

## REVIEW PAPER

# Forensic Odontology and its Medico Legal Issues

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### ABSTRACT

Forensic Odontologists deals with the proper examination, handling and presentation of dental evidence in a court of law. They are to help in identification of bite marks on the victims of attack or in other substances such as wood, leather and food stuffs and to compare bite marks with the teeth of a suspect and presentation of this evidence in court as an expert witness. They are to identify unknown bodies through dental records and to estimate age from teeth; however forensic Odontologist can still contribute to the identity investigation in the absence of dental records through profiling the deceased using features related to teeth. Teeth with their physiologic variations, pathos and effect of therapy record information that remains throughout life and beyond. This article explores an insight to forensic odontology and outlines some of its medico-legal applications in criminal investigations.

**Keyword:** Odontology, Dental records, Identification, Violence

### INTRODUCTION

The roles of any expert in forensic dentistry are to collect, preserve and interpret trace evidence, then to relay the results to the judicial authority. Those functions require sound knowledge in dealing with crime scenes investigation and sufficient acquaintance in law.

The use of teeth as evidence is not recent. There are historical reports of identification by recognizing specific dental features as early as 49 A.C. However, forensic odontology, as a science, did not appear before 1897 when Dr. Oscar Amoedo wrote his doctoral thesis entitled “**L’art dentaire en medecine legale**” describing the utility of dentistry in forensic medicine with particular emphasis on identification.<sup>1</sup>

Traditionally, forensic odontology covered various topics that can be broadly classified into human identification and injury analysis. However, tasks of expert in forensic dentistry have

broadened in recent years to cover issues related to child abuse and domestic violence, human rights protection and professional ethics.

### Why Teeth?

**Every human body ages** in a similar manner, the teeth also follow a specific pattern. These quantitative measurements help to establish relative age of a person. Dental X-ray is an example (**Figure 1**).



**Figure 1** Dental X-ray for age estimation

Each human has an individual set of teeth which can be traced back to establish dental records to find missing individuals.

A tooth is made of enamel, hardest tissue of the body, so it can withstand trauma, decomposition, heat degradation, water

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immersion and desiccation better than other tissues in body. Teeth are a source of DNA; dental pulp or a crushed tooth can provide nuclear or mitochondrial DNA that help to identify a person.

### Human Identification

Identification is based on comparison between known antemortem characteristics of a missing individual with recovered postmortem data from an unknown body. The records of different ante mortem dental works like bridging, fillings, etc. as shown in **Figure 2**; are compared with the post mortem dental findings for identification.



**Figure 2** Different dental works like bridging, fillings, etc

Identification of the deceased is most commonly achieved visually by a relative or a friend who knew the person during life. This is performed by looking at characteristics of the face, various body features and or personal belongings. However, this method becomes undesirable and unreliable when the body features are lost due to post and perimortem changes. Visual identification in those circumstances is subject to error. Methods of human identification that are acknowledged as scientific are fingerprints, DNA, dental and medical characteristics.<sup>2</sup> Those methods vary in complexity, but share similar level of certainty. The dental characteristics are unique in being the easiest and quickest method of identification.

The diversity of dental characteristics is wide, making each dentition unique.<sup>3</sup> The dental enamel is the hardest tissue in the body, and would thus withstand peri and post-mortem damages, and so would dental materials adjoined to teeth. Being diverse and resistant to environmental challenges, teeth are considered excellent post-mortem material for identification with enough concordant points to make a meaningful comparison. For dental identification to be successful, antemortem data need to be available.

This relies heavily on dental professionals recording and keeping dental notes, radio-graphs, study models, clinical photographs..., etc. The availability of dental records will allow comparing the dental characteristics of the person during life with those retrieved at autopsy with concordant points for positive identity as shown in **Figure 3**.



**Figure 3** A- Ante mortem radiograph, B- Post-mortem radiograph

In cases where dental records are not available, expert in forensic dentistry can still contribute to establishing the identity by creating a profile of how the deceased person was during life. This includes any unusual oral habits, type of diet, socio-economic status, but most importantly the age of the person at time of death.

Forensic age estimation in living subjects has gained increasing significance in recent years. In dental age estimation, tooth eruption is a parameter of developmental morphology that can be analyzed by either clinical examination or by evaluation of dental X-rays.<sup>4</sup> Dental aging is based on the chronology of formation and eruption of teeth. This helps in determining the age for persons up to 15 years in a fairly accurate manner. After 15 years of age, dental aging relies on modifications that take place during life, such as attrition, cementum formation and root transparency. Despite being extensively studied, results of aging of this latter group remain less than optimal because those age-related modifications can be influenced by various factors, such as diet and dental pathosis.<sup>5</sup>

The recovered skull (**Figure 4**) with mandible with fallen, broken, or deformed teeth can be of useful data for identification.



**Figure 4** Recovered skull with fallen teeth

### Forensic Dentistry in Mass Disaster

Routine identification tasks are a simple one-to-one matching process. This is not accomplish able in case of disasters. Identification is a big challenge for the medical professionals besides other problems like management of injured one without hospital with impaired transportation, lack of communications, etc. The identification of deceased victims in those circumstances necessitates putting a complete list of data consisting of an antemortem and details of postmortem dental information.

Forensic Odontologist has contributed to the solution of many mass disasters. The 2004 Indian Ocean tsunami is probably the most eminent example on the success of forensic odontologists in identifying large number of victims in the short-run. Nearly half of the victims in Thailand were identified by dental characteristics method alone, and forensic odontologists contributed to the identification of the remaining half by assisting the fingerprint, DNA and physical characteristics teams.<sup>6</sup>

Weak and even absence of dental records did not stop Forensic Odontologists from contributing to the identification of tsunami victims in Thailand. Victims with no dental records were either identified by photographic superimposition, if a photograph showing upper anterior teeth was provided<sup>7</sup>, or by narrowing down possible matches for the DNA and fingerprint teams through dental aging.

### Bite Mark Analysis

Bite marks are compared to known teeth molds to find origin of bite injuries. Few of the bite marks are shown in **Figure 5** and **Figure 6** to show how the criminal go away leaving behind trace evidences, patterns of their teeth, etc. with the victim or scene of crime.



**Figure 5** Bite mark over cheek

Injuries induced by teeth and left on objects, such as skin, have a distinctive pattern. Those patterned injuries (bite marks) are useful to judicial authorities because they help in reconstructing past events that surrounded the biting process. For example, bite marks indicate a violent interaction between the perpetrator and the victim, and they might tell us something about the criminal intentions of the perpetrator, whether sexual, child abuse, or other forms of assaults. Moreover, bite marks are the only patterned injuries that can indicate (with different levels of certainty) who

the biter was. Forensic Odontologists can exclude or include persons suspected of causing the bite marks by comparing the locations and measurements of teeth marks in a bite mark with those of the suspect (s).<sup>6</sup>



**Figure 6** Bite mark on palmer aspect of hand

However, several erroneous bite mark analysis, mainly from the United States courts, rendered this type of evidence questionable.<sup>8</sup> The validity of bite mark analysis has undergone decent review in the last ten years aiming at boosting the scientific weight and improving the technique in a manner that can be reproducible. New research is under way to allow digital comparison of teeth and bite marks at a 3-dimensional level.<sup>9</sup> This noble technique is aimed to overcome perspective distortion, a significant morbid factor in bite mark analysis that results from reducing 3-dimensional objects to 2-dimensional images.

### Child Abuse: Social and Medico Legal Issues

The World Health Organization has declared that violence is a major and growing public health problem across the world.<sup>10</sup> This landmark declaration meant that healthcare providers are involved in detecting and managing cases of violence, including abuse to vulnerable populations, i.e. children, elderly and women. The World Health Organization further distinguishes four types of violence; physical, sexual, psychological and neglect. All forms of violence can manifest in the oro-facial region, and hence should be of concern to dentists. Prevalence of physical violence, as a cause of maxillofacial injuries, ranges from 3.3% to 41% in various countries.<sup>11</sup> This wide range is probably due to different reporting thresholds in different communities. The true prevalence of violence is thus difficult to establish because of not or under reporting this problem.

Child maltreatment is defined as intentional harm or threat of harm to a child by a person acting in the role of caretaker.<sup>12</sup> Healthcare providers who care for children have a professional, and often legal, obligation to identify and protect children who may be victims of abuse and neglect. Injuries due to abuse can manifest in the oro-facial region in various forms, including fractured anterior teeth, fractured alveolar bone, lacerations of the labial and buccal mucosa, lacerations to the frenum and bruises to the lips, face and neck. Therefore, injuries to the oro-

facial region should raise reasonable suspicion to the treating dentist.

In various countries there are laws that govern reporting of violence. Some laws penalize healthcare workers by imprisonment, and or fines, for not reporting violence manifested on their patients.<sup>13, 14</sup> All 50 states in the United States (US) and some countries around the world (including Argentina, Finland, Israel, the Republic of Korea, and Spain) have enacted legislation that mandates reporting of suspected child abuse.<sup>15</sup> In other countries (such as Croatia, Japan, the Netherlands, and Romania), reporting is voluntary.

Avoiding the diagnosis of abuse because of lack of knowledge or phobia of the legal system is hazardous to the health and well-being of children. The offense of child abuse is highly grave in nature and leaves the child in a state of mental turmoil and physical torture. The parliament of India has been long awaited to make the law against child abuse even stricter since the present law and order has many loopholes and thus the criminal gets discharged at a minimal punishment.

Medico legal experts are invariably at the front in detecting signs of violence appearing on their patients, i.e. the bite marks as shown in **Figure 7** besides others. They should be aware that patient has a right to be treated with a reasonable degree of care, skill and knowledge. A mistake by a medical practitioner, which no reasonably competent and careful practitioner would have committed, is nothing short of negligence. But the law recognizes the danger that is inherent in surgical operation, where the operation is a race against time; the court will make greater allowance taking into account the ‘risk-benefit’ test.



**Figure 7** Love bite or hickey

## CONCLUSION

If the human race is to survive and progress, preservation of law is a must. Dental practitioners should be aware of the forensic application of dentistry. Dental records that are shown to provide patients with optimal dental service could also be very beneficial to legal authorities during an identification process. Medical practitioners do not enjoy any immunity from an action in tort, and they can be sued on the ground that they have failed to exercise reasonable skill and care either in reporting the authority

about their patient of medico-legal importance or in treatment or in keeping the records properly.

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