

THE APPLICATIONS OF FORENSIC ODONTOLOGY IN IDENTIFYING VICTIMS OF DISASTERS

1. Dr. R. JAYASRIKRUPAA, MDS

*READER, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY,
SREE BALAJI DENTAL COLLEGE AND HOSPITAL, CHENNAI
BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH*

2. Dr. T.H.THARIKA

*CRRI, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY,
SREE BALAJI DENTAL COLLEGE AND HOSPITAL, CHENNAI
BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH*

3. Dr. N. ARAVINDHA BABU, MDS

*PROFESSOR, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY,
SREE BALAJI DENTAL COLLEGE AND HOSPITAL, CHENNAI
BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH*

4. Dr. KMK MASTHAN, MDS

*PROFESSOR & HEAD, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY,
SREE BALAJI DENTAL COLLEGE AND HOSPITAL, CHENNAI
BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH*

CORRESPONDING AUTHOR:

1. Dr. R. JAYASRIKRUPAA, MDS

*READER, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY,
SREE BALAJI DENTAL COLLEGE AND HOSPITAL, CHENNAI
BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH*

jayasri.krupaa@gmail.com

Abstract: Forensic odontology is a speciality in dentistry which occupies a primary niche within the total spectrum of methods applied to medico legal identifications. Forensic odontology deals with human identifications based on dental records, bite marks, lip prints, tooth prints and palatal rugae patterns. This article primarily aims at making general practitioners aware about the importance of keeping various types of dental records and its implication in forensic odontology.

Keywords: Mass disaster, Age estimation, Bite marks, Dental records, Forensic odontology, Sex determination, DNA analysis, Cheiloscropy, Rugoscopy, Saliva, Teeth prints.

1. INTRODUCTION:

Forensic dentistry is defined by Keiser-Neilson as “that branch of dentistry that in the interest of justice deals with the proper handling and examination of dental evidences and the proper evaluation and presentation of dental findings^[1]. It has a key role in identifying persons in mass disasters [aviation, earthquakes and tsunamis], in crime investigations, in ethnic studies and in identification of decomposed and disfigured bodies [drowned persons, fire victims, and victims of motor vehicle accidents^[2, 3]. It involves the presentation of dental evidence in criminal or civil proceedings all in the interest of justice.

FIELD OF ACTIVITY: This is roughly divided into 3

Criminal: Evidences obtained from the bite marks produced by the teeth which are present on the victim, assailant or some inanimate objects such as food items.

Civil or non criminal: It includes some aspects of fraud, neglect and malpractice. Identification of dead and living subjects is also included in this category

Research: Used for academic courses and also for training dentists working in criminology or police departments^[4, 5]

IDENTIFICATION OF PERSONS:

When the body is disfigured or is mutilated beyond recognition due to barbaric crimes, occupational and motor cycle accidents, aviation and navy disasters, war, fire, flood, man-made, natural mass disasters, casualties, in conditions where the body is unrecognizable and in decomposed state, identification of the person is required. The most stable unique hard structure with unique shape and size are the teeth. Even after death they are not easily decomposed. They are made as a trusted source in identification process, since it can survive disastrous environmental conditions such as fire^[6].

DENTAL RECORDS:

This is the legal document owned by the dentist. This is performed by 2 means. First the dentist should examine previous dental records of the person suspected as deceased and look for the dental characteristics in the deceased person for similarity and confirmation. Secondly when no previous records are present a postmortem dental profiling is done which will narrow the search required for antemortem materials to identify the deceased person^[7]. The ante mortem records are very helpful for identifying individuals in mass disasters^[8]. The ante mortem records [such as history sheets, mouth impressions, radiographs] are used as a tool for positive identification when compared with the postmortem records. The dentist should record dental characteristics of the teeth and surrounding tissues in the postmortem records. The angulations of both the radiograph should be similar so as to simulate and compare the radiographs. The conclusion of ante mortem and postmortem data comparison leads to the following situations by AMERICAN

BOARD OF FORENSIC ODONTOLOGY:

Positive identification: There is some uniqueness among the comparable items in ante mortem and postmortem database. No major difference.

Probable identification: The data is consistent but a lack of quality of ante mortem or postmortem information means one cannot confirm the identity.

Presumptive [possible] identification: Some information may be missing from either source preventing the establishment of a positive identification.

Insufficient identification: There is no supportive evidence to compare and arrive at a conclusion.

Exclusion of identification: Explainable or unexplainable discrepancies exist among comparable items in ante mortem and postmortem databases. This is as important as positive identification^[9, 10].

DENTAL IDENTIFICATION: There are 3 procedures

Comparative dental identification: This is done by comparing the dead individual's teeth with presumed dental records of the individual.

Reconstructive postmortem dental identification or dental profiling: In this attempts are made to know about the ethnicity or race, gender, age, and occupation of the dead individual. This is done when no clue exists about the identity of the deceased.

DNA profiling to oral tissues: Done when no dental records is available. Makes use of modern forensic DNA profiling methods.

VICTIM IDENTIFICATION IN MASS DISASTERS:

The aim of disaster victim identification is to establish every victim by comparing and matching accurate ante mortem and postmortem data^[11]. Identification of mass disaster is classified into natural calamities, accidents, and criminal attacks [terrorist bombing]. Physical features are often destroyed in this situation. The only part of the body not destroyed by majority of trauma is the dental structures. Generally teeth and restorations are resistant to heat unless they are exposed directly to flame^[8].

INSTRUMENTS USED FOR IDENTIFICATION: Dental explorers, Dental mirrors, Bite block, Tissue scissors, Osteotome, Rubber air or water syringe, Cotton swab, Photographic mirrors, Periodontal probes, Bone mallet, Camera, Head lamp, Masks, Films, Stryker saw^[12].

ROLE OF DNA IN FORENSIC IDENTIFICATION:

Since the dental tissues are resistant to environmental assaults, such as incineration, immersion, trauma, mutilation and decomposition, teeth represent an excellent source of DNA material^[13].

The sample for analysis is obtained from biological material such as blood, semen, hair roots, tissues, teeth, bone and saliva. The specimens are collected carefully without contamination, so gloves should be worn and should be stored in cold places or should be frozen. Saliva is a major source of DNA as it contains sloughed epithelial cells from oral mucosa and inner surface of lips. Enzymes seen in saliva and in teeth are Streptococcus salivarius and Streptococcus mutans^[14].

AGE ESTIMATION: When the information related to the deceased is not available, age estimation is an important part of identification process. Dental ageing technique is broken down into 2 categories: Developmental changes, Degenerative changes.

Developmental changes: Development of human dentition begins by the 4th month after conception and eruption continues till the 3rd decade of life. To assess the age of unknown individual, postmortem radiographs should be compared to the eruption standards produced by the Schour and Massler^[15].

Degenerative changes: This occurs when the erupted teeth starts wearing down. It is said that there is an intuitive connection between wearing and age [more wear means older teeth]. Age estimation is the important part in forensic odontology because human dentition follows a reliable and predictable developmental sequence.

SEX DETERMINATION:

This is useful in identifying unknown individuals in natural disasters, chemical and nuclear bomb explosion.

CRANIOFACIAL MORPHOLOGY AND DIMENSIONS: Different features of skull and the mandible are used for determining the sex of an individual. They observed it using constant 6 traits: mastoid, supraorbital ridge, size and architecture of skull, zygomatic extension, nasal

aperture and mandibular gonial angle. This gives a high degree of precision to determine the sex of an individual^[10].

SEX DIFFERENCE IN TOOTH DIMENSION: It is used for differentiating sex by measuring their mesiodistal [MD] and buccolingual [BL] dimension. This is the most reliable method for sex determination. These dimensions are said to be more in male than in females^[15].

SEX DETERMINATION BY DNA ANALYSIS: Amelogenin [AMEL] is one of the major matrix proteins secreted by the ameloblasts of the enamel^[10]. The presence of Barr bodies in females is seen on microscopic examination of the cells from the pulp. The females have 2 identical AMEL genes while males have 2 non- identical AMEL genes^[16, 17].

OTHERS METHODS USED FOR IDENTIFICATION:

CHEILOSCOPY: Also known as lip prints which are seen on the external surface of the lip where there are numerous elevations and depressions^[18]. This can be obtained at crime scenes from clothing, cups, glasses, cigarettes, windows and doors. From the middle portion of the lips the impression are made and characteristic patterns are studied. It should be collected with 24 hours of the time of death. Although these prints are unique to an individual, when the lines are not clear, individual identification based on this trace is “extremely difficult”.

RUGOSCOPY: Palatal rugae comprises about 3-7 ridges radiating out tangentially from the incisive papilla, which are classified as curved, straight, wavy and branched. They are said to be unique for each individual. Palatal rugae are used as supplement in edentulous mouth in case where postmortem identification is not possible.

SHORT COMING IN APPLYING RUGOSCOPY:

Postmortom identification is not possible without the antemortom records

Complex rugae patterns [that cannot be classified under one particular group] can cause intra or inter observer errors^[19].

Palatal rugae are often destroyed, in case of fire and also since decomposition and skeletonization can occur in less than 6 weeks in summer and 4 months in winter, rugoscopy has no application after this stipulated period^[20].

BITE MARKS: It is defined as the physical alteration in or on a medium caused by the contact of the teeth. Suspects or victims in some criminal cases, leave his or her teeth marks on another person or inanimate object^[21]. There are certain individual features and class characteristics for specific type of teeth:

Classic features: rectangular marks are produced by incisors, triangular or rectangular marks by canine, spherical or point shaped marks seen in premolars and molars depending on the amount of attrition.

Individual features: Fractures, rotation, spacing, these make the bite mark distinct^[22].

Bite marks from objects[such as apple, chocolates] yields more information , in this swabs are taken from the object as it may reveal the blood group type and DNA analysis is also possible^[23].

TOOTH PRINTS [AMELOGLYPHICS]: The study of enamel rod end pattern is termed as “ameloglyphics” by Manjunath et al. Ameloblast lay down the enamel rods in an undulating and intertwining path, which is seen on the outer surface of the enamel. This is used as an identification tool in decomposed or burned bodies as enamel resist decomposition^[24].

2. CONCLUSION:

Forensic dentistry plays a major role in identification of those individuals who cannot be identified visually or by other means. A dental record should contain the name, age, sex, location, occupation, the no of teeth present, medical conditions, filled teeth, dentures and other restorations and morphological variations of teeth and mucosa with photographs and radiographs. These records help in positive identification of victims in mass disasters and are highly important. So it is the social responsibility of every dentist to safely maintain the accurate dental records of every patient.

3. REFERENCES:

1. Disaster victim identification. Catherine Adams. Forensic Odontology: An Essential Guide, First Edition. John Wiley and sons,. Ltd. 2014
2. Rothwell BR, Haglund W, Morton TH Jr. Dental identification in serial homicides: The green river murders. J.Am Dent Assoc 1989; 119: 373-9
3. Andersen L, Juhl M, Solheim T, Borrman H. Odontological identification of fire victims-potentialities and limitations Int. Legal Med 1995; 107: 229-34.
4. Cameron JM, Sims BG. Forensic Dentistry. 1st edition. Edinburgh: Churchill Livingstone; 1974.p.310-403.
5. Neville BW, Damm DD, Allen CM, Bouquot JE.Oral and Maxillofacial Pathology. 2nd edition. Philadelphia [PA]: W.B. Saunders Co; 2002.p.201-9
6. Vagish Kumar L Shanbhag: Review Article. Department of Oral Medicine and Radiology. Yenepoya Dental College and hospital. May 15, 2017, IP: 154.70.154.240.
7. Pretty IA, SweetD. A look at forensic dentistry- part 1: The roles of teeth in the determination of human identify Br. Dent J 2001; 190: 359-66.
8. James H. Thai tsunami victim identification overview to date J. Forensic Odontostomatol 2005; 23: 1-18.
9. Avon SL. Forensic Odontology: The role and responsibilities of the dentist. J Can Dent Assoc 2004; 10: 1400-9
10. Acharya AB, Sivapathasundharam B. Forensic Odontology. In. Rajendran R, Shivapathasundharam B. Shafer's textbook of oral pathology. 6th edition. New Delhi: Elsevier; 2009. P. 871-5
11. Sirisup N. Kanluen S. Role of forensic doctors in Thailand's tsunami: Experiences from chulalongkorn medical school. JMed Assoc. Thai 2005; 88:S335-8.
12. Neville .B.. Douglas D. Allen .CM and Bouquot Textbook of oral and maxillofacial pathology. 2nd Edn. Philadelphia [PA]: WB. Saunders Co. 2002: 763-783.
4. 13.KenneyJ, Standish S, Souviron R, Vale G, McGivney J. Jones G. Body identification guidelines . J Am Dent Assoc 1994: 125: 1244-54.
13. International journal of biomedical science Forensic odontology: The mew dimension in Dental Analysis K.P.Divakar
14. Kapali S, Townsend G, Richards L, Parish T. Palatal rugae patterns in Australia Aborigines and Caucasians. Aust. Dent. J. 1997; 42: 129-133.
15. Sweet D. Forensic odontology, Dent Clin North Am 2001; 15: 237-51
16. Slavkin HC. Sex, enamel and forensic dentistry: A search for identity. J Am Dent Assoc 1997; 128: 1021-5.
17. Sivapathasundharam B, Prakash PA, Sivakumar G. Lip prints [cheiloscopy]. Indian J Dent Res 2001; 12: 234-7.

18. JMS-Journal of Medical society- Forensic odontology DOI: 10.4103/ 0972-4958: 175794.
19. Komar DA. Decay rates in cold climate region: A review of cases involving advanced decomposition from the Medical Examiner's office in Edmonton, Alberta. *J.Forensic sci.* 1998; 43: 57-61.
20. Sydney Levine .M.D.S.F.R.A.C.D.S. Forensic odontology- identification by dental means. *Australian Dental Journal.* 1977; 22[6]: 481-487.
21. Sweet D, Pretty IA. A look at forensic dentistry- part 2. Teeth as weapons of violence – Identification of bite mark perpetrators. *Br Dent .J* 2001; 190: 415-8
22. Tsuchihashi.Y. Studies on personal identification by means of lip prints. *Forensic sci.* 1974 Jun; 3[3]: 233- 248.
23. Manjunath K, SriramG, SaraswathiTR, Sivapathasundharam B. Enamel rod end pattern: A preliminary study using acetate peel technique and automated biometrics. *J. Forensic odontol* 2008; 1: 33-6.