

## REVIEW ARTICLE

# Advances in Forensic Odontology - An Overview

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## ABSTRACT

Forensic odontology is the application of dental science to legal investigations, primarily involving the identification of the offender by comparing dental records to a bite mark left on the victim or at the scene, or identification of human remains based on dental records. The forensic odontologist utilizes knowledge of dentistry in bite mark analysis, fixation of identity in mass disaster, age determination, domestic violence, and child abuse cases. Thus, the duty and responsibility of forensic odontologists have increased in recent years in various medico-legal cases. This article is structured to give an overview of advances in forensic odontology.

**Keywords:** Advances, Age estimation, Dental records, Forensic odontology, Mass disasters

**How to cite this article:** Thomas AJ, Oommen S. Advances in Forensic Odontology - An Overview. *Int J Prev Clin Dent Res* 2018;5(2):S79-81.

**Source of support:** Nil

**Conflict of interest:** None

## INTRODUCTION

Forensic odontology is the application of dental science to legal investigations, primarily involving the identification of the offender by comparing dental records to a bite mark left on the victim or at the scene, or identification of human remains based on dental records.

Forensic odontology has three major areas of utilization as follows: (1) Diagnostic and therapeutic examination and evaluation of injuries to jaws, teeth, and oral soft tissues, (2) the identification of individuals, especially casualties in criminal investigations and/or mass disasters, and (3) identification, examination, and evaluation of bite marks which occur with some frequency in sexual assaults, child abuse cases, and in personal defense situations.<sup>[1]</sup>

The common methods used for individual identification are using visual identification, personal information

(such as height, build, age, and presence or absence of hair), medical information (such as scars, tattoos, birthmarks, implants, amputations, and prosthesis), and footprint records from a chiropodist/podiatrist, clothing, personal effects, fingerprints, DNA profiling, and dental identification<sup>[2-4]</sup> identification by dental means gains more importance because the dental tissues are often preserved even if the deceased person is skeletonized, decomposed, burnt, or dismembered. Dental tissues are often used to determine age, sex, and ethnicity of the person who can either be a victim or a suspect.

## ADVANCES

### Forensic Anthropology

It is the identification and examination of skeletal remains which reveals personal attributes such as origin, sex, age, race, and/or injury. Facial reconstruction may be able to identify mass victims of disaster through skeletal remains.<sup>[5]</sup>

### Age Estimation

Age assessment using teeth provided the most reliable guide in the process of identification. Various methods are utilized which include visual method, radiographic method, histological method, computer-assisted method, and comparison with antemortem data.<sup>[6]</sup>

### Tongue Prints

Tongue is unique to each person in its shape and surface textures and is the only internal organ that can be protruded from the body and easily exposed for inspection. The use of tongue prints for forensic identification is at budding stage now. For this technique to be successful, the antemortem photograph or impression of the tongue should be available. The lingual morphological aspects can be preserved using the alginate molding technique for duplicating the minute details which are unique for each and every individual. The lingual impression, together with its photographic image, may constitute secure methods for forensic dentistry identification.<sup>[4,7]</sup>

### Mass Disasters

Comparison of antemortem and postmortem radiographs is the most accurate and reliable method of identification in mass disaster identification.<sup>[8]</sup> So for that,

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disaster victim identification teams are required to process the entire task in four main steps, i.e., body tagging and bagging, fingerprinting, forensic pathology, and forensic dentistry.

### Role of Saliva in Forensic Odontology

Early attempt should be made to collect saliva from bite marks for group tests. Saliva sample can be coupled with forensic DNA analysis to rule in or rule out the connection between an individual and the forensic evidence methylation (which is a chemical change to one of the four building blocks of a person's DNA) changes as our bodies grow older, contributing to age-related diseases.<sup>[9]</sup>

### Facial Reconstruction

Faces are peculiar to every human being born in this world from the past. Face is crucial for human identity and is a boon to the humankind. It plays a major role in forensic sciences due to the fact that if the face of the deceased person remains unchanged, the identity of the person can be easily made without any need for forensic professionals. Computerized facial reconstruction method uses a laser video camera interfaced with a computer or with CT scanning. Skull data are then imaged as a fully shaded 3D surface.<sup>[10]</sup> The face can be drawn with the help of computer software.

### Bite Mark Analysis

On collection of dental evidence, the forensic odontologist analyzes and compares the bite marks factors that may affect the accuracy of bite mark identification includes time-dependent changes of the bite mark on living bodies, effects of where the bite mark was found, damage on soft tissue, and similarities in dentition among individuals. Other factors include photography, impressions, or measurement of dentition characteristics.<sup>[11]</sup>

Significance of Denture Labeling in Forensic Investigations: <sup>[12,13]</sup> The denture marking serves to identify an unknown denture wearer in cases involving amnesia or senility, loss of memory, psychiatric cases, homicide, suicide, victims of fire, explosion, floods, earthquake, plane crash, or war. The denture labeling should consist of name alone or along with other details such as social security number, driver's license number, and city code. In general, a combination of name and identifying number used inside a denture provides great help and prevents misidentification or delay in identification. Unlike acrylic, cobalt-chromium appliances resist melting even in some cases of incinerated remains.

### Denture Marking Using Memory Card

Recently, the memory card can be programmed with all the relevant information regarding the patient identification, the photograph of the patient, and wrap in cellophane, to be placed in polished surface of dentures. This method helps in easy identifying of both persons and dentures.<sup>[14-16]</sup>

### Comparison Microscopes

The use of microscopes in forensic sciences has an impact on the accuracy. Examination of teeth under microscope can confirm sex by the presence or absence of Y-chromatin.<sup>[1]</sup> The phase contrast microscope is useful in analyzing the cemental annulations for age estimation. In case of comparison of the samples, the conventional microscope consumes more time in readjusting the focus and in achieving different views. Moreover, the observer has to rely on memory when comparing two objects. To avoid these problems, the forensic technology has developed a prototype virtual comparison microscope (VCM). With VCM, it is easy to find significant markings in any direction while maintaining a consistent appearance.<sup>[17,18]</sup>

### CONCLUSION

Forensic dentistry has always been an integral part of medical and dental sciences. Availability of better technology has prevailed to reframe our attitude toward the discipline of forensic odontology. Nevertheless, there is a scope for tremendous improvement which would enhance and revolutionize the postmortem procedures. Interdisciplinary knowledge and understanding would be vital to the future of forensic odontology.

### REFERENCES

1. Blackwell SA, Taylor RV, Gordon I, Ogleby CL, Tanijiri T, Yoshino M, *et al* 3-D imaging and quantitative comparison of human dentitions and simulated bite marks. *Int J Legal Med* 2007;121:9-17.
2. Brannon RB, Kessler HP. Problems in mass-disaster dental identification: A retrospective review. *J Forensic Sci* 1999;44:123-7.
3. Woodward JD. Denture marking for identification. *J Am Dent Assoc* 1979;99:59-60.
4. Haines DH. Identification in mass disasters from dental prostheses. *Int J Forensic Dent* 1973;1:11-5.
5. Colvenkar SS. Lenticular card: A new method for denture identification. *Indian J Dent Res* 2010;21:112-4.
6. Richmond R, Pretty IA. Contemporary methods of labeling dental prostheses – a review of the literature. *J Forensic Sci* 2006;51:1120-6.
7. Friedman RB, Cornwell KA, Lorton L. Dental characteristics of a large military population useful for identification. *J Forensic Sci* 1989;34:1357-64.

8. Patidar KA, Parwani R, Wanjari S. Effects of high temperature on different restorations in forensic identification: Dental samples and mandible. *J Forensic Dent Sci* 2010;2:37-43.
9. Manigandan T, Sumathy C, Elumalai M, Sathasivasubramanian S, Kannan A. Forensic radiology in dentistry. *J Pharm Bioallied Sci* 2015;7:S260-4.
10. Fenton TW, Heard AN, Sauer NJ. Skull-photo superimposition and border deaths: Identification through exclusion and the failure to exclude. *J Forensic Sci* 2008;53:34-40.
11. Shamim T, Varghese VI, Shameena PM, Sudha S. Age estimation: A dental approach. *J Punjab Acad Forensic Med Toxicol* 2006;6:14-6.
12. Ubelaker DH, Parra RC. Application of three dental methods of adult age estimation from intact single rooted teeth to a Peruvian sample. *J Forensic Sci* 2008;53:608-11.
13. van der Velden A, Spiessens M, Willems G. Bite mark analysis and comparison using image perception technology. *J Forensic Odontostomatol* 2006;24:14-7.
14. Silva RH, Musse JD, Melani RF, Oliveira RN. Human bite mark identification and DNA technology in forensic dentistry. *Braz J Oral Sci* 2006;5:1193-7.
15. Datta P, Sood S, Rastogi P, Bhargava K, Bhargava D, Yadav M. DNA profiling in forensic dentistry. *J Indian Acad Forensic Med* 2012;34:156-9.
16. Mayall SS, Agarwal P, Vashisth P. Dental DNA finger-printing in identification of human remains. *Ann Dent Spec* 2013;1:16-9.
17. Reddy LV. Lip prints: An overview in forensic dentistry. *J Adv Dent Res* 2011;2:17-20.
18. Krishnan RP, Thangavelu R, Rathnavelu V, Narasimhan M. Gender determination: Role of lip prints, finger prints and mandibular canine index. *Exp Ther Med* 2016;11:2329-32.