ARTIFICIAL INTELLIGENCE IN FORENSIC ODONTOLOGY: EXAMINING LEGAL ADMISSIBILITY, EMERGING CHALLENGES AND THE NEED FOR REGULATORY REFORMS

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Abstract

Forensic Odontology (FO) or forensic dentistry is the use of dental science in legal investigations. It mainly focuses on identifying individuals by analysing the distinctive anatomical structure of the oral cavity. Unlike other forensic disciplines, FO relies on the uniqueness, durability and post-mortem resilience of dental structures. This enables human identification where fingerprints, facial features or DNA are unavailable or severely compromised in cases of criminal investigations, mass disasters, armed conflicts and other incidents involving decomposed, charred or mutilated human remains. Recent advancement of AI, particularly machine learning and deep learning, have transformed FO in its five main areas of human bite marks, sex determination, age estimation, dental comparison and facial reconstruction. However, the use of these AI-assisted techniques raises complex legal, ethical and evidentiary that remain inadequately addressed within existing legal and regulatory frameworks, particularly in Sri Lanka, where AI adoption in forensic practice is still at an early stage. The central research problem of this study is therefore the absence of adequate legal and regulatory standards governing the admissibility, reliability, transparency and accountability of AI-assisted forensic odontological evidence. The main objective of this study is to observe the AI application in these four areas, identify the effects of using this AI systems in legal investigations and to provide recommendations. To achieve these objectives, the study incorporates a qualitative doctrinal legal methodology by analysing relevant legislation on the admissibility of forensic evidence, international guidelines and standards and scholarly literature on forensic science, AI and medico-legal practice. The finding of this study highlighted that AI techniques have improved the analysis of dental records, bite marks, age and sex estimation, facial reconstruction through 3D models and automated image analysis to increase the speed and precision of forensic identifications. However, the findings also demonstrate that the absence of comprehensive legal standards governing AI-assisted forensic evidence creates bias and discrimination, lack of transparency, accountability, privacy and security concerns. Accordingly, the study recommends the development of domestic legislation, internationally harmonized regulatory standards, mandatory validation and auditing of AI systems, strong data protection safeguards and the continued involvement of qualified forensic odontologists in all AI-assisted analyses. Finally, it concludes AI is a tool, not a substitute for forensic expertise.

Keywords: Artificial Intelligence, forensic odontology, human bite marks, legal reforms, sex and age determination