

# IMPLEMENTATIONS OF FORENSIC DENTISTRY IN CRIMINAL INVESTIGATIONS: REVIEW ARTICLE

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## Abstract

This review article was conducted to show the implications of forensic dentistry in criminal investigations. The idea of the present study depends on increased awareness of the importance of forensic dentistry implication in identification of identity of suspicious and victims. These implications included examining elements of oral cavity such as teeth, periodontal tissues and anatomical structures. Teeth are the remaining issues that contain genetic material and remain unaffected for a long time. We also denoted to the potential use of bite mark analysis. Bite analysis is considered a good physical evidence which serve for identification of both victims and criminals. Teeth are used as a weapon that mainly used by victims to defend themselves against attackers. It can also be used by attackers to express their dominance over victims.

We also reviewed advancements in using molecular biology techniques in forensic dentistry. Tooth is considered a good source for genetic material since tooth resists severe adverse conditions when the body is destructed. Finally, we pointed to some software programs used in forensic dentistry to help in identification of dead persons particularly in massive conditions.

Taken together, forensic dentistry has become one of valuable tools worldwide to be used in identification processes and we recommend to use national databases to be used for comparison purposes as the case of fingerprints.

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**Keywords:** Forensic dentistry, forensic odontology, oral cavity, tooth, periodontal tissues

## Introduction

### Roles of forensic dentistry

Forensic dentistry is viewed as the use of dentistry in criminal and civil laws that are employed by police agencies in a criminal justice system. According to this context, forensic dentists play roles in identification of

recovered human remains, identification of whole or fragmented bodies (Verma et al., 2013). Furthermore, forensic dentists have significant roles in determining various parameters including age, race, occupation, previous dental history and socioeconomic status of unidentified human beings. However, it is possible to perform identification through comparing ante mortem and post mortem dental records and to depend on the unique features visible on dental radiographs (Verma et al., 2013).

Forensic dentistry, also referred as forensic odontology, includes studying a lot topics such as individual identification, mass identification, as well as bite mark analysis. Forensic odontology participates in legal studies and makes a base of incriminating evidence. (Douglas and John, 1995).

From a historical point of view, it has been indicated that forensic dentistry has been established since the late 1890s as an important entity in medico legal cases, in particular for identification of the dead. However, forensic dentistry generally covers three basic areas: identifications of human remains, litigation relating to malpractice, and criminal proceedings, primarily in the areas of bite-mark evaluation and abuse cases especially child abuse (Syrjanen and Sainio, 1990).

### **Properties of dental hard tissues**

Dental hard tissues are characterized by having high resistance to extremely adverse conditions including fire in addition to being the only remains after an prolonged period of burial (Phillips, 1993).

Human dentition has been found to be unique and can be separated from other animals. Human dentition is characterized by the intermixing of genetic racial characteristics that have disturbed the natural balance between size and shape of the teeth and those of the supporting jaw bones; and the modern chemical and structural modification of teeth resulting from disease processes or the attempt to cure such disease. Furthermore, investigating the similarity or dissimilarity of a suspect's dentition to the bite mark in question is probably the most significant contribution that forensic dentistry makes to the judicial inquiry (Furness, 1981). It has also been observed that teeth can be used to inflict serious injury on an attacker and may be the only available defensive method for victim (Furness, 1981). On the other hand, Webb et al (2002) reported that attackers involved in sexual attacks such as sexual homicide, rape, and child sexual abuse, bite their victims as a type of showing dominance, rage and animalistic behavior. In his study, Ritz-Timme et al (2000) pointed to important consideration related to teeth which is that teeth remain untouched by most severe conditions and remain unchanged for thousands of years.

### **Reasons for dental identification**

Several researchers have pointed to reasons and situations beyond dental identification of humans which include the body of victim of violent crime, fire, road traffic accident, and work place accident (Dorion, 1990; Andersen et al., 1995; Weedn, 1998; Whittaker, Richards, Jones, 1998).

### **Determination of Species, Sex, and Race**

Usually, there should be no problem in determining species. In some cases, it has been reported that a chance exists in which there is a section of mandible bearing teeth or, in bad conditions, there is a small part of tooth about a few millimeters in size (Ganswindt et al, 2003). Under such circumstances, comparative dental anatomy is employed to plot the differences particularly in relation to enamel which can be examined microscopically and the arrangements arrangement of the enamel rods or prisms differ, for example, between primate and non- primate tissue (Davis, Ireland, Carr, 2004). It has also been pointed to the importance of dentinal fluids that contain specific species information. It is possible to extract some information through using countercurrent electrophoresis with artificially anti-sera. Such fluids are valid to extract information to determine species up to at least one year after death. New advanced technology revealed the possibility to investigate remnants of cells from fragments of bone or teeth for the presence of Barr bodies or the sex chromosome status of the cells with one year validity after death (Davis, Ireland, Carr, 2004).

Regarding racial determination from the skull and teeth, Kittelson et al (2002) showed the difficulty of such a process, but they denoted to the possibility of separation into the main Caucasoid, Negroid, and Mongoloid racial groups may be considered depending on cranial and facial morphology.

### **Bite Mark Analysis**

Bite mark analysis is important in criminal cases in which a suspect or a victim has left his or her teeth marks on another person or on a non-living object such as a candy bar, an apple, cheese or even a beer can seem to occur more frequently. It has been indicated that teeth once used as weapons, they can be due to the person inflicting the wound. However, bite marks can be encountered in various cases including murder or rape with sexual motives (Fischman, 2002).

### **Bites in Human Tissue**

Although examining bite-mark evidence is interesting but it is tough. It is expected to have good force for penetration of the skin. Such bites cause

laceration of the tissues and considered aggressive by default (Sheasby and MacDonald, 2001).

Bite mark has to be photographed using standardized techniques. Technological advances permitted production of special scales with imprinted marks to allow the degree of distortion of the photographic image to be determined (Bernstein, 1985).

### **Implementation of molecular biology in forensic dentistry**

Rohit et al (2012) conducted a review article about the importance of using molecular biology in forensic dentistry. Due to the development of genetics and molecular biology, increased number of solved cases has been witnessed. Authors put emphasis on the importance to join the efforts of certain forensic biology areas to traditional investigation methods in human identification, especially with forensic odontology. According to authors, teeth are considered as a significant source to genetic analysis and molecular studies. They concluded that knowledge of forensic genetics applied to traditional forensic investigations leads to increased information to Justice.

### **Identification and Methods Utilized**

It is worth to put emphasis on the importance of dental records which helps in the identification of individuals who are victims of criminal acts, murder investigations, mass fatalities or missing persons (Avon, 2004). Furthermore, it is of great importance to confirm the identity of a decedent. Various reasons are beyond that and include bringing closure to the immediate family members when tragic or unexpected events occur (Senn and Stimson, 2010). It has also been suggested by the same authors that conformation of identity is required when there is a need to issue a death certificate. In such cases, dental identification is thought to have a principal role in the identification of remains when postmortem changes occur, traumatic tissue injury occurs or there is a lack of fingerprint records which invalidates the use of visual or fingerprinted evidence. Furthermore, identification is crucial when the deceased is decomposed, burned, dismembered, or skeletonized (Avon, 2004). In their study, Toznak et al (2007) showed some cases in which an evidence is extracted from teeth such as the age estimation as well as identification of the person to whom the teeth belong. Such analysis is achieved by comparing ante-mortem dental records, radiographs and photographs with post-mortem records.

Teeth are characterized by having the ability to resist decomposition and tolerate extreme thermal variations. In view of this context, evidence extracted from dental comparisons remains as one of the prime reliable methods of identification (Senn and Stimson, 2010).

According to Sweet and Pretty (2001), three elements in oral cavity are used in comparison for the purpose of identification which the teeth, periodontal tissue, and anatomical features. Teeth are investigated for their presence (erupted, unerupted, impacted), congenitally missing or lost ante-mortem/post-mortem, tooth type (permanent, deciduous, mixed, retained primary, supernumerary), what the tooth positions are, crown morphology and pathology, and root morphology.

Brand and Isselhard (2003) pointed to the potential use of pulp chamber and root morphology in process of identification. Furthermore, it is possible to use the pulp chamber to distinguish approximate age of the individual. It has also been indicated that the root morphology, besides to the pulp chambers can help in determining whether the tooth is from the maxillary or mandibular arch, and distinguishing if it is an anterior or posterior tooth.

McGivney (2012) pointed to the presence of computer identification databases including WinID© or NCIC which are used nowadays to compare ante-mortem and post-mortem data in the identification of deceased or missing individuals. WinID© is used to match missing persons to unidentified human remains. It is used by forensic dentists, forensic odontologists, pathologists, coroners, medical examiners, forensic anthropologists and those in the law enforcement and criminal justice systems to identify the unknown.

### **References:**

- Andersen L, Juhl M, Solheim T, Borrmann H (1995). Odontological identification of fire victims—potentialities and limitations. *Int J Legal Med* 107: 229-234.
- Avon SL (2004). Forensic odontology: the roles and responsibilities of the dentist. *J Can Dent Assoc.*, 70 (7): 453-8.
- Bernstein ML (1985). Two bite mark cases with inadequate scale references. *J Forensic Sci* 30: 958-964.
- Brand RW, Isselhard DE (2003). *Anatomy of Orofacial Structures*. St Louis: Mosby.
- Davis EC, Ireland EJ, Carr R (2004). Human or not? A forensic dental case.
- Dorion RB (1990) Disasters big and small. *J Can Dent Assoc* 56: 593-598.
- Douglas, John. *Mindhunter*, NY: Scribner, 1995.
- Fischman SL(2002). Bite marks. *Alpha Omegan* 95: 42- 46.
- Furness J (1981). A general review of bite-mark evidence. *Am J Forensic Med Pathol* 2: 49-52.
- Ganswindt M, Ehrlich E, Klostermann P, Troike WG, Schneider V (2003) Bone finds: a challenge to forensic science. *Leg Med* 5: S382-S385.

- Kittelson JM, Kieser JA, Buckingham DM, Herbison GP (2002). Weighing evidence: quantitative measures of the importance of bitemark evidence. *J Forensic Odontostomatol* 20: 31-37.
- McGivney J. WinID3 Dental Identification System. Retrieved June 26, 2012.
- Phillips VM (1993). The role of forensic dentistry in South Africa. *Med Law* 12: 487-91.
- Ritz-Timme S, Cattaneo C, Collins MJ, Waite ER, Schutz HW, et al. (2000) Age estimation: the state of the art in relation to the specific demands of forensic practice. *Int J Legal Med* 113: 129-136.
- Rohit Malik, Deepankar Misra, PC Srivastava, Akansha Misra (2012). Review Research Paper Application of Genetics and Molecular Biology In Forensic Odontology . *J Indian Acad Forensic Med*, 34(1): 55-57.
- Senn DR, Stimson PG. (2010). Forensic dentistry. Boca Raton. CRC Press.
- Sheasby DR, MacDonald DG (2001). A forensic classification of distortion in human bite marks. *Forensic Sci Int* 122: 75-78.
- Sweet D, Pretty IA (2001). A look at forensic dentistry--Part 2: teeth as weapons of violence--identification of bitemark perpetrators. *Br Dent J*, 190 (8):415-8.
- Syrjanen SM, Sainio P (1990). Forensic dentistry—recent development towards an independent discipline in modern dentistry. *Proc Finn Dent Soc* 86: 157-170.
- Tohna S, Mehnert AJ, Mahoney M, Crozier S (2007). Synthesizing dental radiographs for human identification. *J Dent Res.*, 86(11):1057-62.
- Verma K, Joshi B, Joshi CH, Rejz Paul MP (2013) Bite Marks as Physical Evidence from the Crime Scene-An Overview. 2:605 doi:10.4172/scientificreports.605.
- Webb DA, Sweet D, Hinman DL, Pretty IA (2002). Forensic implications of biting behavior: a conceptually underdeveloped area of investigation. *J Forensic Sci* 47: 103-106.
- Weedn VW (1998). Postmortem identifications of remains. *Clin Lab Med* 18: 115-137.
- Whittaker DK, Richards BH, Jones ML (1998). Orthodontic reconstruction in a victim of murder. *Br J Orthod* 25: 11-14.
- LDAJ Winter 63: 34-35.