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TEETH DON'T LIE? A CRITICAL LEGAL ANALYSIS OF FORENSIC ODONTOLOGY AS EVIDENCE IN CRIMINAL TRIALS

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ABSTRACT

Forensic odontology the intersection of dental science and legal investigation has become an indispensable yet deeply contested instrument of modern criminal justice. While its application in human identification and disaster victim recognition commands broad scientific acceptance, bite mark comparison evidence occupies a far more precarious epistemic terrain. This article critically examines forensic odontology as a form of expert evidence in criminal trials, interrogating its scientific foundations, evidentiary admissibility, constitutional implications, and the growing risk of wrongful convictions. Drawing on comparative jurisprudence from India, the United States, and the United Kingdom, and situating the analysis within the framework of the Bharatiya Sakshya Adhiniyam, 2023, this article argues that while forensic odontology retains legitimate utility in select domains, courts must exercise heightened vigilance before admitting bite mark testimony. Structural reforms including mandatory accreditation of experts, judicial scientific literacy training, and a statutory preference for saliva-based DNA analysis are urgently required to prevent forensic science from becoming an instrument of injustice.

Keywords: *Forensic Odontology, Bite Mark Evidence, Expert Testimony, Wrongful Convictions, Bharatiya Sakshya Adhiniyam, Daubert Standard, Criminal Trials, Self-Incrimination, DNA Evidence.*

I. INTRODUCTION

The architecture of modern criminal justice rests upon the premise that guilt must be established beyond reasonable doubt through reliable evidence. Historically, that burden was discharged through witnesses, confessions, and documentary proof each susceptible to the infirmities of human fallibility. The twentieth century witnessed a consequential shift: courts began placing increasing faith in forensic science, treating laboratory findings as though they

possessed an objectivity impervious to the biases that infect other forms of proof. Among the scientific disciplines that secured a place in the courtroom, forensic odontology—the application of dental science to legal inquiry emerged as both a celebrated identification tool and, in the domain of bite mark comparison, a source of profound controversy.

Teeth possess remarkable durability. Composed largely of hydroxyapatite, dental enamel survives fire, decomposition, floods, and acid exposure that would obliterate softer biological material.¹ This physical resilience, combined with the assumption that everyone's dentition is unique, gave forensic odontologists grounds to assert that dental evidence could function as a form of biological fingerprint. Courts accepted this reasoning with minimal scrutiny. Bite mark analysts testified with considerable confidence, jurors found their conclusions compelling, and convictions followed.

The difficulties emerged later. Scientific re-examination revealed that human skin—the surface upon which bite marks are typically impressed—is a pliable, dynamic medium that distorts, heals, and varies in response to postmortem changes, positional alteration, and the passage of time.² Studies demonstrated that different examiners, presented with identical bite mark photographs, reached divergent conclusions at rates incompatible with the precision claimed in court.³ Crucially, post-conviction DNA testing began exonerating individuals whose convictions rested substantially on bite mark testimony, exposing a pattern of wrongful condemnation rooted in overconfident forensic assertion.

This article engages these tensions systematically. Part II defines the scope and sub-disciplines of forensic odontology. Part III analyses its scientific basis. Part IV subjects bite mark analysis to rigorous critique. Part V maps the Indian legal framework under the Bharatiya Sakshya Adhinyam, 2023. Part VI examines admissibility doctrines comparatively. Part VII surveys landmark judicial decisions. Part VIII addresses constitutional implications. Part IX identifies structural deficiencies in Indian forensic infrastructure. Part X offers a normative framework for reform.

¹Mary A. Bush & Howard I. Fixott, *Forensic Dental Identification*, in *Principles and Practice of Forensic Dentistry* 3, 5 (Suzanne M. Lain ed., 2nd ed. 2013).

²C. Michael Bowers, *Forensic Dental Evidence: An Investigator's Handbook* 112–18 (2nd ed. 2011); Mary Bush et al., *Biomechanical Factors in Human Dermal Bitemarks in a Controlled Experimental Setting*, 54 *J. Forensic Sci.* 167, 168 (2009).

³David L. Faigman et al., *Bite Mark Evidence*, in *Modern Scientific Evidence: The Law and Science of Expert Testimony* §34:1 (2019); Michael J. Saks & Jonathan J. Koehler, *The Coming Paradigm Shift in Forensic Identification Science*, 309 *Science* 892, 893 (2005).

II. FORENSIC ODONTOLOGY: MEANING, SCOPE, AND SUB-DISCIPLINES

Forensic odontology may be understood as the branch of applied dental science that places the knowledge, methods, and professional judgment of the odontologist in the service of judicial processes.⁴ Its engagement with legal proceedings is historically ancient dental identification of the dead has been recorded since Roman antiquity but its formalisation as a recognised professional discipline occurred principally during the twentieth century, catalysed by the demands of disaster victim identification and the rising significance of scientific evidence in adversarial litigation.

A. Human Identification through Dental Comparison

The identification of deceased individuals through comparison of ante-mortem dental records with post-mortem dental findings represents the methodologically strongest application of forensic odontology. Where death has involved decomposition, incineration, submersion, or severe physical trauma, traditional means of identification including facial recognition and fingerprinting often become unavailable. Teeth, by contrast, survive such conditions in a form amenable to clinical examination.⁵ The comparative process involves radiographic analysis, charting of restorative work, and assessment of anatomical morphology. International experience, including the identification of victims of the 2004 Indian Ocean tsunami, has confirmed the reliability of this methodology.⁶

B. Bite Mark Analysis

Bite marks appear in cases involving sexual assault, child abuse, homicide, and interpersonal violence. The investigative proposition underlying bite mark analysis is that an offender's dentition leaves a characteristic impression on the victim's body or on food and other substrates found at the crime scene, and that forensic comparison of this impression with a suspect's dental cast can yield individuating conclusions.⁷ This area has generated the most significant scientific and legal controversy and is examined in detail in Part IV below.

⁴American Board of Forensic Odontology, *Diplomate Reference Manual 1* (2018), <https://www.abfo.org> (last visited Mar. 12, 2025).

⁵Marco A. De Valck, *Major Incident Response: Collecting Antemortem Data*, 69 *Forensic Sci. Int'l* 221, 223 (2006).

⁶Interpol, *Disaster Victim Identification Guide* 18 (2014).

⁷American Board of Forensic Odontology, *Guidelines for Bite Mark Analysis*, 27 *J. Am. Dental Ass'n* 65 (1986).

C. Age Estimation

Dental development follows broadly predictable biological sequences, permitting odontologists to estimate chronological age from radiographic examination of eruption patterns, root formation, and pulp chamber dimensions.⁸ In Indian legal practice, age estimation acquires particular significance under the Juvenile Justice (Care and Protection of Children) Act, 2015, the Protection of Children from Sexual Offences Act, 2012, and penal provisions calibrated to the minority of complainants or accused persons.

D. Disaster Victim Identification

Mass casualty events whether caused by natural disaster, aviation accidents, or terrorist violence generate demands for rapid and scientifically credible identification of victims. Forensic odontology forms one of the three primary pillars of Interpol's disaster victim identification protocol, alongside fingerprint analysis and DNA profiling.⁹ The dental method is particularly valued where putrefaction or thermal damage precludes the other modalities.

E. Identification of Abuse Victims

Bite marks on children or vulnerable adults may constitute probative evidence of physical abuse. Forensic odontologists are trained to distinguish human bite wounds from animal bites, self-inflicted injuries, and postmortem artefacts, and to assess the age of lesions relative to reported timelines of alleged abuse.¹⁰

III. SCIENTIFIC FOUNDATIONS OF DENTAL EVIDENCE

A. The Uniqueness Hypothesis

The evidentiary premises of forensic odontology rest upon two foundational claims: first, that human dentition is sufficiently individualistic to permit identification; and second, that features of dental morphology are stable enough to be compared meaningfully across time. The uniqueness hypothesis holds that the combination of tooth size, shape, alignment, spacing, restorations, wear facets, and pathological modifications generates a dental profile unlikely to be shared by two individuals.¹¹ This claim, while plausible and broadly accepted for identification purposes, has not been demonstrated to the rigorous empirical standards now

⁸Ragnar Nortvedt & Paul G. Solheim, *Dental Age Estimation in Adults*, in *Forensic Dentistry* 83, 87 (David K. Whittaker & Denis MacDonald eds., 1989).

⁹Interpol, *Disaster Victim Identification Guide* 4 (2014).

¹⁰Robert E. Dorion, *Bitemark Evidence* 271–85 (2nd ed. 2011).

¹¹Lowell J. Levine, *Bite Mark Evidence in Criminal Cases*, *Dent. Clin. N. Am.* 39, 43 (1977).

demanded of forensic disciplines.

B. Durability of Dental Tissues

Dental enamel, among the most resilient biological substances in the human body, is composed largely of inorganic hydroxyapatite crystals that resist degradation under extreme environmental conditions.¹² Studies conducted in forensic contexts confirm that teeth survive cremation temperatures exceeding 700 degrees Celsius, prolonged submersion, and concentrated acid exposure conditions under which soft tissue, fingerprints, and DNA are destroyed or rendered unusable.¹³ This durability underpins the continued relevance of dental evidence in extreme postmortem scenarios.

C. Saliva-Based DNA Recovery

Modern forensic science has introduced a methodologically superior supplement to visual bite mark comparison: the extraction and profiling of perpetrator DNA from saliva deposited at bite sites.¹⁴ Buccal epithelial cells shed into saliva during the biting act may persist on skin surface and under fingernails for periods sufficient to permit sampling, amplification, and STR profiling. DNA evidence carries quantifiable error rates, survives adversarial cross-examination, and has demonstrated a superior track record in both conviction and exoneration contexts. Where saliva sampling is available, it should be regarded as the primary investigative modality.

IV. BITE MARK EVIDENCE: SCIENTIFIC CRITIQUE AND LEGAL CONSEQUENCES

Bite mark comparison, once embraced by courts as a reliable form of individuating evidence, has undergone sustained methodological deconstruction over the past two decades. The critique operates at multiple levels: the biological properties of the substrate, the reproducibility of examiner judgments, the absence of population-level databases, and the statistical architecture underlying identifications.

¹²G. Scheuer & S. Black, *The Juvenile Skeleton* 14 (2004).

¹³P. Throne et al., *Dental Evidence and Identification: Enamel Survival in Extreme Environments*, 182 *Forensic Sci. Int'l* 59, 63 (2008).

¹⁴Robin W. Sweet, *Saliva from Bitemark Evidence*, 18 *J. Can. Dent. Ass'n* 412 (2001); B.A. Sweet & A.S. Hildebrand, *Recovery of DNA from Human Teeth by Cementum and Dentine Extraction*, 43 *J. Forensic Sci.* 1199, 1200 (1998).

A. The Substrate Problem: Skin as an Unreliable Recording Medium

Unlike fingerprint ridges impressed into clay or shoeprints deposited on soft earth, bite marks are recorded on human skin viscoelastic tissue that responds dynamically to pressure, changes shape during and after the biting event, undergoes bruising and oedematous swelling, and is transformed by postmortem decomposition.¹⁵ Research has demonstrated that the two-dimensional representation of a bite mark bears a measurably distorted relationship to the three-dimensional dental anatomy that produced it, and that the magnitude of this distortion is not systematically predictable.¹⁶ The implications are significant: an examiner comparing a photographic bite mark impression against a dental cast is comparing an inherently distorted record against an accurate model.

B. Examiner Subjectivity and Inter-Rater Unreliability

Scientific validity requires that independent applications of a method to the same data produce consistent results. Bite mark analysis fails this test. The President's Council of Advisors on Science and Technology reviewed the available empirical literature in 2016 and concluded that bite mark analysis had not been shown to be a foundationally valid forensic discipline.¹⁷ Proficiency studies demonstrated substantial disagreement between examiners regarding whether a bite mark had been made by a particular individual, with false positive rates in some studies reaching levels that would be intolerable in any other forensic domain.

C. Absence of Population Databases and Validated Error Rates

A forensic method capable of supporting individuating conclusions asserting that a mark was made by a specific person to the exclusion of all others requires a validated population database establishing the frequency distribution of relevant characteristics.¹⁸ No such database exists for human dentition in bite mark contexts. Forensic odontologists who testify to high or absolute degrees of certainty do so without the statistical infrastructure that would render such conclusions scientifically defensible. This epistemic overreach in which the courtroom assertion significantly exceeds what the underlying science can sustain has been

¹⁵Mary A. Bush et al., *Biomechanical Factors in Human Dermal Bitemarks in a Controlled Experimental Setting*, 54 *J. Forensic Sci.* 167, 170 (2009).

¹⁶Mary A. Bush et al., *Inquiry into the Scientific Basis for Bite Mark Profiling and Arbitrary Distortion Compensation*, 55 *J. Forensic Sci.* 976, 980 (2010).

¹⁷President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* 85 (2016) [hereinafter PCAST Report].

¹⁸National Research Council, *Strengthening Forensic Science in the United States: A Path Forward* 176 (2009) [hereinafter NRC Report].

widely documented in the scholarly literature.

D. Wrongful Convictions: The Human Cost

The consequences of methodological insufficiency have not remained abstract. Post-conviction DNA testing has led to the exoneration of multiple individuals whose convictions rested substantially on bite mark testimony.¹⁹ Among the most widely analysed is the case of Ray Krone, who was twice convicted of murder in Arizona, sentenced to death, and ultimately exonerated in 2002 after thirteen years of incarceration when DNA analysis identified another individual as the perpetrator.²⁰ Similarly, in California, William Richards spent more than two decades imprisoned before courts acknowledged that the bite mark testimony underpinning his conviction lacked adequate scientific foundation.²¹ These cases demonstrate that the admissibility threshold, rather than acting as a filter of unreliable science, has in practice permitted demonstrably flawed testimony to secure convictions against factually innocent persons.

V. THE INDIAN LEGAL FRAMEWORK FOR EXPERT EVIDENCE

A. Bharatiya Sakshya Adhiniyam, 2023

The Bharatiya Sakshya Adhiniyam, 2023, which superseded the Indian Evidence Act, 1872 with effect from July 2024, governs the admissibility and weight of evidence in Indian courts. Section 39 of the BSA, which broadly corresponds to section 45 of the repealed Act, permits courts to receive the opinion of persons 'specially skilled' in a relevant area of science, art, trade, or profession where the court must form an opinion upon a question demanding such specialised knowledge.²² Forensic odontologists qualify as expert witnesses under this provision when they testify on matters of dental identification, bite mark analysis, or age estimation.

However, the BSA, like its predecessor, establishes a relevance-based rather than a reliability-based threshold. Section 39 does not impose obligations of methodological validation, peer review, or error rate disclosure analogous to those required under the Daubert doctrine in the United States.²³ The opinion of a forensic odontologist is admissible provided

¹⁹Innocence Project, *Informing Injustice: The Disturbing Use of Bite Mark Evidence* (2016), <https://innocenceproject.org> (last visited Mar. 12, 2025).

²⁰*State v. Krone*, 182 Ariz. 319, 897 P.2d 621 (1995).

²¹*In re Richards*, 63 Cal. 4th 291, 371 P.3d 195 (2016).

²²Bharatiya Sakshya Adhiniyam, 2023, No. 47 of 2023, §39 (India).

²³*Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 593–94 (1993).

it relates to a matter in issue and is offered by a suitably qualified person. The question of how that opinion was formed and whether the underlying method is scientifically sound is treated primarily as a matter of weight rather than admissibility, placing an unrealistic burden on defence counsel and trial judges to subject forensic claims to effective scrutiny without structural gatekeeping mechanisms.

B. Bharatiya Nagarik Suraksha Sanhita, 2023

The Bharatiya Nagarik Suraksha Sanhita, 2023 governs criminal procedure and provides the investigative apparatus through which forensic evidence is gathered. Its provisions pertaining to medical examination of arrested persons and collection of biological samples furnish the procedural authority for dental impression-taking and saliva collection.²⁴ The lawful exercise of these powers requires compliance with chain-of-custody protocols, contemporaneous documentation, and the involvement of qualified medical personnel each of which has implications for the subsequent admissibility of dental evidence.

C. Bharatiya Nyaya Sanhita, 2023

The Bharatiya Nyaya Sanhita, 2023 defines the substantive offences in the context of which forensic odonatological evidence is most commonly adduced: homicide, sexual offences, and offences involving bodily harm.²⁵ In prosecutions under these provisions, bite mark evidence may assume significance as a means of placing the accused in contact with the victim's body and the reliability concerns discussed in Part IV above acquire their most acute practical importance.

VI. ADMISSIBILITY: COMPARATIVE LEGAL STANDARDS

A. The Frye General Acceptance Standard

In the United States, the admissibility of novel scientific evidence was governed for much of the twentieth century by the standard articulated in *Frye v. United States*, which required that a scientific method attain general acceptance within the relevant professional community before its results could be received in evidence.²⁶ Bite mark analysis initially satisfied this standard, partly because the forensic odontology community itself endorsed the method and partly because courts were ill-equipped to distinguish the consensus of a

²⁴Bharatiya Nagarik Suraksha Sanhita, 2023, No. 46 of 2023, §§51, 53, 176 (India).

²⁵Bharatiya Nyaya Sanhita, 2023, No. 45 of 2023 (India).

²⁶*Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923).

professional guild from the consensus of a scientific discipline subjected to rigorous external validation.

B. The Daubert Standard: A Stricter Gatekeeping Regime

The Supreme Court of the United States fundamentally reconstituted the admissibility framework in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, holding that the Federal Rules of Evidence required trial judges to serve as gatekeepers, screening proffered expert testimony for scientific validity before admitting it.²⁷ The Court identified a non-exhaustive set of factors relevant to this inquiry: whether the theory or technique had been tested; whether it had been subjected to peer review and publication; whether its error rate was known; and whether it enjoyed general acceptance within the relevant scientific community.

Bite mark evidence, subjected to Daubert scrutiny, has fared poorly. Several United States federal and state courts have excluded or significantly limited bite mark testimony on the basis that the method lacks known error rates, has not been adequately validated through controlled studies, and cannot support high-confidence individuating conclusions.²⁸ The Texas Forensic Science Commission recommended a moratorium on bite mark testimony in 2016, though this recommendation was ultimately not adopted.²⁹

C. The United Kingdom Approach

English courts operate under principles requiring that expert opinion be based on a recognised body of knowledge or experience, as articulated in *R v. Turner*.³⁰ The Law Commission of England and Wales, in its 2011 report on expert evidence, recommended the codification of a reliability-based admissibility standard that would require courts to assess whether the expert's opinion was based on sufficiently reliable evidence and reasoning.³¹ These recommendations have materially influenced judicial practice, even where not yet enacted in statutory form.

D. The Indian Position and its Limitations

Indian courts have not adopted an explicit reliability-based admissibility standard for forensic evidence. The relevance gateway under section 39 of the BSA is permissive, and the

²⁷*Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993).

²⁸PCAST Report, *supra* note 17, at 87–89.

²⁹Texas Forensic Science Commission, *Bite Mark Comparison Review* (2016).

³⁰*R v. Turner* [1975] 1 QB 834, 841 (CA).

³¹Law Commission of England and Wales, *Expert Evidence in Criminal Proceedings in England and Wales*, Law Com. No. 325 (2011).

general principle that any relevant evidence is admissible unless specifically excluded leaves the trial court with limited doctrinal tools with which to exclude methodologically deficient expert testimony.³² The Supreme Court of India has emphasised that expert evidence must be scrutinised with care and that uncorroborated expert opinion should not be the sole basis of conviction,³³ but these are principles of weight rather than admissibility leaving unreliable forensic science within the factfinder's reach.

VII. LANDMARK JUDICIAL DECISIONS

A. *People v. Marx* (California, 1975)

One of the earliest judicial endorsements of bite mark evidence was rendered by the California Court of Appeal in *People v. Marx*.³⁴ The court admitted the testimony of three forensic odontologists who concluded that bite marks on the victim's nose had been made by the defendant, applying the *Frye* standard to hold that the method was generally accepted. The decision was subsequently criticised for conflating the general acceptance of dental identification with the methodologically distinct and far more contentious field of bite mark comparison.

B. *The Trial of Ted Bundy* (Florida, 1979)

The prosecution of Ted Bundy brought bite mark evidence to wide public attention. Expert testimony established that bite marks on a victim's body were consistent with the defendant's dentition, and this evidence formed a significant component of the prosecution's case.³⁵ The conviction and its subsequent notoriety contributed to the professional legitimacy of forensic odontology, creating a reputational trajectory that proved difficult to reverse as scientific criticism mounted in subsequent decades.

C. *State v. Krone* (Arizona, 1992 and 1996)

Ray Krone was convicted of murder in Arizona on two separate occasions, with bite mark testimony playing a central evidentiary role in both trials. In 2002, DNA profiling of biological material recovered from the victim identified another man as the perpetrator, and Krone was exonerated after more than a decade of incarceration, including time on death row.³⁶

³²*Ramesh Chandra Agrawal v. Regency Hospitals Ltd.*, (2009) 9 SCC 709, 715 (India).

³³*Magan Bihari Lal v. State of Punjab*, (1977) 2 SCC 210, 214 (India).

³⁴*People v. Marx*, 54 Cal. App. 3d 100, 126 Cal. Rptr. 350 (1975).

³⁵Stephen G. Michaud & Hugh Aynesworth, *Ted Bundy: Conversations with a Killer* 11–14 (1989).

³⁶*State v. Krone*, 182 Ariz. 319 (1995).

The Krone case became emblematic of the dangers of admitting forensic testimony that overstates the conclusions the underlying science can sustain.

D. Daubert v. Merrell Dow Pharmaceuticals, Inc. (U.S. Supreme Court, 1993)

Although not a forensic odontology case, *Daubert* profoundly reshaped the legal environment within which all forensic science evidence is considered.³⁷ The decision's requirement that judges evaluate the scientific validity of expert methodologies not merely the qualifications of the witness created a framework within which bite mark evidence would eventually face sustained judicial scrutiny. Its influence has been felt beyond the United States, informing reform proposals in multiple jurisdictions.

E. Indian Jurisprudence

India has not produced a reported decision in which the admissibility of forensic odonatological evidence was subjected to appellate analysis comparable to *Daubert* or the PCAST framework. Indian courts have accepted dental evidence in cases involving victim identification and age determination without conducting methodological audits.³⁸ The Supreme Court's jurisprudence affirms that expert opinion must be supported by cogent reasoning and tested through cross-examination,³⁹ but these principles have not been systematically deployed to constrain forensic odonatological testimony.

VIII. CONSTITUTIONAL DIMENSIONS

A. Article 20(3): Protection Against Self-Incrimination

Article 20(3) of the Constitution of India provides that no person accused of an offence shall be compelled to be a witness against himself. The question of whether the compulsory extraction of dental impressions from an accused falls within the protection of this provision is substantially informed by the Supreme Court's seminal ruling in *State of Bombay v. Kathi Kalu Oghad*.⁴⁰

In *Kathi Kalu Oghad*, the Supreme Court drew a distinction between testimonial acts—the communication of knowledge derived from personal recollection—and the production of physical specimens that exist independently of the accused's mind.⁴¹ On this reasoning, a dental

³⁷*Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993).

³⁸Kewal Krishan, *Bite Mark Evidence in India: A Review*, 34 *J. Indian Acad. Forensic Med.* 162, 164 (2012).

³⁹*Ram Narain v. State of Rajasthan*, AIR 1973 SC 2209, 2213 (India).

⁴⁰*State of Bombay v. Kathi Kalu Oghad*, AIR 1961 SC 1808 (India).

⁴¹*Id.* at 1820–21.

impression, like a fingerprint or blood sample, constitutes physical evidence rather than testimonial communication, and its compelled extraction would not attract the Article 20(3) prohibition. However, scholars have noted that this bright-line distinction may insufficiently account for the communicative content of dental evidence, particularly where the implication of a specific actbitingis inextricable from the evidentiary inference the impression is designed to support.

B. Article 21: Due Process and the Risk of Wrongful Conviction

Article 21 of the Constitution guarantees that no person shall be deprived of life or personal liberty except according to procedure established by law. The due process dimension of this guarantee has been interpreted broadly by the Supreme Court to encompass fairness in criminal proceedings.⁴² Where a conviction rests substantially on forensic evidence that cannot withstand rigorous methodological scrutiny, the constitutional guarantee of a fair trial is implicated. The admission of bite mark testimony generated by an invalid method and its subsequent use to sustain a conviction may therefore raise due process concerns that courts are constitutionally obligated to address.

C. The Presumption of Innocence

The presumption of innocence, enshrined in domestic criminal procedure and affirmed by international human rights instruments to which India is a party, requires that the prosecution discharge its burden of proof through evidence of adequate probative value.⁴³ When forensic experts present methodologically deficient testimony with a confidence that the science does not support, they distort the evidentiary landscape in a manner that structurally disadvantages the accused. Courts and legislatures share a constitutional responsibility to prevent forensic authority from substituting for proof.

IX. STRUCTURAL DEFICIENCIES IN THE INDIAN FORENSIC CONTEXT

Even where the science of forensic odontology is employed with methodological care, the institutional and infrastructural context in which it is practised in India introduces additional layers of unreliability. Several deficiencies warrant specific attention.

⁴²*Maneka Gandhi v. Union of India*, (1978) 1 SCC 248, 284 (India).

⁴³International Covenant on Civil and Political Rights art. 14(2), Dec. 16, 1966, 999 U.N.T.S. 171; *Bharatiya Nagarik Suraksha Sanhita*, 2023, §114 (India).

First, the number of trained forensic odontologists in India is critically inadequate relative to the population and the caseload of the criminal justice system.⁴⁴ This scarcity means that investigations must frequently proceed without specialist consultation, or must rely on general dental practitioners who lack specialised forensic training substitution with potentially significant consequences for the reliability of the evidence produced.

Second, dental record-keeping in India, outside major metropolitan hospitals, remains inconsistent and frequently incomplete. The reliability of ante-mortem and post-mortem comparison depends entirely on the availability and accuracy of pre-existing dental documentation precondition that cannot be assumed in a country where large segments of the population have no documented dental history.⁴⁵

Third, forensic laboratories lack standardised protocols for the collection, preservation, and analysis of dental evidence. Chain-of-custody failures compromise the integrity of samples and provide grounds for defence challenges that can result in the exclusion of otherwise probative material.⁴⁶

Fourth, the independence of forensic laboratories from law enforcement agencies is insufficiently guaranteed. Experts who are institutionally affiliated with or financially dependent upon prosecution agencies face structural pressures that may unconsciously orient their professional judgments toward outcomes favourable to the State a phenomenon the forensic science literature has extensively documented as 'contextual bias'.⁴⁷

X. TOWARDS REFORM: A NORMATIVE FRAMEWORK

The foregoing analysis reveals a normative deficit at the intersection of forensic science and criminal law. The following reforms would address the structural and substantive deficiencies identified in this article.

A. Statutory Admissibility Standard for Forensic Evidence

India should enact, whether through amendment of the BSA or through dedicated forensic evidence legislation, a reliability-based admissibility standard for expert testimony adapted from the Daubert framework. Such a standard should require courts to assess, at minimum, whether the method has been empirically tested, whether its error rate has been

⁴⁴B.R. Sharma, *Forensic Science in Criminal Investigation and Trials* 67 (5th ed. 2012).

⁴⁵Kewal Krishan et al., *Dental Age Estimation in Indians*, 32 *J. Indian Acad. Forensic Med.* 131, 133 (2010).

⁴⁶National Crime Records Bureau, *Crime in India 2022* 198 (2023).

⁴⁷Itiel E. Dror & David Charlton, *Why Experts Make Errors*, 56 *J. Forensic Identification* 600, 602 (2006).

estimated, and whether its conclusions are supported by adequately validated reasoning. This reform would equip trial judges with a principled basis upon which to exclude forensic claims that cannot survive scientific scrutiny.

B. Mandatory Restriction of Bite Mark Testimony

Courts should decline to admit expert opinions that assert high or absolute degrees of dental individuation in bite mark cases unless the proponent demonstrates that the opinion is based on a validated methodology with a known error rate. Where such demonstration cannot be made, expert testimony should be restricted to observational descriptions that a mark is consistent with human dental anatomy, for example without advancing individuating conclusions that the underlying science cannot sustain.

C. Accreditation of Forensic Odontologists

A statutory accreditation scheme should be established, modelled on the American Board of Forensic Odontology or equivalent bodies, mandating minimum training standards, continuing professional development, and peer review of casework. Expert witnesses who are not accredited under such a scheme should not be permitted to testify in criminal proceedings on matters of forensic odontological analysis.

D. Judicial Scientific Literacy Training

The National Judicial Academy and its state equivalents should incorporate forensic science methodology including the principles of error rates, validation studies, and contextual bias into judicial training programmes. Judges equipped with scientific literacy are better positioned to exercise meaningful gatekeeping functions and to evaluate expert testimony critically, reducing reliance on professional authority as a substitute for methodological rigour.

E. Priority of DNA Evidence

Wherever saliva sampling from a bite site is feasible, investigating agencies should be directed by procedural guidelines to prioritise DNA extraction before any visual or photographic documentation of the bite mark. The current operational hierarchy in which visual analysis often precedes or supplants biological sampling should be reversed. Saliva-derived DNA evidence, with its quantifiable statistical significance, must be treated as the preferred evidentiary modality in bite mark investigations.

F. Independent Forensic Institutions

Forensic science laboratories engaged in criminal casework should be structurally separated from law enforcement command structures and placed under independent regulatory oversight. This institutional arrangement reduces the risk of contextual bias, enhances the credibility of forensic evidence in adversarial proceedings, and reinforces the perception of impartiality that is essential to public confidence in criminal justice.

XI. CONCLUSION

Forensic odontology occupies a paradoxical position in the landscape of criminal evidence. In its most scientifically grounded applications post-mortem identification through dental comparison and disaster victim recognition it provides investigators and courts with a reliable and indispensable tool. In its most contested application bite mark comparison it has generated a corpus of convictions, some of which have proven to be wrongful, premised upon expert authority that the underlying science cannot sustain.

The phrase 'teeth don't lie' encapsulates an intuition that is partly justified and partly dangerous. Teeth, as physical objects, do preserve objective information. But the interpretation of that information particularly the interpretation of the imperfect impressions left on human skin is a human act subject to all the subjectivity, variability, and motivated reasoning that afflict human judgment. When courts treat expert interpretation as though it possessed the objectivity of the physical evidence itself, they commit a category error with potentially grave consequences for the accused.

The reform agenda proposed in this article does not counsel the wholesale rejection of forensic odontology. It counsels' discernment: a principled insistence that the weight accorded to forensic expert testimony be calibrated to the demonstrated reliability of the method upon which it rests. Such insistence is not hostile to science; it is demanded by it. It is not hostile to effective criminal prosecution; it is demanded by the constitutional guarantee that guilt be established through evidence capable of withstanding rational scrutiny.

India's adoption of the Bharatiya Sakshya Adhiniyam presents a legislative opportunity to embed a more rigorous framework for expert evidence into the foundation of the new procedural architecture. That opportunity should not be squandered. The integrity of the criminal justice system measured not only by the convictions it secures but by the wrongful convictions it prevents depends upon it.

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