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Review Article

Training and Professional Roles of Forensic Odontologists: A Global Perspective

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ABSTRACT

Background: Forensic odontology (FO) contributes to human identification and medico-legal investigations. However, educational pathways, professional responsibilities, and recognition vary internationally. The distinction between practical forensic work and research-based contributions also remains insufficiently understood. This review examines the complementary roles of forensic odontologists in medico-legal practice and scientific research, with particular emphasis on postgraduate training and professional competencies.

Methods: This conceptual narrative review draws on published literature, professional guidelines, and examples of postgraduate educational programs to discuss professional roles, training pathways, and developments in forensic science. It is not intended as a systematic review or an exhaustive comparison of national regulatory systems.

Results: Forensic odontology encompasses both applied medico-legal activities and research-driven scientific development. Core competencies include dental identification, age estimation, and disaster victim identification (DVI). Master's-level and doctoral training commonly emphasize different competencies, although their roles may overlap. Emerging technologies, including cone-beam computed tomography (CBCT), three-dimensional imaging (3D), and artificial intelligence (AI), further highlight the importance of methodological validation and critical scientific evaluation. The application of bite mark analysis requires particular caution because of concerns regarding scientific reliability and evidentiary limitations.

Conclusion: Practical expertise and research-based scientific contributions are complementary components of FO. Greater international collaboration, clearer competency frameworks and evidence-based professional standards may strengthen education, research and medico-legal practice.

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Introduction

Forensic odontology (FO) is a specialized branch of dentistry that applies dental science to matters of law and justice. Traditionally, it has been associated with postmortem identification, age estimation, and bite mark analysis, often involving dentists participating in medico-legal investigations and disaster victim identification (DVI) operations [1]. However, the discipline has evolved beyond direct casework to encompass scientific research, methodological development, and digital technology integration [2, 3].

Despite this broader scope, misconceptions persist regarding the professional qualifications and contributions of forensic odontologists. One recurring misconception is that an individual must perform hands-on postmortem examinations to contribute meaningfully to the discipline [4]. This perspective overlooks research-focused professionals who develop, validate, and evaluate methods subsequently applied in forensic investigations [5].

This conceptual narrative review examines FO as both an applied medico-legal service and a research-driven scientific discipline. It aims to clarify the scope of professional contributions, discuss postgraduate training pathways and explain the complementary roles of practitioners and research scientists. The central conceptual argument is that professional contribution should be considered in relation to training, expertise and demonstrated competencies rather than being restricted to direct casework. As professional recognition and training arrangements vary internationally, the discussion considers selected educational programs and professional guidelines rather than proposing a universal regulatory model.

The discipline has progressed from traditional dental identification to a multidisciplinary forensic science. Its historical foundations include Oscar Amoedo's pioneering publication on dental identification in 1897, followed by developments in professional standards, forensic methods, and certification [6]. Since the 2000s, digital imaging, CBCT, three-dimensional scanning, and AI have further expanded its applications, increasing the importance of methodological validation, population-specific standards, and reproducible evidence [7].

Methods of Literature Search

This article adopts a conceptual narrative approach rather than a systematic review methodology. It draws on published literature, professional guidance and available descriptions of postgraduate forensic odontology programs to examine education, professional roles and scientific developments. Literature was considered for its relevance to forensic odontology training, medico-legal responsibilities, professional recognition, research competencies and emerging technologies. The discussion uses selected international examples to illustrate differences in educational and professional arrangements. It does not claim exhaustive database coverage, systematic screening, or quantitative synthesis of the literature.

Historical Perspective and Evolution of Forensic Odontology

Forensic odontology emerged as a formal discipline in the early 20th century, initially emphasizing the identification of individuals through dental records [8]. Key historical milestones include:

- **1897:** Dr. Oscar Amoedo's pioneering work "L'Art Dentaire en Médecine Légale," establishing dental identification principles.
- **1940s–1960s:** Expansion of FO into bite mark analysis and legal documentation.
- **1970s–1990s:** Formation of professional societies, e.g., the "American Board of Forensic Odontology (ABFO)", setting formal standards for practice and certification (6).
- **2000s–present:** Integration of digital imaging, cone-beam computed tomography (CBCT), three-dimensional (3D) scanning, and artificial intelligence (AI), extending the field beyond traditional postmortem examinations [2, 9].

These advancements highlight the field's evolution from strictly practice-based to research-driven, emphasizing method validation, population-specific standards, and reproducible scientific evidence.

Research-Based Training Pathways in Forensic Odontology

Master's-Level Training

Master's-level postgraduate training commonly provides foundational competencies for practical forensic work. These may include dental record analysis, radiographic interpretation, dental identification, age estimation, participation in supervised casework, and understanding relevant legal and ethical responsibilities. Programs such as the Master of Forensic Odontology offered by the

University of Dundee illustrate postgraduate pathways focused on developing specialized knowledge and practical competencies [10].

Such training commonly emphasizes the application of established methods. However, this does not exclude research involvement, academic contributions or methodological development. The extent of research exposure and independent practice may differ according to program structure, institutional requirements and national professional arrangements.

Doctoral-Level Training (PhD)

A PhD represents an advanced academic research qualification and involves independent investigation, critical evaluation of existing knowledge and the development of original scientific contributions [11]. Within FO, doctoral research may address methodological development, validation of identification techniques, statistical modeling, population-specific standards and the evaluation of emerging technologies.

Brazilian educational experiences illustrate the integration of forensic odontology education across undergraduate, postgraduate and doctoral levels, although training structures differ between countries [11]. Doctoral training can strengthen the scientific foundation of forensic methods through experimental investigation, reproducibility assessment, and critical examination of existing standards [5, 12]. Master's-level and doctoral pathways should therefore be understood as having different, potentially overlapping educational emphases rather than representing mutually exclusive professional categories. Recognizing the complementary nature of forensic practice and forensic research strengthens collaboration within the discipline and promotes a balanced understanding of professional roles [13]. Rather than diminishing either pathway, acknowledging both enhances the scientific integrity, legal credibility, and future development of forensic odontology as a whole.

Medico-Legal Casework and Professional Responsibilities

Forensic odontologists contribute to medico-legal investigations through DVI operations, dental identification, age estimation in living individuals, assessment of dental evidence, and expert testimony. Their responsibilities depend on training, experience, demonstrated competency, and the requirements of the relevant jurisdiction. Professional activities may overlap between practitioners and researchers, as illustrated in Table 1. Practitioners apply recognized techniques in casework, while research-focused professionals investigate the scientific basis, limitations, and reliability of those techniques. These roles are not mutually exclusive: an individual may undertake both practical and research activities.

Practitioners depend on scientifically evaluated methods, while researchers benefit from practical case-based observations and feedback [3, 14]. This relationship is particularly important in forensic science, where methods must be scientifically defensible and suitable for their intended application. Professional recognition should consequently consider the nature of an individual's expertise and contribution rather than relying exclusively on academic qualifications or direct casework participation.

International arrangements for forensic odontology education and professional recognition are not uniform. For example, the American Board of Forensic Odontology provides professional standards and guidelines, whereas postgraduate educational pathways such as those described by the University of Dundee and the Brazilian experience illustrate different approaches to specialist education [6, 10, 11]. These examples demonstrate variation in educational structures and professional frameworks; they should not be interpreted as evidence of an internationally standardized certification system.

Digital and Research-Driven Forensic Odontology

The integration of advanced technologies has expanded the scientific scope of FO. CBCT, three-dimensional imaging, AI, and digital dental record management systems offer opportunities for quantitative assessment, comparison, and improved information management [2].

CBCT and 3D imaging permit assessment of dental and craniofacial structures beyond conventional two-dimensional measurements. However, the availability of digital measurements does not automatically establish their accuracy or forensic validity. Factors such as image resolution, segmentation procedures, measurement reproducibility, observer variability, and population characteristics may influence results. Research should therefore establish appropriate validation procedures and report measurement errors and reliability before proposed methods are considered suitable for forensic application [15].

Similarly, AI-based approaches for age estimation, sex estimation and human identification require critical evaluation beyond reporting model accuracy. Performance may vary according to dataset composition, sample size, population characteristics

and external validation. Potential algorithmic bias, false matches and generalisability must also be considered. A model demonstrating promising results in a development dataset cannot automatically be assumed to perform reliably in independent forensic casework.

Digital dental databases and automated comparison systems can support DVI by improving the organization and comparison of dental information. AutoIDD represents an example of automated identification using dental data [16]. Nevertheless, automated systems require evaluation of matching performance, false-positive and false-negative results, data quality, and reproducibility. Human monitoring remains important when interpreting automated outputs, particularly where findings may influence medico-legal decisions.

The development of these technologies illustrates the contribution of research-focused forensic odontologists. Their work may include developing measurement protocols, evaluating algorithms, examining methodological limitations, and establishing population-specific standards. Such contributions are complementary to practical casework and support the scientific development of the discipline [12, 17].

Bite Mark Analysis: Scientific Considerations

Bite mark analysis has historically been associated with forensic odontology and the assessment of patterned injuries. However, its evidentiary use has generated substantial scientific controversy. Concerns include the distortion and variability of skin, limitations in reproducing injury patterns, difficulties in establishing reliable individualization, and the potential for examiner interpretation to influence conclusions [4].

Consequently, apparent similarities between a dental pattern and an injury should not automatically be interpreted as proof of individual identity. The limitations of the underlying evidence must be considered, and conclusions should remain proportionate to the scientific support available. This highlights the importance of critical research, appropriate validation, and cautious interpretation in forensic practice. The historical inclusion of bite mark analysis within FO should not be regarded as evidence that all traditional methods possess equivalent scientific reliability.

Conclusion

Forensic odontology encompasses both practical medico-legal activities and research-driven scientific development. Master's-level training commonly emphasizes the application of established methods and practical competencies, whereas PhD training focuses on independent research, methodological innovation, and scientific validation. Nevertheless, these pathways are not mutually exclusive, and professional roles may overlap according to individual training and experience. Practitioners contribute directly to forensic investigations, while research-focused professionals strengthen the scientific basis of methods through development, validation, and critical evaluation. Both contributions are essential to the discipline. Greater international collaboration, transparent competency frameworks, and evidence-based professional

Table 1. Roles of Forensic Odontologists in Practice and Research.

Role	Focus	Typical activities	Skills/Tools	Main contribution
Forensic practitioner	Casework and legal application	Dental examinations DVI Court testimony Bite mark case analysis	Dental charting Radiograph interpretation; comparative analysis Legal documentation	Identification reports Court evidence Operational casework
Research scientist / academic FO	Method development/ validation	Developing/validating identification & sex-prediction models Studying population traits Publishing research	Statistical analysis CBCT/3D imaging AI Experimental design	Validated protocols Scientific publications Evidence-based standards
Educator/trainer	Knowledge transfer and capacity building	Teaching Supervising simulations; conducting workshops & conferences	Curriculum design, teaching methods Mentoring	Competent practitioners Workforce development Dissemination of best practices
Digital/technology FO	Technology integration	Applying CBCT, 3D and intraoral scanning Developing digital identification and AI prediction workflows	3D modelling software, machine learning Workflow validation	Digital forensic pipelines, population-specific tools, improved casework efficiency

recognition may strengthen forensic odontology education and practice while supporting its continued scientific advancement.

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Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript. All authors contributed to the manuscript and approved the final version.

Ethical Considerations

Not applicable.

References

[1] Valenzuela A. Forensic odontology in human identification in multiple victims' incidents. Span J Leg Med. 2023;49(2):1-4. [DOI: 10.1016/j.remle.2023.08.001]

[2] Riaz S, Bukhari KMA, Haque S, Zafar MS, Syed S. Modernizing forensic anthropology: a data-driven pipeline for human identification and profiling. Eur J Dent. 2026;20(2):392-8. [DOI: 10.1055/s-0046-1816537]

[3] Sezer B. The role of forensic odontology in modern forensic science: applications, responsibilities and emerging trends. Turkish J Forensic Med. 2025;39(2):242-55. [DOI: 10.61970/adlitip.1744389]

[4] Koehler JJ, Mnookin JL, Saks MJ. The scientific reinvention of forensic science. Proc Natl Acad Sci U S A. 2023;120(41):e2301840120. [DOI: 10.1073/pnas.2301840120]

[5] Radu CC, Hogea T, Caras C, Radu CM. Forensic odontology in the digital era: a narrative review of current methods and emerging trends. Diagnostics (Basel). 2025;15(20):2550. [DOI: 10.3390/diagnostics15202550]

[6] American Board of Forensic Odontology. Diplomates reference manual: section IV standards & guidelines. Colorado Springs: ABFO; 2021. [Link]

[7] Riaz S. Advances in forensic odontology for human identification: a comprehensive review of methods, accuracy, and challenges. IIUM J Orofac Heal Sci. 2026;7(1):70-80. [DOI: 10.31436/ijohs.v7i1.409]

[8] Rötzscher K. Forensic and Legal Dentistry. Cham: Springer; 2014. [DOI: 10.1007/978-3-319-01046-5]

[9] Goncharuk-Khomyn M. Forensic dental identification during wartime: impact of AI and digital dentistry. J Dent. 2024;147:105174. [DOI: 10.1016/j.jdent.2024.105174]

[10] University of Dundee. Forensic odontology MFOdont. Dundee: University of Dundee; 2026. [Link]

[11] Dietrichkeit Pereira JG, Frontanilla Recalde TS, Barreto Costa P, Jacometti V, Vigorito Magalhães L, Alves Da Silva RH. Forensic odontology education: from undergraduate to PhD - a Brazilian experience. J Forensic Odontostomatol. 2017;35(2):157-65.

[12] Dinis-Oliveira RJ. Forensic science or sciences? The recognition as an independent science and redefinition of expert practices based on transdisciplinary. Forensic Sci Res. 2025;10(3):owaf012. [DOI: 10.1093/fsr/owaf012]

[13] Silverman B. Research and development in forensic science: a review. London: Home Office; 2011.

[14] Gholami A, Massoudi S, Kharazian Moghaddam M, Ghazi Marashi M, Marashi M, Bashar R, et al. The role of the gray wolf in rabies transmission in Iran and preliminary assessment of an oral rabies vaccine in this animal. Journal of Medical Microbiology and Infectious Diseases, 2017, 5(3): 56-61. [DOI: 10.29252/JoMMID.5.3.4.56]

[15] Moreton R. Computer systems validation: why validate? RELI Research; 2026. [Link]

[16] Reesu GV, Woodsend B, Mânica S, Revie GF, Brown NL, Mossey PA. Automated identification from dental data (AutoIDD): a new development in digital forensics. Forensic Sci Int.

2020;309:110218. [DOI: 10.1016/j.forsciint.2020.110218]

[17] Emam NM. Role of forensic odontology in identification of persons: a review article. Cureus. 2024;16(3):e56570. [DOI: 10.7759/cureus.56570]