (41%) and child abuse reporting (40%). The studied concluded that dental practitioners in Chennai had insufficient knowledge and practice in forensic odontology^[12]. Our studied focused on evaluating the level of awareness and knowledge about forensic odontology among the participants, as well as their attitudes towards this field. By assessing these factors, we aimed to identify gaps in knowledge and training, and to highlight the need for enhanced educational efforts in forensic odontology within the dental curriculum at these institutions¹³. Furthermore, only a few workshops or conferences on forensic odontology were held annually for dental surgeons, limiting opportunities to spark student interest in the field^[16].

Limitations

The studied only involved students from two dental colleges in one city, so the results might not be applicable to all dental students in India. Additionally, students did not receive sufficient hands-on experience or training in forensic odontology, which impacted their knowledge and confidence. These limitations indicate the need for broader, more diverse sampling and improved educational frameworks to enhance forensic odontology awareness and practice among dental students.

Conclusion

The studied revealed a significant gap in knowledge and practice of forensic odontology among dental students in Shivamogga, highlighting minimal curriculum presence and practical exposure in India. This indicates a need for integrating forensic odontology in the curriculum and specialized training to better prepare students for effective participation in the field.

Public Health Significance

Forensic odontology was crucial for identification in legal and disaster scenarios, but it remains underdeveloped in India due to inadequate education and training. This studied identifies gaps in dental students' knowledge and suggests that better education and training could improve their forensic skills, enhance dental record-keeping, and strengthen public health and legal systems.

Conflict of Interest

Not available

Financial Support

Not available

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