An insight into the awareness and utilization of “dental evidence” among the police force in Punjab

Deepti Sharma,
George Koshy,
Amandeep Pabla¹,
Sanchita Garg,
Manveer Singh
Departments of Oral and
Maxillofacial Pathology,¹ Public
Health Dentistry, Christian Dental
College and Hospital, Ludhiana,
Punjab, India

Access for correspondence:
Dr. Deepti Sharma,
Department of Oral and
Maxillofacial Pathology, Christian
Dental College and Hospital,
Ludhiana, Punjab, India.
E-mail: deepti_dentist@yahoo.co.in

Abstract

Introduction: The prime objective of the subsequent investigation is to ascertain the identity of an individual by the evaluation of evidence and facts relevant to crime or disaster. The whole process revolves around the correct interpretation of the facts, reconstruction, and comprehension of the sequence of events and thus single evidence forms a very important piece of information. In most of the countries including India, forensic medical, and dental evaluation at the crime scene are performed by police officials as medical and dental experts are rarely involved as first responders. Aims and Objectives: This questionnaire-based study is aimed to emphasize the importance of dental evidence in human identification, age and gender determination, and expanding the role of dentistry in criminal investigations. Material and Methods: A questionnaire-based study was conducted among the 350 gazetted and nongazetted police officers posted in Ludhiana (Punjab) commissionerate. It was exploratory in nature. Results: We found that the gazetted officers, postgraduates, and personnel with <20 years of experience revealed that commendable knowledge, positive attitude, and approach for the practical applications of forensic odontology (FO) in routine investigations. Conclusion: Dental professionals and law enforcement agencies must go hand in hand so that FO can be utilized to its maximum potential.

Key words: Forensic, knowledge, law, odontology, police, records

How to cite this article: Sharma D, Koshy G, Pabla A, Garg S, Singh M. An insight into the awareness and utilization of “dental evidence” among the police force in Punjab. J Forensic Dent Sci 2018;10:27-33.
last few decades, this branch has justified its utilization in different aspects of individual identification and criminal investigations.[6]

From the past few years, there has been an alarming rise in incidences of brutal rapes, human trafficking, terrorist attacks, homicides, and natural disasters in India.[5] Many such cases have been primarily solved with forensic dental evidence. It is difficult to forget the horrifying Nirbhaya rape and murder case (2013), where photographic and computer-aided analysis of the bitemarks found on the victim’s body helped to identify the five prime suspects.[8] In Sheena Bora murder case (2016), the facial superimposition technique was used to ensure the identity through skeletal remains particularly jaw and teeth, which were exhumed 3 years after the murder[7] and also in Prime minister Rajiv Gandhi’s assassination (1991), dentition helped in his identification.[9] Apart from these cases, selected famous international cases have also been enlisted in literature which has involved dental forensic science.[9] Moreover, Indian statistics reveals nearly 63,611 deaths in 2001–2010 due to various natural disasters. These incidents have emphasized on the necessity to adopt a multidisciplinary approach for identifying the victims and perpetrators.[10]

The information on the individual’s age, race, and gender and also sometimes cause and time of death could be ascertained by recognizing dental sample as substantial evidence by police personnel as they are the first one to take custody of investigating sites/crime scenes.[11] The knowledge about recognizing a dental sample as substantial evidence by police personnel is important to prevent the loss and tampering of evidence. However, the irony is that neither the police force nor the dentists are well aware of the significance of dental evidence and a dentist’s opinion in the context of law.[12] The criminal trials in India are governed by the Criminal Procedure Code and Indian Evidence Act 1872, which are the parent procedural laws. The sections 45, 46, and 47 of the act highlight that the court when required can trust the skills of persons with technical knowledge of the facts concerned.[13] Thus, a dental professional’s words could be used as an expert opinion in the context of law. It is high time to realize that this branch is no longer an abstraction but is closely woven into the fabrics of the law enforcement agencies.[14]

In our country, where FO is still in its infancy, it becomes a necessity to educate and arm the crime investigating officers and their team with the protocols and tools of forensic dental science. This would help them to identify, recover, and interpret the dental evidence correctly, thus providing timely justice to all.[15] This questionnaire-based study is pursued with the following objectives.

**Objectives**

A. To evaluate the knowledge and attitude of police officials regarding the subject of FO and dental evidence

B. To assess the awareness about identification, collection, utilization, and interpretation of dental evidence by investigators (disaster management/crime scene)

C. To emphasize the importance of utilization of FO protocols and tools for evidence evaluation

D. To develop an awareness/training program based on the feedback.

**Material and Methods**

This questionnaire-based survey was carried out by the Department of Oral Pathology and Public Health Dentistry of Christian Dental College and Hospital, Ludhiana (Punjab). It was exploratory in nature, cross-sectional in design. The study was conducted among the police officers posted in Ludhiana commissionerate including the gazetted and nongazetted police personnel as participants. The officials on special duty/short-term duty/leave, those who participated in the pilot study and officials who could not read or write Punjabi were excluded from the study.

The stratified sampling technique was used, and police stations/posts of five zones (North, South, East, West, and Central) in Ludhiana were covered. Statistically, the sample size for the study for a population of 4300 police officials in Ludhiana was calculated to be 350 (with a degree of accuracy = 5% and confidence interval = 95%). The information on the nature of the study was provided to all the participants and the consent implied by an individual’s voluntary completion of the questionnaire was acknowledged. A pilot study was conducted among 30 police officers, which were later excluded from the main study.

A questionnaire containing 22 questions was designed to assess the awareness, approach, and status of utilization of dental evidence and FO science among the participants [Figure 1]. It was prepared initially in English and later translated into the official Punjabi language. Back translation was done for content reliability. The validity of the questionnaire was also assessed in both languages. The content validity was evaluated through the distribution of questionnaire among the subject experts and investigating officers. The content and face validity were observed to be 0.8 which was satisfactory. The questionnaire was comprised two parts. The first section was for demographic details and the second part catered to questions emphasizing on forensic dentistry and dental evidence. Sufficient time was given to the participants to fill the questionnaire (5–7 min). Descriptive statistics were used for statistical evaluation. Completed questionnaires were coded, and spreadsheets were created for data entry, and the data were analyzed using SPSS version 17 (SPSS Inc., Chicago, IL, USA). Chi-square test was used to find the association between demographics parameters and knowledge, attitude, and practice regarding FO.
Results

The first part of the questionnaire was designed to obtain the demographic details of the participants including the age, gender, rank, qualifications, and the experience. The males (89%) formed the dominant study participants as compared to females (11%). The mean age of the participants was 37.6 years. More than half of the participants had <20 years of experience (54.3%), and 64% of individuals were undergraduates. The constables and head constables constituted 41.7% and 36.9% of the study population, respectively [Figure 2]. Most of the participants considered the study idea and design highly constructive, and the response rate was 100%.

The police officials irrespective of their ranks have sufficient knowledge about the role of FO in age estimation ($P = 0.004$) with 100% response rate for gazetted officers. About 68.7%
of high-rank officers were aware of the fact that dental evidence could be used as substantial biological evidence in the context of law. When questioned about high-profile cases which have been solved using dental evidence, 38% of the participants mentioned Nirbhaya case, but most of them were unaware of other cases. However, 19% considered dental prosthetic replacements as important evidence which should be taken to the forensic laboratory for evaluation \((P = 0.004)\). Nearly, 51% of them were significantly aware of the fact that as such no center or state level guidelines are available for dental evidence collection [Figure 3 and Table 1].

Based on their education, we observed that 75% of matriculates considered circumstantial evidence such as wallets, jewelry, and clothing as more significant proofs for human identification. For evidence collection, undergraduate, graduates, and postgraduates depended mainly on their training \((P = 0.001)\). About 64.3% of postgraduates considered bitemarks as reliable evidence from the crime scene; however, only 21% were equally aware of the significance of tissue sample and saliva around the bitemark as substantial evidence [Table 2]. Fingerprints and blood stains were considered as the most reliable evidence over the lip prints and saliva \((P = 0.006)\) by the participants with more than 20 years of experience. The bitemarks, bruises, and saliva were considered as reliable evidence in cases of child abuse by the officers with <20 years of experience \((P = 0.004)\). Nearly, 77% of participants on experience basis considered lack of proper record maintenance as major hindrance for the utilization of dental records for forensic investigations [Table 3].

**Discussion**

The enforcement of the principles of FO in routine criminal investigations and mass disasters involves the
Table 1: Observations based on the Rank

| Criteria                                           | Based on rank |
|----------------------------------------------------|---------------|
|                                                   | Constable     | HC             | ASI, SI        | ADCP, DCP     | *N  |
| Forensic odontology for age estimation             | 81 (55.5%)    | 72 (55.8%)     | 45 (76.3%)     | 16 (100%)     | 214 |
| Dental evidence as substantial evidence in court   | 29 (19.9%)    | 34 (26.4%)     | 17 (28.8%)     | 11 (68.7%)    | 91  |
| Use of dental prosthesis as evidence               | 33 (22.6%)    | 28 (21.7%)     | 4 (6.8%)       | 16 (100%)     | 65  |
| No protocol for evidence collection                | 50 (34.2%)    | 42 (32.6%)     | 10 (16.9%)     | 16 (100%)     | 179 |
| High profile cases (Nirbhaya case)                 | 65 (44.5%)    | 45 (34.9%)     | 19 (32.2%)     | 13 (81.2%)    | 132 |

*N: Number of participants

Table 2: Observations based on the qualification

| Criteria                                           | Based on qualification |
|----------------------------------------------------|------------------------|
|                                                   | 10<sup>th</sup> | 12<sup>th</sup> | Graduate | PG   | *N  |
| Circumstantial evidence for human identification   | 92 (74.8%)  | 63 (61.2%)  | 58 (60.4%) | 12 (42.9%) | 225 |
| Bite marks as evidence on adhesive tape            | 32 (26.0%)  | 28 (27.2%)  | 28 (29.2%) | 18 (64.3%) | 106 |
| Tissue sample/saliva around bite mark              | 51 (41.5%)  | 32 (31.1%)  | 21 (21.9%) | 6 (21.4%)  | 110 |
| For evidence collection rely on training           | 59 (48.0%)  | 64 (62.1%)  | 63 (65.6%) | 21 (75.0%) | 207 |

*N: Number of participants

Table 3: Observations based on the experience

| Criteria                                           | <20 years | >20 years | *N  |
|----------------------------------------------------|-----------|-----------|-----|
| Fingerprints as evidence over dental evidence      | 113 (59.5%)| 118 (73.8%)| 231 |
| Evidence in child abuse cases                      | 67 (35.3%)| 36 (22.5%) | 103 |
| Bite mark and saliva as evidence                   | 115 (60.5%)| 69 (43.1%) | 184 |
| Methods for collection of bite mark                | 53 (27.9%)| 26 (16.3%) | 79  |
| Lack of records                                    | 42 (22.1%)| 18 (11.3%) | 60  |

*N: Number of participants

Expertise of forensic dentists, investigating officers, and judiciary. At the crime investigating site, all personals involved (especially the first responders) should have an adequate understanding of the forensic process and the scientific disciplines. Their prime priority should be to maintain the integrity of crime scene and evidence. We observed that 51% of police personnel were not aware of the protocols or guidelines for evidence collection, especially regarding dental evidence. Forensic medical science is essential and integral part of the training curriculum of the police force, but FO is only briefly discussed. Thus, explaining the hostile and indifferent attitude toward the forensic dentistry. This study highlighted the lack of knowledge and training for the identification and handling of dental evidence. We found that gazetted officers, postgraduates, and personnel with <20 years of experience revealed praiseworthy knowledge, positive attitude, and approach for the practical applications of FO in routine investigations. However, personnel with more than 20 years of experience were sticking to the old norms, and 75% of them still considered fingerprints as more substantial proofs over tooth prints. Although we could not find data, supporting these findings in the literature. This study emphasizes the role of education and mass media to develop a positive approach for a new field.

Our research comes with modest limitations that include small sample size, although sampling was based on stratification. Second unequal distribution of participants according to designation (more of constables and head constables in our study) was also observed. As this study was a questionnaire based in design, subjectivity could be a confounding factor. But all in all, it sheds light on the prevalence and status of FO in criminal investigations and disaster management.

In this study, constables, head constables, and the assistant subinspectors formed the team of investigating officers reaching first at the crime scene site as described by 96% of the participants. A few said that nature of the crime or incidence decides who will be the first to take hold of the situation. The similar findings were observed in the studies conducted by Pandit et al. and Garg et al. in accordance with this findings, Senthil et al. in their study conducted in Puducherry observed that oral and dental findings were not reported in crime investigation files, and dental samples as substantial biological evidence were not valued and accepted by the police force due to ignorance or lack of awareness. Thus, the whole investigation could be compromised and misled if dental evidences are left unnoticed by the evidence collectors. Deebaei et al. in their study conducted in Tehran observed that out of 248 only in 4.8% cases, the tooth information (dental records and position of teeth) had been used for identification. In this study, police personnel had meager knowledge regarding the tools and equipment required for dental evidence collection and transportation, with only 23% respondents being aware of bitemarks collection methods. Shamim has discussed few dental evidence identification protocols, methods, and tools in their study.
Most of the criminal cases, conflicts, and natural and man-made disasters dealt by the police force do not involve the active participation of forensic dental experts.[22] We strongly feel that in such circumstances knowledge and skill of forensic odontologist could be a blessing in disguise, as a tooth could be the missing lead for solving a crime by comparative dental identification.[23] Pandit et al. also highlighted the need for better communication between the police personnel and forensic odontologists.[24] Mansour Al-Sarhani-advocated the implementation and utilization of FO in criminal investigations to identify the suspects and victims.[25] Rahmat et al. also suggested that police officers could be educated through structured continuing education programs.[26]

Hence, we recommend the inclusion of FO as a separate subject in the training curriculum of the police officers as police professionals, who lack the knowledge of FO, would be unable to competently assess and handle scientific evidence and hence the pursuit of justice can be seriously hampered potentially, leading to factual errors.[27] Dental institutes should conduct seminars, symposiums, workshops, and hands-on programs for the police and other security forces educating and instilling the practical aspects of FO. The educative programs should be conducted in different states, to ensure the utilization of this branch and police department should also embrace the knowledge and avail the services.[28]

Proper official dental evidence identification, collection, and analysis guidelines should be laid down and followed throughout India equivalently as adopted and implemented by American Board of FO.[29] A positive rapport with the police department is also required to begin the forensic dental services which could be mutually beneficial. The change has to be brought from the grass root levels. Teamwork is essential to ensure that evidence relating to the injury is documented, collected, preserved, analyzed, and interpreted following appropriate protocols and using scientifically accepted techniques.[30]

Shanbhag emphasized that several dentists and legal professionals are quite ignorant of the importance of keeping well-maintained dental records for the identification of unknown persons in the field of forensics and thus undermine their role as forensic experts[31] whereas dental records are more readily available than fingerprint database especially in American and European countries.[32] Hence, dentists have the social and legal obligation to maintain accurate, legible dental records of their patients. This is not practiced in India as we do not have a law to govern this and antemortem record maintenance depends on personal preferences.[32,33] Therefore, the central government should legalize the process of maintenance of antemortem dental records by government/private institutions, practitioners and should set the appropriate protocols while releasing these records safeguarding the privacy of patients.[34] The dental institutes should be identified at district/state levels, which could serve as referral centers with well-equipped dental laboratories, standardized techniques, and skilled forensic odontologists. The forensic dental experts should be recruited in state-level forensic laboratories.[35]

This study is conducted with the aim of changing the perception of society and police department toward the forensic dental science. We intend to collect the baseline data from the police personnel through this questionnaire-based study, emphasizing the importance of dental evidence in human identification, age and gender determination, and expanding the role of dentistry in criminal investigations. In the future, we plan to develop an awareness/training program based on the feedback. As this study is one of the few to encompass police personnel at a district level, it can be considered as an ongoing process of learning and delivering best possible methods to practice FO.

Conclusion

This article attempts to make the concerned professionals aware of the expanding role of FO. Dental Professionals have the moral responsibility of introducing and educating the police personnel and legal professionals about the potential applications of this branch so that judiciary would not falter to base their judgment on the undisputed dental evidence provided by Forensic dentist in the Court of law. The need of the hour is that dental professionals and law enforcement agencies must go hand in hand so that FO can be utilized to its maximum potential. The paucity of trained and skilled forensic dental manpower in India should be catered, and endeavors to foster and develop this discipline within the overall forensic science framework in India should be encouraged.

Acknowledgement

We sincerely thank Commissioner of Police Ludhiana(Punjab) Mr. JS Aulukh and ADCP Dr. Sandeep Garg to help us in our endeavor.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Łorkiewicz-Muszyńska D, Przystańska A, Łabęcka M, Kruzelnicki A. Current status of forensic odontology education – The underestimation of needs? Dent Med Probl 2013;50:217-22.
2. Luciana C, Isadora AD, Rafael GL. Forensic dentistry: An overview of the human identification’s techniques of this dental specialty. J Forensic Res 2014;6:256-61.
3. Avon SL. Forensic odontology: The roles and responsibilities of
4. Pretty IA, Sweet D. A look at forensic dentistry – Part I: The role of teeth in the determination of human identity. Br Dent J 2001;190:359-66.

5. Bansal S. Which city in India is safest to live in? The Hindu; 2016. Available from: http://www.thehindu.com/data/comparison-of-crime-in-indian-cities/article9081218.ece. [Last accessed on 2016 Sep 07].

6. Pandit S, Desai D, Jeergal P, Venkatesh S. Awareness of forensic odontology among police personnel: A new ray of hope in forensic odontology. J Forensic Dent Sci 2016;8:56.

7. Deshpande S, Sheena Bora case: How skull-face superimposition process identified remains. The Times of India; 2015. Available from: http://www.timesofindia.indiatimes.com/India/Sheena-Bora-case-How-skull-face-superimposition-process-identified-remains/articleshow/49916889. [Last accessed on 2016 Sep 27].

8. Sahni A, Rehani S, Mathias Y, Kardam P, Nagpal R, Kumari R, et al. A questionnaire survey on forensic odontology: Are we really aware? J Forensic Dent Sci 2016;8:113.

9. Ramasamy C. A select list of international cases involving forensic odontology (49-2013 AD). Available from: http://www.historyofdentistry.group/volumes/Select%20List%20Of%20Dental%20Forensic%20Cases.pdf. [Last accessed on 2017 Jan 27].

10. Puri PM, Khajuria H. Disaster Victim Identification (DVI) through dental evidence: Overview and challenges in Indian scenario. Int J Res Sci Innov 2015;2:55-7.

11. Pereira CP, Santos JC. The role of forensic odontology for identification of a criminal sexual assault: A casework report. J Civil Law Sci 2015;4:138-41.

12. Bassed R. Forensic odontology – Broader than just identification. Int Dent Australas Ed 2015;10:36-43.

13. Jaybhaye AS. Role of forensic expert in crime investigation – The Indian perspective. Int J Adv Res Law Soc Sci 2012;1:1-10.

14. Weigler S. Bite mark evidence: Forensic odontology and the law. Health Matrix J Law Med 1992;2:303-23.

15. Liu F, Lei G, Jia XD, He SY, Dang YH. Worldwide trends of forensic dentistry: A 20-year bibliometric analysis in Pubmed. Rom J Leg Med 2016;24:236-41.

16. Kavithe B, Einstein A, Sivapathasundharam B, Saraswathi TR. Limitations in forensic odontology. J Forensic Dent Sci 2009;1:8-10.

17. Uzabakirio A. The role of forensic science in criminal investigation in Rwanda. Res J Forensic Sci 2015;3:1-4.

18. Deebaei A, Moghaddam HF, Delkhosh P. The statistical analysis of application of teeth in forensic odontology center, Tehran, Iran, 1980-2000. Pak J Med Sci 2008;24:48-51.

19. Senthil M, Kumar D, Ramu C. Prevalence of using forensic odontology in crime investigation in identification of individuals – A retrospective study in Pondicherry city – India. J Sci Dent 2012;2:19-21.

20. Garg SP, Jindwani K, Singh K, Garg V. Role of a medical doctor at scene of crime. J Indian Acad Forensic Med 2013;35:66-70.

21. Bowers CM. Forensic Dental Evidence – An Investigator’s Handbook. San Diego, California: Elsevier; 2004. p. 1-65.

22. Shamim T. Forensic odontology. J Coll Physicians Surg Pak 2010;20:1-2.

23. Garg Y, Bhaskar DJ, Agali CR, Garg K. Forensic dentistry: An aid in criminal investigation. Int J Dent Med Res 2015;1:160-3.

24. Jurel SK. Role of dentist in forensic investigations. J Forensic Res 2012;3:148.

25. Sarhani MA. Implementations of forensic dentistry in criminal investigations. Eur Sci J 2014;10:196-201.

26. Rahmat RA, James H, Nambar P. Attributes of a competent forensic odontologist. Malays Dent J 2015;37:9-16.

27. Taylor J. A brief history of forensic odontology and disaster victim identification practices in Australia. J Forensic Odontostomatol 2009;27:64-74.

28. Acharya AB. A decade of forensic odontology in India. J Forensic Dent Sci 2010;2:1.

29. Metcalf RD, Klim-Lemann J. Overview of forensic odontology. J Calif Dent Assoc 2015;43:295-301.

30. Hinchliffe J. Forensic odontology, part 4. Human bite marks. Br Dent J 2011;210:363-8.

31. Shanbhag VK. Significance of dental records in personal identification in forensic sciences. J Forensic Sci Med 2016;2:39-43.

32. Sarode GS, Sarode SC, Choudhary S, Patil S, Anand R, Vyaz H, et al. Dental records of forensic odontological importance: Maintenance pattern among dental practitioners of Pune city. J Forensic Dent Sci 2017;9:48.

33. Brown KA. Procedures for the collection of dental records for person identification. J Forensic Odontostomatol 2007;25:63-4.

34. Devadiga A. What’s the deal with dental records for practicing dentists? Importance in general and forensic dentistry. J Forensic Dent Sci 2014;6:9-15.

35. Nedel F, Nedel AP, Silva RH, Lund RG. Evaluation of identification cases involving forensic dentistry in the city of Pelotas, RS, Brazil, 2004-2006. Braz J Oral Sci 2009;8:55-8.