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REVIEW ARTICLE

Legal Practices in Forensic Odontology in India: An Evidence-Based Review

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Abstract

Forensic odontology – the application of dental science to legal investigations – has emerged as a vital yet underutilized discipline in India's justice system. This article provides a comprehensive overview of forensic odontology and its legal relevance in India, examining the current legal framework, institutional guidelines, and key judicial precedents that govern its practice. We discuss representative case studies from Indian courts – involving human identification, bite mark analysis, and age estimation – where forensic dental evidence proved pivotal. Recent developments, including educational advancements and increased recognition of forensic odontology, are highlighted alongside persistent ethical and legal challenges facing practitioners. Key judicial rulings that have shaped the admissibility and weight of dental evidence in Indian courts are analyzed. Finally, we offer recommendations for strengthening the legal and institutional integration of forensic odontology into India's justice system. The goal is to underscore the significance of forensic odontology in criminal and civil proceedings and to chart a path for its enhanced utilization, standardization, and recognition as a forensic specialty in India. However, emerging global scientific critiques—particularly regarding bite mark analysis—necessitate cautious interpretation and corroborative use of forensic odontological evidence within the Indian legal framework.

Keywords: Forensic odontology, Expert evidence, Indian Evidence Act, Bite mark analysis, Disaster victim identification, Dental records, Age estimation, Juvenile justice, BNSS 2023, Ethics.

Introduction

Forensic odontology (forensic dentistry) applies dental knowledge to legal questions—most commonly: (i) human identification (living or deceased), (ii) disaster victim identification (DVI), (iii) bite mark evaluation, (iv) dental age estimation, and (v) assessment of oro-facial injuries and dental malpractice issues. Dental tissues and restorations are uniquely durable; teeth often survive fire, trauma, immersion, and decomposition, making them valuable when fingerprints or facial features are unavailable.[1]

In India, forensic odontology has gained visibility through high-profile prosecutions and disaster responses, but routine integration remains inconsistent. The main reasons include uneven training pathways, variable record-keeping practices, limited dedicated posts in forensic laboratories, and a lack of nationally uniform protocols.[2,3] Despite its increasing recognition, forensic odontology in India faces challenges related to standardization, scientific validation of certain methods, and variability in legal interpretation. These issues necessitate not only descriptive understanding but also critical evaluation of its evidentiary reliability."

Methodology

This review was conducted using a structured narrative approach integrating scientific literature and legal sources relevant to forensic odontology in India.

A comprehensive search was performed across the following databases and sources

- PubMed
- Scopus
- Google Scholar
- Indian Kanoon (legal database)
- Official government portals (India Code, NDMA)
- Institutional guidelines (DCI, IDA, INTERPOL)

Search Strategy

The following keywords and combinations were used

- Forensic Odontology India

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- Bite mark evidence reliability
- Dental age estimation law in India
- Expert evidence, Indian Evidence Act Section 45
- Forensic dentistry legal framework in India
- Disaster victim identification dental records
- Boolean operators (AND, OR) were applied where appropriate.

Inclusion Criteria

- Peer-reviewed scientific articles
- Landmark judicial decisions (Supreme Court and relevant trial courts)
- National and international forensic guidelines
- Articles discussing legal, ethical, and scientific aspects of forensic odontology

Exclusion Criteria

- Non-English publications
- Non-relevant or anecdotal reports
- Studies lacking scientific or legal relevance

Time Frame

Literature from 2000 to 2026 was primarily considered, with inclusion of older landmark legal cases where relevant.

Data Synthesis

The collected data were analyzed and synthesized into thematic categories

- Legal framework
- Institutional context
- Applications in legal practice
- Scientific reliability
- Ethical and legal challenges

A critical appraisal approach was adopted to compare Indian legal acceptance with global scientific standards.

Legal framework governing forensic odontology in India

Expert evidence under the Indian Evidence Act, 1872

Forensic odontologists enter court primarily as "experts" under Section 45 of the Indian Evidence Act, which recognizes opinions of persons specially skilled in "science or art" as relevant.[1] Once the court is satisfied about (a) the necessity of expert assistance and (b) the expert's competence, odontological opinions—e.g., comparative dental identification, interpretation of radiographs, bite injury assessment, and age estimation—can be admitted.

Key legal point

admissibility is not the same as proof. Courts typically treat expert opinion as *advisory* and weigh it against the totality of evidence. It is crucial to distinguish between the admissibility of expert opinion and its evidentiary weight, as courts retain discretion in evaluating reliability.

"Caution" principle for relying on expert opinion

Indian courts have repeatedly cautioned against resting a conviction solely on expert opinion without corroboration. In Magan Bihari Lal v. State of Punjab (1977), the Supreme Court warned that it is risky to found a conviction solely on expert evidence and that corroboration should be sought where possible.[2] This logic applies across forensic domains, including odontology—particularly for pattern-comparison methods such as bite marks.

Criminal procedure and admissibility of scientific reports

Under the Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023, Section 329 provides for the admissibility of reports of specified Government scientific experts and empowers courts to summon experts if needed.[3] In practice, many forensic odontologists may still testify mainly through the Evidence Act route (Section 45) unless they are part of notified government forensic structures.

Dental record-keeping as an ethical-legal obligation

A major "enabler" for forensic odontology, especially identification, is antemortem dental documentation. Indian professional regulation directly addresses this:

- DCI Revised Dentists (Code of Ethics) Regulations, 2014 require every dental surgeon to maintain records and preserve them for a minimum period of three years from the commencement of treatment.[4]
- The Indian Dental Association (IDA) has published record-keeping guidance recommending retention of records/radiographs/models/photographs/clinical details for at least eight years.[5]

These provisions are crucial in court because the credibility of dental identification often depends on the availability and integrity of antemortem records.

Institutional and educational context in India

Undergraduate curriculum exposure

Forensic odontology is explicitly included in the Revised BDS Course Regulations, 2007, with learning objectives such as age estimation, bite marks, and assisting the legal system.[6] This establishes baseline awareness but does not by itself produce courtroom-ready specialists.

Training pathways and professional bodies

India has relied significantly on professional upskilling and structured fellowship routes. The Indian Board of Forensic Odontology (IBFO) (under IAFO) has offered training/certification; publications describe a 12-month certificate fellowship with practical training components.[7,8]The IAFO publicly documents the IBFO's constitution (2014) and training role.[8]

Disaster Victim Identification protocols

Table 1: Applications and Limitations of Forensic Odontology

Application	*Legal relevance*	*Strength*	*Limitation*
Human identification	Criminal & DVI cases	Highly reliable with records	Depends on record quality
Bite mark analysis	Violent crimes	Supportive evidence	Scientifically controversial
Age estimation	Juvenile justice, POCSO	Useful when no documents	Error margins
Dental records	Identification & litigation	Objective evidence	Poor record maintenance

Internationally, forensic odontology is treated as a primary identifier alongside friction ridge analysis (fingerprints) and DNA. INTERPOL's DVI materials and the 2023 DVI Guide emphasize standardized dental coding and forms.[9,10]

Major Recent India Development

The National Disaster Management Authority (NDMA) released dedicated DVI guidance (2026), specifically highlighting the value of dental records and forensic odontology within structured victim identification systems.[11]

Applications in Indian Legal Practice (with representative case materials)

Bite Mark Evidence (criminal prosecutions)

The most discussed Indian precedent for bite mark evidence is the Nirbhaya case. In Mukesh & Anr v. State (NCT of Delhi) (2017), the Supreme Court's narrative includes forensic odontology evidence where bite marks photographed on the victim were compared with dental models/casts of suspects, and the discussion forms part of the overall evidentiary mosaic supporting conviction.[12]

- *Practical take-away for India*

Courts may admit bite mark testimony when (i) chain of custody is intact, (ii) documentation is adequate (scaled photographs, proper lighting/angles), (iii) methods are explained transparently, and (iv) the opinion is consistent with other strong evidence (DNA, injuries, timeline, witness/medical evidence).[12]

Bite marks—how trial courts scrutinize limitations

A useful illustration of courtroom scrutiny appears in the Ernakulam Sessions Court judgment (Jisha case, 2016), where cross-examination and limitations of bite mark photograph quality are discussed, reflecting that courts may test whether the bite pattern is sufficiently captured for meaningful comparison.[13]

Age estimation in the justice system

Dental age estimation is commonly sought when documentary age proof is unavailable or disputed—especially in juvenile justice and POCSO-linked contexts.

- The Supreme Court in Jarnail Singh v. State of Haryana (2013) emphasized the structured approach under the juvenile justice framework, placing documentary evidence higher than medical estimation when documents exist.[14]
- Juvenile Justice (Care and Protection of Children) Act, 2015 (JJ Act, 2015) contains Section 94 (Presumption and determination of age), establishing how age is to be determined within the JJ system.[15]
- Under the POCSO Act, 2012, Section 34 deals with the determination of age by the Special Court in relevant contexts.[16]

- *Forensic odontology's role*

dental assessment (eruption status, radiographic staging of third molars, etc.) is often a component of medical age opinion. The ethical-legal requirement is to *report ranges and uncertainty*, not false precision—because small margins can have major legal consequences.

Disaster victim identification and humanitarian legal needs

DVI is not only about criminal prosecution; it is also about humanitarian identification, death certification, succession, insurance claims, and closure for families. INTERPOL's DVI framework lists forensic odontology as a primary identifier.[9,10] India's NDMA guidance (2026) explicitly recognizes the role of dental records in identification systems.[11]

Scientific reliability and admissibility: where Indian courts must be especially careful

- *Bite mark evidence*

global validity concerns and India's courtroom implications

International scientific reviews have raised serious concerns about the foundational validity and reliability of bite mark analysis:

- The 2009 National Academy of Sciences report highlighted limitations and called for stronger scientific foundations across pattern-comparison domains (including bite marks).[17]
- The 2016 PCAST report concluded that bite mark analysis does not meet scientific standards for foundational validity.[18]
- NIST (2023) Scientific Foundation Review further evaluates the state of bite mark analysis literature and limitations.[19]

Bite mark analysis has been widely criticized for its lack of reproducibility and subjective interpretation. Studies have demonstrated variability in expert conclusions when analyzing the same bite mark evidence. Unlike DNA or

fingerprint evidence, bite mark analysis lacks a universally accepted scientific validation framework. While admissible under Section 45 of the Indian Evidence Act, bite mark evidence does not meet the threshold of strong scientific reliability as per international scientific bodies.

- *Dental identification: generally stronger, but record-dependent*

Comparative dental identification can be highly robust when antemortem records exist and are complete—radiographs, charting, restorations, implants, and distinctive features. However, gaps in private-practice record retention and inconsistent documentation reduce reliability. A dedicated review of dental records in India highlights persistent deficiencies and emphasizes long-term retention as a practical rule.[20]

Ethical and legal challenges in Indian practice

Qualification, standardization, and "who is an expert?" Because India has mixed pathways (workshops, fellowships, and limited formal seats), courts may face variability in training depth. The legal solution is not exclusion but

- *Credential transparency*

training duration, practical exposure, proficiency assessment, publications, case experience, and adherence to recognized protocols (INTERPOL DVI forms, standardized photography, validated radiology methods).

- *Chain of custody and documentation standards*

Odontology often hinges on physical and photographic evidence. Any weak link improper scaling of bite photographs, lack of time-stamped records, missing consent/authorization trails, poor impression storage creates vulnerability during cross-examination and reduces evidentiary weight.

- *Privacy and lawful access to dental records*

Using dental records for identification or investigation engages confidentiality and privacy considerations. Indian practice typically relies on (i) next-of-kin consent, (ii) police requisition with lawful authority, and/or (iii) court directions. A clearer SOP culture, aligned with NDMA DVI and INTERPOL principles, reduces misuse risk while enabling lawful justice goals.[9,11]

Age estimation: rights sensitivity and error margins

Ethically, odontologists must report limitations clearly, use population-appropriate reference data, and avoid categorical statements when confidence is not warranted. Legally, courts tend to prefer documentary proof when available and treat medical age as a last resort—consistent with the approach discussed by the Supreme Court in Jarnail Singh.[14]

Recommendations for strengthening forensic odontology in India

National protocolization and SOPs

Create India-specific, court-ready SOPs for (a) bite mark documentation and analysis, (b) dental identification, (c) dental age estimation reporting formats, and (d) chain-of-custody templates—aligned with INTERPOL DVI and NDMA DVI guidance.[9,11]

Structured credentialing and minimum competency standards

Expand standardized certification/fellowship frameworks and integrate them into government forensic systems with transparent competency requirements (case logs, proficiency testing, peer review).[7,8]

Record-keeping enforcement and digitization

Implement stronger compliance with DCI Ethics (minimum 3 years) and adopt best-practice retention (IDA suggests 8 years) with secure digital radiology archiving and standardized templates suitable for DVI and court.[4,5]

Evidence-based caution for bite marks

Given global validity concerns (NAS, PCAST, NIST), Indian courts should routinely demand corroboration and insist that conclusions be expressed with calibrated uncertainty.[17-18]

Dedicated posts and integration in forensic labs and disaster systems

Create sanctioned forensic odontology units/panels in State FSLs and formal linkages with disaster management authorities, consistent with NDMA's DVI approach.[11]

Judicial and investigative capacity building

Regular joint trainings for police, prosecutors, forensic doctors, and dental experts—especially on (i) evidence preservation, (ii) photography/radiology standards, and (iii) courtroom communication of uncertainty (Table 1).

Conclusion

Forensic odontology in India rests on a legally enabling framework—chiefly the Indian Evidence Act's expert opinion provisions while its real-world effectiveness depends on record quality, standardized methods, and credible expert training.[1,4,11,20] The Indian judiciary has shown willingness to consider odontological evidence (notably in bite mark discussions in Mukesh), but global scientific reviews demand careful calibration of claims, especially for bite marks.[12,17-19] While forensic odontology offers significant utility in legal investigations—particularly in human identification and age estimation its application must be guided by scientific rigor and legal prudence. Bite mark analysis, in particular, requires cautious interpretation in light of global scientific criticism. Strengthening standardization, record-keeping practices, and expert training will be essential to enhancing its reliability and judicial acceptance in India.

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