10.5005/jp-journals-10052-0028

REVIEW ARTICLE

Forensic Odontology: An Overview

[1]M Madhuri, [2]Sushma Pulivarthi, [3]P Balaji, [4]C Poornima, [5]MB Sowbagya, [6]G Poornima

ABSTRACT

Dentistry has much to offer law enforcement in the detection and solution of crime or in civil proceedings. Forensic odontology fieldwork requires an interdisciplinary knowledge of dental science. Most often, the role of the forensic odontology is to establish a person's identity. Teeth, with their physiologic variations, pathology, and effects of treatment, record information that remains throughout life and beyond. The teeth may also be used as weapons and, under certain circumstances, may leave information about the identity of the biter. Forensic odontology has an important role in the recognition of abuse among persons of all ages. Dental professionals have a major role to play in keeping accurate dental records and providing all necessary information so that legal authorities may recognize malpractice, negligence, fraud or abuse, and identify unknown humans.

Keywords: Dental records, Dentists, Forensic odontology.

How to cite this article: Madhuri M, Pulivarthi S, Balaji P, Poornima C, Sowbagya MB, Poornima G. Forensic Odontology: An Overview. Int J Prev Clin Dent Res 2016;3(2):131-133.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Despite breakthrough in science and technology, natural calamities and crimes continue to persist in human life. Identification of human remains is essential for various reasons, including legal, criminal, humanitarian, and social grounds. The human body becomes disfigured to a great extent in case of burns, accidents, and mass disasters, such as earthquake so much so that identification of the individual becomes a challenge. However, dental remains can be used for identification because using them is cost effective, reliable, and fast. Forensic Odontology, or forensic dentistry, was defined by Keiser-Neilson in 1970[1] as "that branch of forensic medicine which, in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings." This article sheds light on the role of the dentist in identification of human and dental remains along with recent advances in the field of forensic odontology.

[1]Intern, [2]Postgraduate Student, [3]Professor and Head [4-6]Reader

[1-6]Department of Oral Medicine and Radiology, RajaRajeswari Dental College and Hospital, Bengaluru, Karnataka, India

Corresponding Author: M Madhuri, Intern, Department of Oral Medicine and Radiology, RajaRajeswari Dental College and Hospital, Bengaluru, Karnataka, India, Phone: +918147013790 e-mail: madhuri.madineni@gmail.com

HISTORY OF FORENSIC ODONTOLOGY

The earliest recorded case of forensic dentistry concerns a female associated with emperor Nero, who was identified after her death through the unique arrangement of her teeth. In the year 66 AD, Nero's mistress Sabina got Nero's wife killed by her soldiers and demanded to see the head of the victim in a dish. She recognized the head by a black anterior tooth.[2] Later, in 1775, Paul Revere identified victims of a revolutionary war by their teeth and dental work. He also identified the body of Joseph Warren by identifying a walrus tusk used as a pontic for his missing maxillary canine.[3] In 1977, the bodies of Hitler and his wife Eva Braun were identified using dental records with radiographs and prostheses.[4]

DENTAL RECORD AS A LEGAL DOCUMENT

The dental record is a legal document owned by the dentist, and contains subjective and objective information about the patient. Results of the physical examination of the dentition and supporting oral and surrounding structures must be recorded. In addition, the results of clinical laboratory tests, study casts, photographs, and radiographs become components of the record, and should be kept for 7 to 10 years.[5]

Radiographic Examination

Comparison of ante mortem and postmortem radiographs is the most accurate and reliable method of identifying remains. Observations, such as distinctive shapes of restoration, root canal treatment, buried root tips, bases under restorations, tooth and root morphology, and sinus and jawbone patterns can be identified only by examination of radiographs.[6]

Age Determination Based on Dental Data

Age estimation is a subdiscipline of forensic sciences and should be an important part of the identification process, especially when information related to the deceased is unavailable.[7,8] Small variations in tooth formation and eruption among persons has made dental estimation of chronological age the primary method of age determination for younger persons. Human dentition follows a

reliable and predictable developmental sequence, beginning about 4 months after conception and continuing to the beginning of the third decade of life when development of all the permanent teeth is completed.[9]

The use of radiographs is characteristic of techniques that involve observation of the morphologically distinct stages of mineralization. Such determinations are also based on the degree of formation of root and crown structures, the stage of eruption, and the intermixture of primary and adult dentitions.[10]

Mass Disaster Identification

Transport accidents form the majority of cases in which dental identifications are needed, particularly aircraft accidents in which both fire and trauma are often severe. Dental examination is significantly confounded when heat and flames have fragmented tooth enamel, and soot and smoke have been deposited on the teeth. Generally, teeth and restorations are resistant to heat, unless they are exposed directly to flame. Preservation is possible in most cases.[11]

Anthropologic Examination

In addition to analysis of teeth, the most common methods of identification include visual identification, fingerprinting, serologic and DNA comparison, and anthropologic examination of bone. Each method has its advantages and disadvantages. They all rely on the principle that identification is derived from a positive correlation between known information about a person and findings from a physical examination of the decedent.[12]

The Forensic Process Model[13]

The US Department of Justice published a process model in the Electronic Crime Scene Investigation: a guide to first responders that consists of four phases:

1. Collection involves the evidence search, evidence recognition, evidence collection, and documentation.
2. Examination is designed to facilitate the visibility of evidence, while explaining its origin and significance. It involves revealing hidden and obscured information and the relevant documentation.
3. Analysis looks at the product of the examination for its significance and probative value to the case.
4. Reporting entails writing a report outlining the examination process and pertinent data recovered from the overall investigation.

Application of Software Technology in Forensic Odontology

In the past decade it had been observed that software technology has emerged as an indispensable part of forensic odontology. Several research studies with application of software technology to identify an individual have been proposed and found to give very reliable results.[14]

Rugae Pattern

Special software was designed, called the Palatal Rugae Comparison Software (PRCS) version 2.0, to match the clinical photographs taken using an SLR digital camera. The software recorded an accuracy of 99% in identification of individuals; whereas manual methods have shown high false positive and negative cases.[15]

Facial Reconstruction

There are few studies that showed that, with the application of three-dimensional (3D) computed tomography scan and computer software, facial reconstruction can be done with low standard error of those measurements, from 0.85 to 3.09%. So, it can be used reliably in identification of individuals, especially in mass disasters.[16]

Maxillary Sinus in Gender Determination

Width, length, and height of the maxillary sinuses were measured in computerized tomography scans with the application of software. Authors have concluded that computerized tomography measurements of maxillary sinuses may be useful to support gender determination in forensic medicine; however, with a relatively low-accuracy rate.[17]

Bite Marks

Bite mark comparison protocols include measurement and analysis of the pattern, size, and shape of teeth against similar characteristics observed in an injury on skin or a mark on an object.[18,19]

CONCLUSION

Law practitioners are in an uninterrupted battle with criminals in the application of digital/computer technologies, and require the development of a proper methodology to systematically search digital devices for significant evidence. So, we emphasize on the need for digital/computer forensics and application of technologies to be practiced in an effective and legal way and to formalize basic technical issues, and point to references for further reading.

REFERENCES

1. Keiser-Neilsen S. Person identification by means of teeth. Bristol: John Wright and Sons; 1980.
2. Sansare K. Forensic odontology, historical perspective. Indian J Dent Res 1995 Apr-Jun;6(2):55-57.
3. Devore DT. Radiology and photography in forensic dentistry. Dent Clin North Am 1977 Jan;21(1):69-84.

4. Bagi BS. Role of forensic odontology in medicine. J Indian Dent Assoc 1977;49(2):359-363.
5. Nolla CM. The development of permanent teeth. J Dent Child 1960;27(2):254-266.
6. Kvaal S, Kolltvit KM, Thompson IO, Solheim T. Age estimation of adults from dental radiographs. Forensic Sci Int 1995 Jul 28;74(3):175-185.
7. Wood RE, Kirk NJ, Sweet DJ. Digital dental radiographic identification in the pediatric, mixed and permanent dentitions. J Forensic Sci 1999 Sep;44(5):910-916.
8. Willems G. A review of the most commonly used dental age estimation techniques. J Forensic Odontostomatol 2001 Jun;19(1):9-17.
9. Whittaker DK. An introduction to forensic dentistry. Quintessence Int 1994 Oct;25(10):723-730.
10. Cameron JM, Sims BG. Forensic dentistry. Edinburgh: Churchill Linvingstone; 1974.
11. Wood RE, Clark B, Brooks SE, Blenkinsop B. Combined physical and computer-aided facial reconstruction in human skeletal remains. Can Soc Forensic Sci J 1996;29(4):195-203.
12. Neville B, Douglas D, Allen CM, Bouquot J. Forensic dentistry. In: Oral and maxillofacial pathology. 2nd ed. Philadelphia (PA): W.B. Saunders Co.; 2002. p. 763-783.
13. National Institute of Justice. Electronic Crime Scene Investigation. 2001 Jul. A Guide for First Responders. Available from: http://www.ncjrs.org/pdffiles1/nij/187736.pdf.
14. Hemanth M, Vidya M, Shetty N, Karkera BV. Identification of individuals using palatal rugae: computerized method. J Forensic Dent Sci 2010 Jul;2(2):86-90.
15. Sdos S, Ramos DL, Cavalcanti MG. Applicability of 3D-T facial reconstruction for forensic individual identification. Pesqui Odontol Bras 2003 Jan-Mar;17(1):24-28.
16. Teke HY, Duran S, Canturk N, Canturk G. Determination of gender by measuring the size of the maxillary sinuses in computerized tomography scans. Surg Radiol Anat 2007 Feb;29(1):9-13.
17. Van der Velden A, Spiessens M, Willems G. Bite mark analysis and comparison using image perception technology. J Forensic Odontostomatol 2006 Jun;24(1):14-17.
18. Sweet D, Parhar M, Wood RE. Computer based production of bite mark comparison overlay. J Forensic Sci 1998 Sep;43(5): 1050-1055.
19. Adams BJ. Establishing personal identification based on specific patterns of missing, filled, and unrestored teeth. J Forensic Sci 2003 May;48(3):487-496.