

# Awareness of Forensic Odontology among Legal Professionals, Chennai, India

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## Abstract

**Background:** The forensic discipline of law is a multidisciplinary team comprising of specialists in forensic medicine, forensic odontology, security and law. **Aim:** The study was to find the awareness level of scope and utility of forensic odontology among lawyers in Chennai, South India. **Materials and Methods:** A cross-sectional study using a self administered structured questionnaire was conducted in 200 lawyers between August and September of 2013. The data was analyzed depending on age, gender, type and years of practice. **Results:** Lawyers above 40 years of experience were more aware of palatal rugae analysis ( $P = 0.02$ ), and those with more than 20 years were aware of lip print ( $P = 0.001$ ) and bite mark analysis ( $P = 0.001$ ). Males were more aware of forensic odontology with respect to criminal identification ( $P = 0.001$ ). The knowledge of bite mark analysis was higher among male lawyers ( $P = 0.001$ ), civil and criminal practicing lawyers ( $P = 0.004$ ). All participants were aware that loss or fracture of tooth constitutes a grievous injury under Indian Penal Code (IPC) 320 clause 7(5). **Conclusion:** This study highlighted the knowledge of forensic odontology among legal professionals and also identified the areas in which they need further appraisal.

**Keywords:** Bite marks, Forensic, Legal, Lawyers, Odontology, Questionnaire

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## Introduction

Forensic odontology deals with an examination of dental evidence, evaluation and presentation of dental findings in the interest of justice.<sup>[1]</sup> Various methods are used to resolve issues related to civil cases, criminal cases and dental jurisprudence. Though the scope of forensic odontology is well-established in the dental profession, the practical application lies largely in the hands of legal professionals, and their interaction with dentist is a crucial in its optimal application in legal issues.

The forensic discipline of law involves the application of science and technology in detection and investigation of crime and administration of justice, through

the coordinate efforts of a multidisciplinary team comprising of specialists in the forensic medicine, forensic odontology, police and lawyers. Dental identification remains one of the most reliable and frequently applied methods for the identification by the comparisons of ante-mortem and post-mortem records.<sup>[2]</sup>

Forensic odontology includes identification of human remains through dental records at the scene of crime, which assesses physical injuries in child or adult abuses, and determines age and gender of the living or deceased in order to present forensic dental evidence as a witness in a law court. The ability of the dental tissues to withstand environmental assaults and to retain its original structure is utilized in the law field to solve many cases. In forensic odontology, tooth prints, radiographs, photographs and investigations such as rugoscopy and cheiloscopy, are utilized.<sup>[3]</sup> Molecular methods including DNA fingerprinting contribute to the accurate forensic diagnosis.

This present study aimed to understand the level of awareness of forensic odontology among legal professionals in Chennai, India.

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## Materials and Methods

### Informed consent

The legal professionals were asked voluntarily to participate in the study, and the confidentiality was respected.

### Study design and participants

A pre-validated questionnaire was distributed to 200 lawyers [Table 1]. Convenience sampling was used to draw the sample. Both male and female lawyers were included in the study. The face validity and content validity of the questionnaires were assessed by specialists in both dentistry and law. The questions were framed to assess the knowledge and application of forensic odontological techniques in law and justice.

### Questionnaire design

The questionnaire had a set of 15 questions. The first part of the questionnaire consisted of demographic details including age, gender, and duration of work experience and the specialty they practiced in. The second part comprised of questions related to knowledge in forensic odontology, application of its techniques, law pertaining to dentistry and in handling of forensic odontological cases in their practice. The questions regarding the knowledge aspects in forensic odontology were: Whether the lawyers knew that forensic odontology is a part of forensic medicine; whether they knew that the enamel of tooth is the hardest part of the body; and also about susceptibility of dental hard tissues to degradation, the role in estimation of age, gender and victim/deceased identification. The application of forensic odontological

technique includes DNA analysis with the help of teeth, bite mark analysis, lip print analysis and rugae analysis. In the questionnaire, the options given were: Yes, no, and not sure. The questionnaire and consent forms were given in both English and the regional language Tamil.

### Statistical analysis

The data collected was analyzed using Statistical Package for the Social Sciences version 11.0. Descriptive statistics for the collected data was recorded. The associations between different variables were tested using the Chi-square test or Fisher's exact test. A *P*-value less than 0.05 was statistically considered significant.

## Results

A total of 200 individuals participated in the study, and the response rate was 100%. Lawyers less than fourth decade of age comprised of 65%, and more than fourth decade accounted for 35%. The study group comprised of lawyers in the age group between 23-88 years. Males comprised of 80% and females 20% in our study. Depending on the experience in the specific field of law, 77% of the lawyers had experience less than 20 years, and 23% had experience more than 20 years. The civil practitioners included in the study were 20%, 39% criminal practitioners and 41% practicing in both [Figure 1].

Lawyers aged above fourth decade had more knowledge regarding forensic odontology as a part of forensic medicine (*P* = 0.001), handled such cases (*P* = 0.015), and understood enamel of the tooth as the hardest part of the body (*P* = 0.002), bite mark analysis (*P* = 0.001) and

**Table 1: Questionnaire**

Forensic dentistry/ odontology is a part of forensic medicine	(Yes/No/Not sure)
Have you handled any forensic dentistry related case before? If yes mention the type of work	(Yes/No/Not sure)
Estimation of age can be done by examining teeth	(Yes/No/Not sure)
Gender determination can be done with the help of teeth, facial bones	(Yes/No/Not sure)
Forensic dentistry plays a role in victim/deceased & criminal identification	(Yes/No/Not sure)
Facial bones are used for reconstructive identity	(Yes/No/Not sure)
Enamel of the tooth is the hardest part of the body	(Yes/No/Not sure)
Dental hard tissues are easily susceptible to degradation and putrefaction	(Yes/No/Not sure)
DNA analysis can be done with the help of teeth	(Yes/No/Not sure)
Forensic dentistry plays an important role in identification of deceased when it is damaged beyond recognition by major catastrophes such as earthquakes, tsunami, fire accidents	(Yes/No/Not sure)
Forensic dentistry plays a role in civil cases involving malpractices	(Yes/No/Not sure)
Forensic dentistry plays a role in victim & criminal analysis	
Bite mark analysis	(Yes/No)
Lip print analysis	(Yes/No)
Rugae analysis(ridges in the upper part of mouth)	(Yes/No)
The court of law accepts the statement of dentist as an expert witness involving civil and criminal cases	(Yes/No/Not sure)
Dental jurisprudence is the application of principles of law to practice of dentistry	(Yes/No/Not sure)
Loss/fracture of tooth is a grievous injury under IPC 320 clause 7 (5)	(Yes/No/Not sure)

lip print analysis ( $P = 0.01$ ), when compared with those lawyers aged less than 40 years. Among the lawyers below fourth decade of age, 38% of them were aware of rugae analysis ( $P = 0.02$ ) [Figure 2].

Awareness of the knowledge about role of the forensic odontology in criminal or victim deceased identification ( $P = 0.001$ ), facial bones used for reconstructive identity ( $P = 0.001$ ), role in identification of deceased when damaged beyond recognition ( $P = 0.001$ ) and bite mark analysis ( $P = 0.001$ ) was more among the male lawyers in the study [Figure 3].

Lawyers, who had greater than 20 years of experience, had more knowledge regarding forensic odontology as a part of forensic medicine, handling of such cases, enamel of the tooth as the hardest part of the body ( $P = 0.001$ ), role in criminal/victim deceased identification ( $P = 0.004$ ) and facial bones used for reconstructive identity ( $P = 0.02$ ). Bite mark analysis and lip print analysis ( $P = 0.001$ ) were familiar among the lawyers with less than 20 years of experience. [Figure 4].

Criminal lawyers had more knowledge regarding DNA analysis with the help of teeth ( $P = 0.05$ ), rugae mark analysis ( $P = 0.001$ ), dentist as expert witness in a court of law ( $P = 0.03$ ) than those lawyers practicing in civil or both. The lawyers practicing in both civil and criminal cases were more aware of bite mark analysis ( $P = 0.04$ ), [Figure 5].

## Discussion

Forensic odontology has a key role in identification of persons in mass disasters for example, aviation, earthquakes or tsunamis, crime investigations and identification of decomposed and disfigured bodies like that of drowned persons, fire victims and victims of motor vehicle accidents.<sup>[4]</sup> Dentistry has much to offer law enforcement in the detection and solution of crime or in civil proceedings.<sup>[5]</sup>

Teeth and associated structures have played a major role in forensics. The history dates back to 66AD when

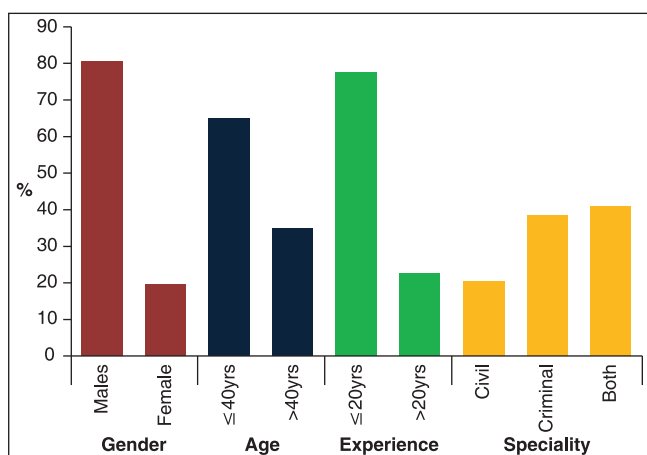


Figure 1: Sociodemographics of respondents

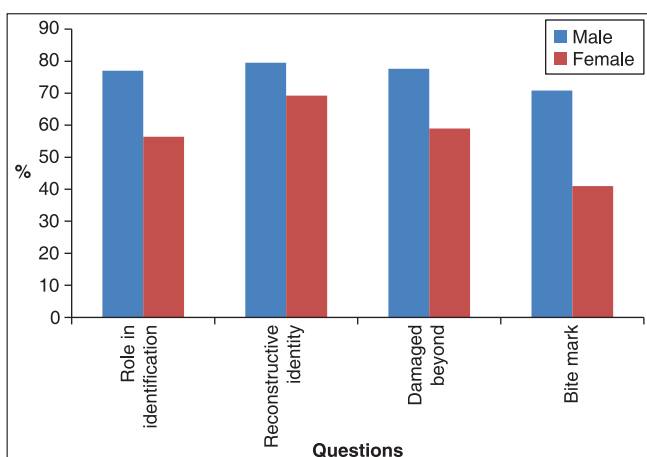


Figure 3: Awareness of forensic odontology related to gender

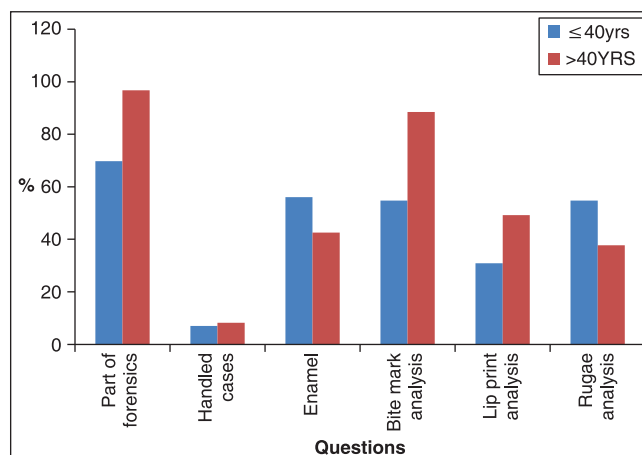


Figure 2: Awareness of forensic odontology related to age

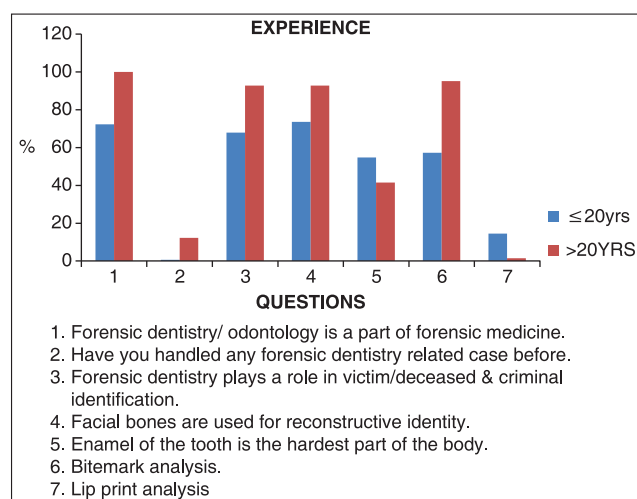
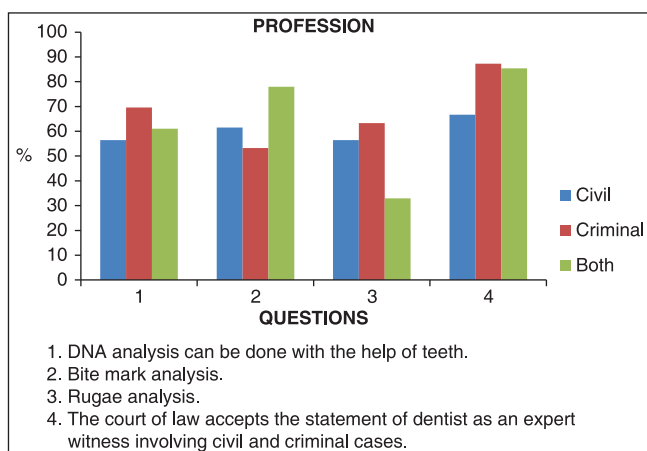


Figure 4: Awareness of forensic odontology related to experience



**Figure 5:** Awareness of forensic odontology related to specialty

the first victim was identified using teeth<sup>[6]</sup> to the recent incidents, in where bite marks had the potential to serve as corroborative evidence that supplemented fingerprints and DNA.<sup>[7]</sup> The practice of forensic odontology has gained importance in a number of countries across the world. The present study showed the knowledge among the practicing lawyers towards forensic odontology.

Investigation plays a very important role in any crime case. The lawyers should be well equipped with the knowledge of identifying individual's age and gender by teeth, associated structures, facial bone and DNA analysis using teeth.

In our present study, 91% lawyers knew about estimation of age, and 78% knew about gender determination. Age estimation and gender determination are of wider importance in forensics, not only for the purpose of identifying deceased victims but also in connection with crimes and accidents.

Lawyers above the fourth decade with a greater than 20 years of experience had a better knowledge regarding forensic odontology as a part of forensic medicine, this was perhaps due to the increased frequency in handling the general cases and encountering a varied type of cases.

Male lawyers and the lawyers with greater than 20 years of experience were more aware of the role of forensic odontology in the victim/deceased and criminal identification, and facial bones used for reconstructive identity. Male lawyers knew the role of forensic odontology in identification of deceased that is damaged beyond recognition by major catastrophes such as earthquakes, tsunami, and fire accidents. This suggests that the males have frequently encountered forensics cases during their practice and the practical difficulties of females to appropriately deal with these issues.

The results regarding the questions related to techniques used in forensic odontology such as the analysis of bite mark, lip print, rugae and DNA were obtained. Lawyers above the fourth decade, male lawyers, lawyers with greater than 20 years of experience and both civil and criminal lawyers were well-aware of the bite mark analysis. Lawyers above the fourth decade with greater than 20 years of experience were knowledgeable regarding lip print analysis, while those with less than 20 years of experience had better knowledge about enamel as the hardest part in the body. Rugae analysis was well known in the lawyers below the fourth decade and the criminal lawyers. Criminal lawyers were well-known of DNA analysis with the help of teeth, and accepted that they knew that the statement of dentist as an expert witness involving civil and criminal cases in a law court.

During crime investigations, many types of assaults are encountered of which biting is a primitive type. The bite mark is "a mark made by teeth either alone or in combination with other mouth part". Analysis of this type of evidence presumes that the dentition of the biter (animal or humans) is unique, can be compared scientifically, and is related to the resultant pattern mark on the surface of victim or object.<sup>[1]</sup> In the recently reported studies, the bite marks on the victim's body were identified through bite mark analysis, showing that the marks was left by the accused, and acted as an adjunct in getting the right judgment.<sup>[8,9]</sup>

The external surfaces of lips have numerous elevations and depressions forming a characteristic pattern called lip prints.<sup>[4]</sup> Palatal rugae are ridges and grooves in the roof of mouth radiating out tangentially. Just like fingerprints, the pattern of lip prints and rugae are considered every unique to every individual. The cheiloscopy using for examination of lip prints and the rugoscopy using for investigation of palatal rugae work as supplemental tools in forensic odontology. However, there are certain limitations in these forensic odontological techniques, as various factors can alter the lip print recording. Lip print pattern depends on whether the mouth is opened or closed. In closed mouth position, the lip exhibits well-defined grooves; while in open mouth position, the grooves are relatively ill defined and difficult to interpret.<sup>[4]</sup> As for rugoscopy, a postmortem identification is not possible without the antemortem records. The shape and clarity of bite marks found on the skin of the victims will change in a relatively short duration (10–20 minutes) both in living and dead, therefore, this necessitates their recording at the earliest possible time.<sup>[4]</sup> The lawyers should be kept informed of these forensic odontological techniques, as these methods are used in criminal judicial system worldwide.

In this preliminary study, the male (80%) and the female (20%) lawyers were not distributed equally. The

percentage of women among lawyers continues to be negligible in the Indian Bar,<sup>[10]</sup> and this is also reflected in the present study.

Comparison of results from the present study with other available published literature is not possible, since this study is the first report on awareness of legal professionals towards forensic odontology.

Legal professionals who lack knowledge of forensic odontology will be unable to competently assess and handle scientific evidence, and hence the pursuit of justice can be seriously hampered potentially, leading to factual errors.<sup>[11]</sup> The traditional law degree curriculum does not currently cover the basic concepts in forensic odontology. It should be addressed that the basic scientific concepts about forensic odontology can be incorporated, and that practical internship can also be included to equip the legal professionals for independently handling the cases in forensic odontology.

A similar study by Dekov on forensic medicine and legal practice emphasized the need for providing short-term lecture courses and publishing expertise guide for lawyers in this forensic field.<sup>[12]</sup>

## Conclusion

Lawyers help the police, investigators, dental surgeons and judges in the law court to restore truth from tooth.<sup>[13]</sup> A solid basic knowledge on forensic odontology and their practical applications in the legal field are essential for legal professionals to provide timely justice to one and all.

Although lawyers are well aware of the role of forensic odontologist in age estimation, gender determination and identifying victim/criminal identification, certain additional knowledge about DNA analysis with teeth, lip print and rugae analysis is needed.

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