

# Awareness of forensic odontology among police personnel: A new ray of hope in forensic odontology

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## Abstract

**Background:** Police personnel play an important role in collecting and producing evidence. Knowledge about the various aspects of forensic as well as dental sciences and related evidence in them provide a golden opportunity to forensic odontologists to actively participate in the identification of the accused or victim. They can also act as an expert witness in court to produce forensic dental evidence. **Aim:** To evaluate the awareness and knowledge about the utilization of forensic odontology during evidence collection by the crime scene investigation (CSI) officers. **Materials and Methods:** Four hundred police officers were included in this survey. A questionnaire was designed to assess the awareness and knowledge about forensic odontology and application of the known knowledge in identifying and considering the dental evidences. Data were analyzed using the software Statistical Package for Social Sciences (SPSS, Chicago, IL, USA) version 17.0 by comparing the overall awareness of forensic odontology among the trained SI officers and trainee police personnel. **Results:** The collected results showed that there is a requirement for changes in the current practice of evidence collection and highlighted the need for better communication between the police personnel and forensic odontologists. A significantly higher number of police officers in both the trained and trainee groups reported knowledge about the subject ( $P < 0.001$ ) through newspapers and mass media as the sources of knowledge. **Conclusion:** Even though the respondents have knowledge about forensic odontology, there is a lack of communication and facilities in their system; hence, steps must be taken to educate the police personnel about the application of forensic odontology.

**Key words:** Crime investigative officers, evidence collection, forensic odontology, questionnaire

## Introduction

Forensic odontology is a challenging and fascinating branch of forensic science. Application of science and


technology for the detection and investigation of crime and administration of justice is not new to us.<sup>[1]</sup> Forensic odontology has been defined by the Federation Dentaire

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Internationale (FDI) as branch of dentistry that, in the interest of justice, deals with the proper handling and examination of dental evidence and with proper evaluation and preservation of dental findings.<sup>[2]</sup> Avon classified forensic odontology into civil, criminal, and research.<sup>[3]</sup> It involves the identification of deceased individuals through the comparison of ante- and postmortem records.<sup>[4-6]</sup> The importance of communication, training, and evidence-based guidelines for collecting dental samples from the crime scene are essential to identify the offenders or victims. Knowledge about recognizing a dental sample as evidence by the police personnel is important so that there is no loss of evidence.

Recently, forensic odontology has evolved as a new ray of hope in the field of crime investigation due to its wide range of applications in the identification of human remains through dental records at the scene of crime such as domestic violence (child abuse, spousal abuse, or elder abuse) through bite marks and physical injuries, determination of age and gender of the living and deceased, and to testify as an expert witness in the court to produce forensic dental evidence.<sup>[7]</sup>

The question always arises as to whether the police personnel need to know about forensic odontology, the reason being that dental remains provide an accurate source of identification of the victim or the suspect. In recent times, the occurrence of natural and man-made disasters is more frequent in India with increasing crimes like gang rape and child abuse. During such calamities, the bodies of the victims may become mutilated beyond recognition where the vital role of forensic odontologist comes into the picture in the identification of such individuals and probes into the depth of crime.<sup>[5]</sup>

As police personnel are the ones who arrive first to the crime scene and take the chain of custody, their knowledge regarding identifying and collecting the biological evidences, dental prosthesis, and hard tissues is required in the growing field of forensic odontology.<sup>[6]</sup>

To evaluate the awareness and compliance of forensic odontology among police personnel, a small questionnaire-based survey was conducted in the city of Mysore, Karnataka, India.

## Materials and Methods

The survey included a study group of 400 police officers from Mysore city, which included 320 trained police officers (having more than 5 years of experience) and 80 trainee police officers. A questionnaire was designed to assess the awareness, knowledge, and status of utilization of forensic odontology science among the participants.

The questionnaire containing 14 questions [Table 1] was distributed among the two groups on a working day.

**Table 1: Questionnaire used in the study (option a, considered as 1 that was the expected answer and all other options are considered as 2 for the ease of statistical analysis)**

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Who visits the scene of crime?	Crime investigative officer, biologist, forensic odontologist Crime investigative officer, medical officer, forensic expert Crime investigative officer, biologist, toxicologist Crime investigative officer, biologist., human right officers
Who collects the evidence at the scene of crime?	Property recovery team and forensic expert Responding police patrol Forensic expert Medical officer
Victim personal identification is based on the examination of	Medical examination (for previous surgery, missing organs, implants) Body fluids (for alcohol, drugs, and poison) Dental examination Genetic identification
The postmortem unit consists of	Postmortem medical unit with dental laboratory facility Body examination unit Postmortem finger printing unit Postmortem dental examination unit
In the event of police patrol collecting the evidence, have you got any education and training?	Yes No
Collecting the evidence by you rely on	Training Experience
Accurate identification methods involves the collection of	Internal examination, e.g., medical evidence, dental evidence and laboratory findings Matching antemortem and postmortem evidence Circumstantial evidence like clothing, jewelry, and pocket contents External examination, e.g., of general features (description) and specific features (fingerprints)
The identification experts are	Crime investigative officers, biologists, forensic odontologists Medical officers, crime investigative officers, fingerprint experts Crime investigative officer, biologist, forensic science expert Biologist, finger print expert, medical officer
Ways through which you know about forensic odontology?	Newspapers As a part of your training program Internet Workshops conducted by dentists or forensic odontologist
Forensic odontology means	Forensic science that deals with tooth Forensic science that deals with poison cases Forensic science that deals with human skeletal remains Forensic science that deals with determining the time of death
Choice of evidence collection in mass disaster?	Any dental prosthesis Skull

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**Table 1: Contd...**

Tooth
Jeweler
Materials carried to the scene of incident for evidence collection are
Search and detection equipment along with forensic odontology kit
Site determination tape or barriers
Search and detection equipment
Photographic equipment
Mode of transport of the collected evidence?
Preservatives
Plastic container
Do you have any protocol for evidence collection
Yes
No

Information on the nature of the study was provided to all the participants and consent implied by an individual's voluntary completion of the questionnaire. The individual identity of the participants was noted in the questionnaire. Sufficient time was given to the participants to fill the questionnaire. The questions and the responses were coded numerically in order to facilitate data entry and analysis by SPSS version 17.0. Association between the different variables was tested using Chi-square and Fisher's exact test.  $P < 0.005$  was considered to be statistically significant.

## Results

A total of 400 questionnaires were distributed among the participating police personnel and the response rate was 100%. Four hundred forms were filled but the income box was left empty. This was considered valid for inclusion in the study.

The working experience among the participants from the trained group in the department ranged 5-22 years. Eighty trainee police personnel were also included in the study to evaluate the recent advances in their training period.

On analyzing the collected data, we found that newspapers were the main source of knowledge among a high proportion of subjects in both the trained and trainee groups ( $P < 0.001$ ) [Table 2]. This shows that there was no access or protocol to the study material during their training period concerning the subjects and there were no provisions for them to attend workshops conducted by other professionals like dentists or forensic experts.

Apart from the source of knowledge, the evidence-collection method is mainly based on the experience ( $P < 0.001$ ) of the trainee group. It was observed that 88% of the police officers collected evidence from the area of crime or calamity only on the basis of their experience, emphasizing no prior training in this field.

Our survey revealed that both the trained and trainee groups were interested in attending the forensic odontology workshops to expand their knowledge on the subject with the help of expert forensic odontologists. In our study, we also got the information that there is no protocol for evidence collection ( $P < 0.001$ ) that is statistically significant. No proper guidelines are followed for the mode of transportation of the collected evidence being available. Of all the evidences collected during mass disasters, 95% was mainly circumstantial evidence like jewelry, clothing, or pocket contents. The victim's personal identification is mainly based on medical examination (pervious surgery marks) that showed ( $P = 0.007$ ) highly statistically significant value.

Our study was designed to evaluate the knowledge of forensic odontology among police personnel. The result of the survey revealed that although the knowledge about forensic odontology is adequate, there is a lack of attitude and facilities in the application of this knowledge.

## Discussion

Keiser-Nelson defines forensic odontology as "that branch of forensic medicine which deals with proper handling, examination and presentation of dental evidence in best interest of justice."<sup>[8]</sup> It is a specialized field of dentistry related to solving legal problems where dental evidence is used for identification of victims, suspects, and abused in organized crimes as the tooth is the hardest tissue in human body that is extremely resistant to chemical and physical changes.<sup>[7]</sup>

The branch of forensic science consists of a crime scene investigator, forensic biologist, forensic pathologist, forensic toxicologist, and forensic odontologist.<sup>[9]</sup> Unfortunately, in India, forensic odontologists being involved in crime scene investigation are rare.<sup>[10]</sup>

In the current situation, crime scene assessment and evidence collection are normally the responsibilities of the police, which is a difficult and demanding exercise and it can only be brought to a successful conclusion if properly planned and with active involvement and participation of other agencies like forensic experts.<sup>[4,11]</sup>

Our present study was conducted to analyze the awareness levels in the crime scene investigation (CSI) officers, 99.8% showed that accurate identification method involves collecting the circumstantial evidences like clothing, jewelry, and ID cards. About 99.4% of investigated events did not include forensic odontologists during their visit to the crime scene. This shows that only 6% of chances remain where dentists can actively involve in crime scene investigation.

**Table 2: Results of the study**

Question	No. of officers with positive response=400		Trained n=320		Trained + trainee n=400		Trainee n=80		P
	n	%	n	%	n	%	n	%	
Officers visiting the scene of crime	400	100	318	99.4	398	99.5	80	100	1.000
Evidence collecting committee	400	100	215	67.2	400	100	59	73.8	0.258
Victim personal identification	400	100	224	70	400	100	68	85.0	0.007
Postmortem unit	400	100	312	35	400	100	58	72.5	0.204
Education and training given to collect the evidence	399	99.8	319	99.7	400	100	80	100	1.000
Evidence collection rely on	400	100	283	88.4	400	100	53	66.2	<0.001
Accurate identification method	399	99.8	319	99.7	399	99.8	80	100	1.000
Victim identification team consists of	400	100	373	93.2	400	100	80	100	0.842
Source of knowledge about forensic odontology	400	100	310	77.5	400	100	80	100	<0.001
Forensic odontology means	400	100	394	98.5	400	100	80	100	0.467
Mass disaster-evidence collection	384	96.0	304	95.0	400	100	80	100	0.050
Equipment carried to the scene of crime	400	100	320	100	400	100	80	100	<0.001
Collected evidence is carried through	396	99.0	316	98.8	400	100	80	100	0.315
Protocol for evidence collection	400	400	320	100	400	100	80	100	<0.001

Crime scene analysis is done by the crime scene investigators and the forensic experts. The crime scene investigators, as soon as they get the call of a crime event, reach the crime scene and collect the evidence with detailed measurements of the area, along with the sketch and diagrams of the scenes, photographs, documentation of the remains, and evidences, and then package, label, and transfer the evidences to the laboratory. The forensic expert collects the evidence, interprets the results, preserves the evidence, and relays the result as an expert witness.

Every incident, be it a crime, accident, natural disaster, armed conflict, or any other, leaves traces at the scene and provides extremely useful data for investigation and identification.<sup>[12]</sup> The goal of the subsequent investigation is to correctly interpret the facts, reconstruct the events, and understand the sequence of events. Arriving unprepared at the scene, especially without the commensurate equipment and expertise, may result in missed opportunities and compromise the entire investigation.

The reason why CSI officers are doing most of the evidence collection is because of the lack of communication and restricted knowledge on the individual system.<sup>[13]</sup> An uncoordinated approach can lead to misunderstanding, duplication of efforts, or to wrong assumptions that someone else is taking care of a particular assignment like police personnel or biologists collecting human remains without the presence of forensic odontologist. Without clear assignments of the responsibility, important elements at the scene may be overlooked, evidence may go unrecognized or worse, may be lost. Having too many or inappropriate people involved also runs the risk of compromising or destroying relevant evidence.

Forensic odontologist associated with the identification of the deceased and crime investigations are usually required to provide testimony in a court of law in the capacity of an "expert witness." An example of a case where forensic odontology has been applied successfully in solving criminal cases or to identify the offender or victim is as follows: Assassination of the former Prime Minister of India Mr. Rajiv Gandhi in 1991. The body remains were identified by his dentition.<sup>[5,7,14]</sup>

Recent tragedies and situations have shown the importance of dental evidence and the literature search covering the last 5 years that describe the novelties referred to buccodental studies in comparative identification, buccodental evaluation of reconstructive identification, human bites as a method for identifying the aggressor, and the role of DNA in sex identification. Oral cavity is a rich and noninvasive source of DNA that can be used to solve problems of a social, economical, or legal nature.<sup>[6,15]</sup>

Forensic odontology can be implicated in human identification during mass disasters as the teeth and jaws are impervious to most types of injury, being well-protected from fire and mechanical trauma, and are highly resistant to postmortem destruction and dental decomposition. It is also used to identify domestic violence and child abuse by bite marks and laceration on the soft tissues of the mouth. Palatal rugae patterns, lip prints, and cuspal inclination studies are the other tools of human identification.<sup>[4,7,10,16]</sup>

Lack of knowledge about the importance of biological evidence many a times lead to the loss of evidence like a bite mark or lip print that may be destroyed by the case attender in hospital; avulsed tooth, denture, or any prosthesis may go unnoticed by the evidence collectors. This can be overcome

by the knowledge and presence of forensic odontologist during evidence collection as a missing tooth gives hint of a missing link.

To date back to history, forensic odontologist along with the police personnel helped in solving the terrible secrets of the serial murderer Ted Bundy and identified him as a rapist and murderer through his bite mark on a victim's body.<sup>[17]</sup>

Recently, the forensic odontologist Dr. Ashith B. Acharya played a vital role in proving guilty all the accused in the Nirbhaya rape and murder case by examining the dental modules of the five accused sent by Delhi Police and comparing it with the bite marks on the victim's body.<sup>[14]</sup>

Through this study we would like to ask dentists and forensic odontologists to conduct more workshops or hands-on programs to create the awareness among the police personnel regarding the application of forensic odontology in solving medico legal cases. Police personnel should know the various forms of accurate identification methods by matching ante-and postmortem details obtained from circumstantial and physical examinations. Dental examination is a particularly important and effective method, the examination of teeth and jaws can only be properly carried out by forensic dental experts who will perform the oral examination as a part of general autopsy.<sup>[4]</sup> The obtained tooth, any maxillofacial prosthesis, or implants can be further used to analyze the age and sex of the individual by comparing the antemortem records obtained by the dentist. Dentists should make it a point to preserve the documents and study models of the patient. Police departments should introduce a course on the utilization of forensic odontology in case solving during trainings for investigative officers. Familiarization visits of investigative officers to forensic odontology centers will also help them know more about the recent advances in the field of forensic odontology.

## Conclusion

Forensic odontologists play a major role in the identification of those individuals who cannot be identified otherwise. Recent tragedies and situations have increased awareness concerning the importance of forensic dentistry in the identification of victims, especially in the current era in India. Forensic dentistry must be effectively introduced in the field of crime investigation. Moreover, the likelihood of future disasters due to terrorism, earthquakes, and other causes require dental professionals in India to be prepared for an expanded role.

Periodic training and participation in routine death investigations will be helpful in providing the knowledge and team work is needed for a successful response.

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## Conflicts of interest

There are no conflicts of interest.

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