Original Article

Assessment of Knowledge, Awareness and Practice of Forensic Odontology amongst Dental Students in Bareilly

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ABSTRACT

Background: Forensic dentistry is a challenging and fascinating branch of forensic science that involves the application of dental sciences in the identification of deceased individuals through the assessment of ante-and post-mortem records. Lately, Forensic Odontology (FO) has evolved as a new ray of hope in supporting forensics, but, this vital field is in a state of infancy in India. **Aims and Objectives:** The aim of the study is to assess the knowledge, awareness and practice of FO amongst Dental Students in Bareilly. **Materials and Methods:** A cross-sectional study was conducted in a sample of 126 dental students (undergraduate, PG and interns) in Bareilly and data were collected by means of a questionnaire. The questionnaire consisted of 15 relevant questions with demographic data. **Results:** The present study revealed that 98.63% of the participants know importance of FO and 43.83% were aware of the time record for maintaining dental records. 82.87% of the participants know that the dental age and gender can be determined by examining the teeth. 93.15% were aware of polymerase chain reaction method used for identifying the genetic relationship between individuals 93.15% wanted to undergo training for FO. **Conclusion:** Though forensic dentistry is still evolving in India, it has the potential to grow significantly with the right awareness and instruction. However, by including FO in our academic program along with providing practical courses for the same, this condition could be remedied.

Key words: Awareness, Forensic odontology, Knowledge

INTRODUCTION

The term "forensic" is derived from the Latin word forensic, which means, "pertaining to the forum," which means "court of law."[1] Forensic science refers to areas of endeavor that are used in a judicial situation and accepted by the court and the general scientific community to separate truth from untruth.[2] Forensic science applies science and technology to the detection and investigation of crimes and the administration of justice.[3] In particular, forensic odontology (FO) involves identifying the deceased by analyzing antemortem and post-mortem evidence while the deceased is mutilated, burned, dismembered, and skeletonized in catastrophic events or mass calamities.[4]

According to the World Federation, FO is a division of dentistry that deals with the management of dental proof in the interest of justice and proper assessment and presentation of dental findings. In the year 1849, law accepted 1st case in which FO was applied.[5]

The entity of forensic dentistry comprises four areas of interest: Dental identification, Bite marks, Cheiloscopy (study of lip prints), and Rugoscopy (study of palatal rugae patterns). The important uses of FO include identification of humans through dental records and also used during crime scene; in cases of abuse through bite marks/physical injuries, age determination as well as gender of the living or dead and to attest in the court with forensic dental evidences.[1]

Although the Indian Dental Association recommends that an individual's dental records (radiographs, models, photographs, and clinical correspondence) should be securely retained for at least the legal minimum period of 5–6 years, the practice is yet to be enforced in all dental practices across India.[3] Currently, in India, dental students are given an introduction to FO at the undergraduate (UG) level in the subjects of oral pathology and medicine. In future, if FO evolves itself as a new specialized branch in dentistry, it may provide a hope of anticipation for the budding dental surgeons in India.[6] The question continually arises whether

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or not the dental practitioners ought to understand about FO.[4] The main obstacles to expanding the application of FO for the daily benefit of society at the moment are a dearth of trained personnel, a lack of training facilities, and an inadequate UG introduction to the field.[3] So this study was planned.

MATERIALS AND METHODS

Study design and population

A cross sectional study was conducted in August 2024 to determine the knowledge, practice and attitude regarding FO among dental students of Institute of Dental Sciences, Bareilly. This was done through a questionnaire having 15 close-ended questions. The sample was calculated using G*power 3.1 software (Franz Faul universitat, Keil, Germany). Sample size of 115 students is deemed to be appropriate to conduct the study at 0.05 level of significance.

Data collection

The questionnaire was distributed amongst 225 students. Out of which, only 146 students were incorporated in the study as some students dropped out, some didn't completed the form and some didn't submit the form. Information was obtained from demographic data of participants which includes gender, age and education level.

Questionnaire

An overview of the 15 questions is shown in [Table 1]. The data collected were used to evaluate the following components:

1. Knowledge
2. Practice
3. Attitude.

Statistical analysis

Using the statistical package Statistical Packages for the Social Sciences version 23 the statistical analysis was done. The descriptive statistics included frequency and percentage. The ordinal variable were compared using the Chi-square test and correlations were establishes using Chi-square test.

RESULTS

Demographic profile	
Gender	
Female	94 (64.38)
Male	52 (35.62)
Educational qualification	
3rd year	27 (18.49)
4th year	28 (19.18)
Post-graduate	50 (34.25)
Internship	41 (28.08)

Table 1: Questionnaire composition

Category	No. of questions
Knowledge	7
Awareness and practice	8

Q.1: Do you think FO is an important facade of dentistry?

In our study, 98.63% of the participants were aware of the branch of science called forensic dentistry among the females 97.9% were aware and 97.9% were aware among the females. The intergroup comparison between males and females was statistically non-significant.

Q.1	No (%)	Yes (%)	Total (%)	Chi-square (%)	*P*-value	Significance
Female	2	92	94	1.172	0.472	Non-significant
	2.1	97.9	100.0			
Male	0	52	52			
	0.0	100.0	100.0			

Q.2: Do you consider FO as an efficient method to identify victims in a mass disaster?

In our study, 97.26% of the participants considered FO as an efficient method to identify victims in a mass disaster among the males 98.1% were aware and 96.8% were aware among the females. The intergroup comparison between males and females was statistically non-significant.

Q.2.	No (%)	Yes (%)	Total (%)	Chi-square (%)	*P*-value	Significance
Female	3	91	94	0.203	1.000	Non-significant
	3.2	96.8	100.0			
Male	1	51	52			
	1.9	98.1	100.0			

Q.3: Do you consider bite marks pattern of human teeth as an important adjunct for assessing crime scene?

In our study, 97.94% of the participants considered bite marks pattern of human teeth as an important adjunct for assessing crime scene? Among the females 96.8% were aware and 100.0% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.3.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	3	91	94	1.694	0.553	Non-significant
	3.2	96.8	100.0			
Male	0	52	52			
	0.0	100.0	100.0			

Q.4: Do you think lip print patterns of human can be used for identification of a population?

In our study, 82.19% of the participants thought lip print patterns of human can be used for identification of a population among

the females 83.0% were aware and 80.8% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.4.	No	Yes	Total	Chi-square	*P*-value	Significance
Female	16	78	94	0.112	0.822	Non-significant
	17.0	83.0	100.0			
Male	10	42	52			
	19.2	80.8	100.0			

Q.5: Are you aware that you are eligible to appear in the court to present forensic dental evidence?

In our study, 78.08% of the participants thought lip print patterns of human can be used for identification of a population among the females 79.8% were aware and 75.0% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.5.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	19	75	94	0.444	0.535	Non-significant
	20.2	79.8	100.0			
Male	13	39	52			
	25.0	75.0	100.0			

Q.6: Are you aware of any methodology to estimate the dental age of an individual by examining the teeth which can be used for legal purposes?

In our study, 82.87% were aware of any methodology to estimate the dental age of an individual by examining the teeth which can be used for legal purposes among the females 80.9% were aware and 86.5% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.6.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	18	76	94	0.735	0.421	Non-significant
	19.1	80.9	100.0			
Male	7	45	52			
	13.5	86.5	100.0			

Q.7: Are you aware of time for which dental record should be maintained?

In our study, 43.83% were aware of time for which dental record should be maintained. Among the females 44.7% were aware and 42.3% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.7.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	52	42	94	0.077	0.972	Non-significant
	55.3	44.7	100.0			
Male	30	22	52			
	57.7	42.3	100.0			

Q.8: Can teeth serve as a source of DNA?

In our study, 83.35% were aware that teeth serve as a source of DNA among the females 89.4% were aware and 86.5% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.8.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	10	84	94	0.258	0.601	Non-significant
	10.6	89.4	100.0			
Male	7	45	52			
	13.5	86.5	100.0			

Q.9: Are you aware of PCR method used for identifying the genetic relationship between individuals?

In our study, 93.15% were aware of polymerase chain reaction method used for identifying the genetic relationship between individuals among the females 93.6% were aware and 92.3% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.9.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	6	88	94	0.090	0.744	Non-significant
	6.4	93.6	100.0			
Male	4	48	52			
	7.7	92.3	100.0			

Q.10: Can sex determination be done using Barr bodies?

In our study, 85.61% were aware that sex determination be done using Barr bodies among the females 85.1% were aware and 86.5% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.10.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	14	80	94	0.040	0.901	Non-significant
	14.9	85.1	100.0			
Male	7	45	52			
	13.5	86.5	100.0			

Q.11: As a dentist, we can help forensic experts by maintaining records?

In our study, 98.63% believed as a dentist, we can help forensic experts by maintaining records among the females 98.9% believed and 98.1% believed this among the males. The intergroup comparison between males and females was statistically non-significant.

Q.11.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	1	93	94	0.021	0.979	Non-significant
	1.1	98.9	100.0			
Male	1	51	52			
	1.9	98.1	100.0			

Q.12: Did your teaching curriculum included how to maintain dental records at institutional level?

In our study, 72.60% read in their teaching curriculum about how to maintain dental records at institutional level among the females 73.4% and among the males 71.2% had read in their teaching curriculum about how to maintain dental records at institutional level the intergroup comparison between males and females was statistically non-significant.

Q.12.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	25	69	94	0.095	0.827	Non-significant
	26.6%	73.4	100.0			
Male	15	37	52			
	28.8%	71.2	100.0			

Q.13: Are you aware of any forensic odontologist in Bareilly region?

In our study, 8.90% were aware aware of any forensic odontologist in Bareilly region among the females 7.4% were aware and 11.5% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.13.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female		7	94	0.691	0.545	Non-significant
	87	7.4	100.0			
Male	46	6	52			
	88.5	11.5	100.0			

Q.14: Are you aware of any formal training centers in India for FO?

In our study, 34.24% aware of any formal training centers in India for FO. Among the females 30.9% were aware and 40.4% were aware among the males. The intergroup comparison between males and females was statistically non-significant.

Q.14.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	65	29	94	1.351	0.277	Non-significant
	69.1	30.9	100.0			
Male	31	21	52			
	59.6	40.4	100.0			

Q.15: If given a choice, would you undergo any such training?

In our study, 93.15% wanted to undergo training for such a purpose. Among the females, 94.7% were interested for formal training and 90.4% were interested for formal training among the males. The intergroup comparison between males and females was statistically non-significant.

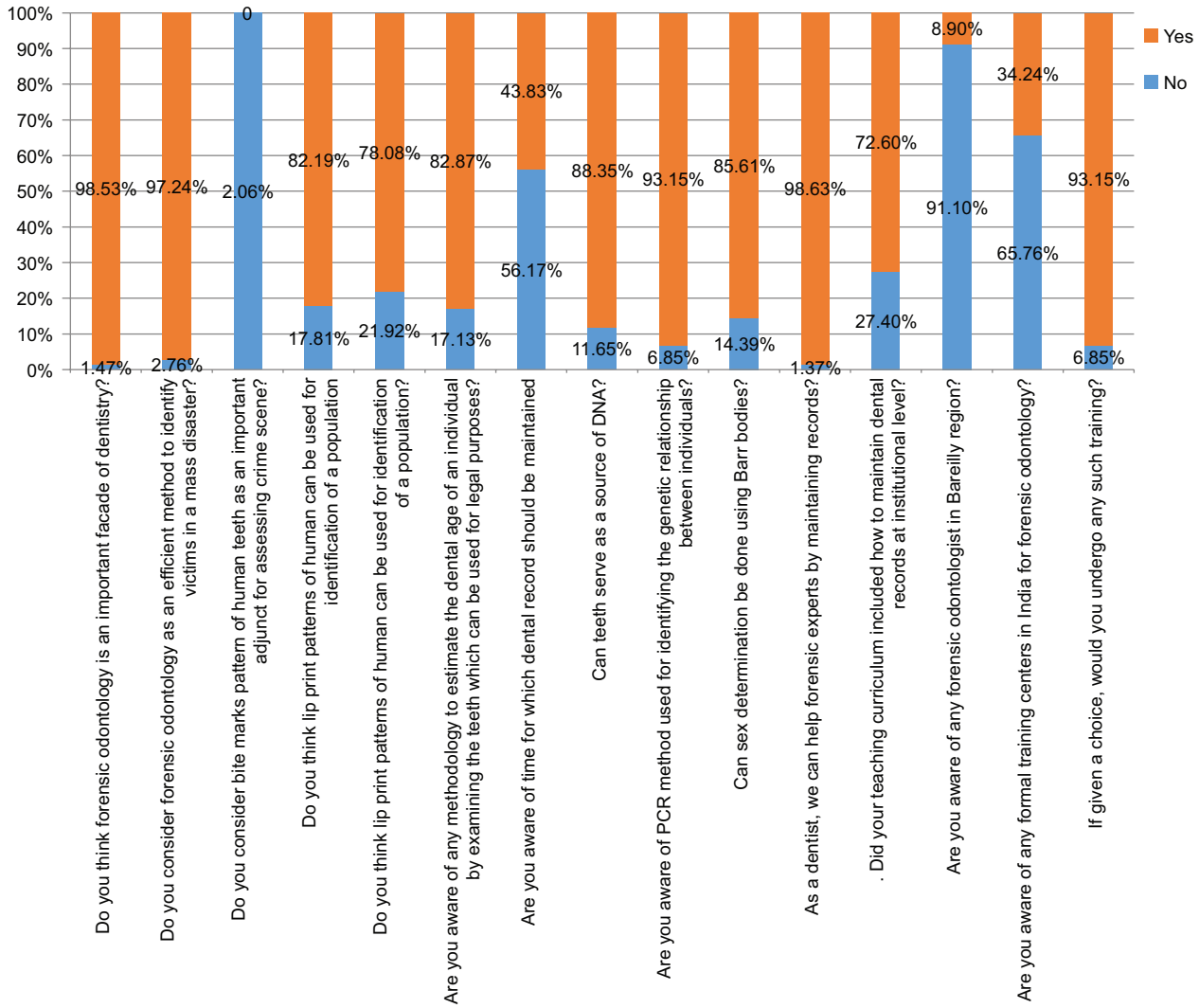
Q.15.	No (%)	Yes (%)	Total (%)	Chi-square	*P*-value	Significance
Female	5	89	94	0.967	0.312	Non-significant
	5.3	94.7	100.0			
Male	5	47	52			
	9.6	90.	100.0			

Question	No (%)	Yes (%)
Do you think forensic odontology is an important facade of dentistry?	02 (1.47)	144 (98.63)
Do you consider forensic odontology as an efficient method to identify victims in a mass disaster?	04 (2.76)	142 (97.26)
Do you consider the bite marks pattern of human teeth as an important adjunct for assessing crime scene?	03 (2.06)	143 (97.94)
Do you think lip print patterns of humans can be used for identification of a population	26 (17.81)	120 (82.19)
Are you aware that you are eligible to appear in court to present forensic dental evidence?	32 (21.92)	114 (78.08)
Are you aware of any methodology to estimate the dental age of an individual by examining the teeth that can be used for legal purposes?	25 (17.13)	121 (82.87)
Are you aware of the time for which dental record should be maintained	82 (56.17)	64 (43.83)
Can teeth serve as a source of DNA?	17 (11.65)	129 (88.35)
Are you aware of the PCR method used for identifying the genetic relationship between individuals?	10 (6.85)	136 (93.15)
Can sex determination be done using Barr bodies?	21 (14.39)	125 (85.61)
As a dentist, we can help forensic experts by maintaining records?	02 (1.37)	144 (98.63)
Did your teaching curriculum include how to maintain dental records at institutional level?	40 (27.40)	106 (72.60)
Are you aware of any forensic odontologists in the Bareilly region?	133 (91.10)	13 (8.90)
Are you aware of any formal training centers in India for forensic odontology?	96 (65.76)	50 (34.24)
If given a choice, would you undergo any such training?	10 (6.85)	136 (93.15)

PCR: Polymerase chain reaction

DISCUSSION

In the difficult and intriguing field of forensic science known as "forensic dentistry," dental sciences are applied to identify living or deceased individuals.[1] Better awareness of FO among the DP's would be necessary in medicine. The practice of FO is important in a no. of developed countries.[2] This study was directed amongst the dental students to evaluate their awareness about FO.



Various questionnaire-based studies related to FO were conducted in various regions.

Nagarajappa *et al.*,[2] conducted a cross-sectional study on 149 dental practitioners in Kanpur which revealed that participants had good awareness about FO but lack of practice in dental record management.

Similar study conducted in Karachi by Akram *et al.*,[5] on 248 dentists. The majority of dentists (86.2%) understood the value of forensics in dentistry, and the majority (88.7%) knew that if they kept accurate records, they might assist forensic specialists. The results showed that the dentists have sufficient knowledge and positive attitude in the field of FO.

On the contrary, a study conducted in Chennai by Preethi *et al.*,[7] to analyze the knowledge, attitude and practice among dental practitioners (n = 322) in Chennai. 21% of the DP's maintained dental records, with only 12% of the practitioners maintaining complete records. Half the respondents were unaware of any methodology to approximate the age by teeth examination, which was in contrast with our study where nearly 82.87% were aware.

In our study 97.94% of the subjects were aware of the bite marks which is conceded with the study conducted by Preethi *et al.*, where 82% were acquainted with significance of bitemarks and 71.4% of respondents were familiar with bite mark patterns according to Bhakhri *et al.*,[8]

In the present study, when inquired whether human lip prints could be used for identification of a population, the results of this study showed that 82.19% of the respondents agreed with it. These results are in dissimilarity with the studies carried out by Nagarajappa *et al.*[2] and Rahman *et al.* where about 70% of the respondents answered this question in affirmative.

Another contrasting study, conducted in eastern province of Saudi Arabia by Al Khalaf *et al.*,[9] to evaluate knowledge and practice of forensic dentistry among DP's working in the Eastern province, Saudi Arabia. Seventy-three percent of participants said they didn't know enough about forensic dentistry. During their UG studies, over two-thirds of the individuals did not receive any forensic dental training. 10% of the participants dealt with forensic dental cases.

Kashif *et al.*,[10] conducted a study among two dental schools in Karachi that sought to appraise the knowledge of FO among teaching faculty, post-graduate trainees and house officers. The results indicated that 61.20% (n = 306) of people believed in the significance of retaining the dental record. 67.80% (n = 339) of investigators could estimate age of a victim while only 49.20% (n = 246) of cases identified gender. About 46.20% (n = 231) of participants agreed that forensic dentistry helped out in the testification as an expert witness.

Pillai *et al.*,[6] conducted a study in Gujarat on 607 participants consisting of dental students, DAs, and DPs in Gujarat. 95.7% agreed that dental evidence plays a significant role in forensic cases. 80% of the respondents agreed for a separate PG course in FO. For more than 80% of the participants, dental age estimation and bitemark analysis were deemed the most promising areas in FO.

Rahman *et al.*,[3] assessed the knowledge, awareness, and practice related to FO among BDS, MDS and interns in Bhubaneswar. Surprisingly, the MDS group had the lowest degree of awareness (24.3%), with just roughly 40% of the respondents knowing the requisite time period for keeping dental records.

Rubel *et al.*,[11] conducted a study to analyze the awareness of FO among dentists (n = 200) in Davangere and revealed that 88.5% of the participants were aware that maintaining records is important. In our study, 98.63% were aware that we can help forensic experts by maintaining records.

Another study by Bhargava *et al.*,[12] was conducted amongst the teaching staff in Jharkhand. A total of 102 dental faculty members from diverse specialties participated in the survey. Ninety-five percentage of study participants agreed that teeth are likely to be a source of DNA. In our study, 88.35% students were aware of use that teeth can be used as a source of DNA.

In the present study, when the respondents were inquired regarding the awareness of presence of any forensic odontologist in India, surprisingly, 34.24% were aware of it. Which is in accordance with a study conducted by Rubel *et al.* 34.24% of the respondents knew forensic odontologists in India.[11] but they are unaware of any forensic odontologist in Bareilly region.

Among most studies didn't show much gender difference. In our study, Women were significant respondents (64.38%), which is in accordance with the study conducted by Kashif *et al.*[10]

Dental tissues' resilience to external stresses while maintaining originality is what makes FO so important. For this reason, teeth are a great and reliable source of DNA material. The knowledge that they acquired from the media helped participants to answer better.[8]

Forensic odontologists associated with the age estimation/identification and in some criminal investigations are usually summoned in the court to provide testimony as an "expert witness" Nearly one-fourth of the participants in our study were unaware of the fact that they could attest in court to present forensic evidence.[4] Which is in accordance with the study conducted in Bhubaneswar in 2017 by Rahman *et al.*,[3] who concluded that 63.14% were aware that they are eligible whereas, which is in contrast with the study conducted in Kanpur where 95.9% students were aware.[2]

Overall knowledge could be concised as moderate knowledge among students regarding FO but as this is still an emerging branch and need to be explored further. FO to advance and mature into a separate specialty, multidisciplinary approaches involving all the stakeholders need to be incorporated. Teaching FO in the educational sector should be promoted and it should be a separate dental subject as most of the seminars, lectures and courses in our area do not give an opportunity to this field. We also recommend introducing those new models of practice of FO along with post-graduate programs in the field so that our students could play a valuable role in the field.

CONCLUSION

The students were aware about the basic knowledge, importance, and awareness about FO but they still need to be educated about their practical aspects.

Future scope

In the upcoming years, the field of FO will gain more prominence thanks to the inclusion of FO as a distinct subject in the dentistry curriculum and official courses.

Limitations

- The limitations of this study include that the data were collected through self-administered questionnaires, which can result in over or under-estimation. Therefore, it should be kept in mind that the respondents may not have answered the question meticulously.
- Hence, we further emphasize on a larger sample size with a more distinct distribution of members in future studies.

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