

A Look at Forensic Odontology

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Abstract

Forensic Odontology is a new science that utilizes dentist's knowledge to serve the judicial system. Dentists qualified in forensic science are giving expert opinion in cases related to bitemark analysis, human identification, malpractice, and craniofacial trauma worldwide. Human identification relies heavily on the quality of dental records; however Forensic Odontologists can still contribute to investigation the identity in the absence of dental records through profiling the person using features related to the teeth. Along with other healthcare providers, dentists encounter non-accidental cases of injuries. Detection, interpretation and management are important from a legal and human point of view. Dentists should be aware of the legal impact, and should refer them to the appropriate authorities for suitable action. This article gives an idea to Forensic Odontology and outlines some of its medico-legal applications.

Keywords: Forensic Odontology; Identification; Violence; Abuse.

Forensic Odontology is the forensic science that only concerned with all the dental evidence [1]. As we enter in a new millennium, society faced fresh challenges in every conceivable area. Despite leaps in modern technology, geographical changes and the medical breakthroughs that last century brought, the crime still persists our lives [2]. The role of any forensic scientist is to collect, preserve and interpret trace evidence, then to relay to the judicial authority in a form of a report. It requires sound knowledge in dealing with crime scenes and sufficient acquaintance in law [1].

In the forensic odontology specialty, dentistry plays a small but a significant role in this process. By identifying the victims of disaster and crime through dental records, dentists assist those who involved in crime investigation [2].

For identification the use of teeth as the evidence is not recent. However, Forensic Odontology, as a

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science, did not appear when Dr. Oscar Amoeda wrote his doctoral thesis in 1897 entitled "L'Art Dentaire en Medecine Legale" [1]. In 1898, the Scientific advent of forensic odontology has been attributed to Dr. Oscar Amoeda who identified the victims of a fire accident in Paris [3]. Various topics that can be broadly classified into injury analysis and human identification. The tasks of Forensic Odontologists have broadened to cover issues related to child abuse and human rights protection, domestic violence and professional ethics [4].

Human Identification

Mainly human identification is based on comparison between known characteristics of a missing individual (termed *ante-mortem* data) with recovered characteristics an unknown body (termed *post-mortem* data).

Identification of deceased is most commonly achieved visually by a relative or a friend who knew the person during life. This is performed by just looking face characteristics, various body features and/or personal belongings. However, this particular method becomes unreliable and undesirable, when

the body features are lost due to post- and peri-mortem changes. Visual identification in those circumstances is subject to error. Methods of human identification that acknowledged as scientific are fingerprint, DNA, dental and medical characteristics [5]. Those methods that vary but they share similar level of certainty. The dental characteristics method is unique in being the easiest and quickest method of identification.

The dental characteristics are wide, making each dentition unique [6]. The dental enamel is the hardest tissue in the body, and thus withstands peri- and post-mortem damages, and so would dental materials adjoined to teeth. Being resistant and diverse to environmental challenges, teeth are considered excellent post-mortem material for identification points to make a meaningful comparison.

To make the dental identification to be successful, ante-mortem data need to be available. This relies heavily on keeping dental notes, radiographs, study models, dental professionals recording and clinical photographs etc. The availability of dental records will allow it to compare the dental characteristics of the person during life with those retrieved from the person after death.

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

Dental aging is mainly based on chronology and eruption of teeth. This also helps in determining age of a person's up to 15 years-old in a accurate manner. After 15 years of age, dental aging relies on modifications which may occur during life, such as cementum formation, attrition and root transparency. Despite being extensively studied, results of aging remain less than optimal because those age-related modifications are influenced by various factors, such as dental pathosis and diet [7].

Dentists' Role in Mass Fatality Incidences

The routine identification tasks are a simple matching process. Mass fatality incidences represent a big challenge to local authorities and another challenge is the damage inflicted on infra-structure which includes hospitals, transportation, communications etc., which impedes recovery.

The identification of deceased victims' in those circumstances putting a hierarchy system which consists of an ante-mortem, post-mortem and

reconciliation teams. Those teams are headed by team leaders, with officers to coordinate the work. The results are reported to an identification board.

In mass disasters many forensic Odontologists have contributed to the resolution. Forensic Odontologists, in 2004 Indian Ocean tsunami is the most eminent example on the success of identifying large number of victims in short time. In Thailand, nearly half of the victims were identified by dental characteristics method alone, and identification of remaining half contributed by Forensic Odontologists by assisting the DNA, fingerprint, and physical characteristics teams. Absence of dental records did not stop Forensic Odontologists from contributing to the identification of tsunami victims in Thailand. Victims who have no dental records were either identified by photographic superimposition, if a photograph showing upper anterior teeth was provided, [8] or by narrowing down possible matches for the DNA and fingerprint teams through dental aging.

Bitemark Analysis

Bite marks analysis was first published by Sorup⁹. Bite marks can be found in food, flesh, cigars, pipes and musical instruments [10]. Bite marks in themselves provide a kind of dental identification [11].

Injuries induced by teeth which left on the objects, have a distinctive pattern. Those distinctive patterns (bitemarks) are useful to judicial authorities as they help to reconstruct past events that surrounds the biting process. For example, bitemarks indicate a violent interaction between the perpetrator and the victim, and might tell us something about the criminal intentions of the perpetrator, whether it is child abuse, sexual, or other forms of assaults. It can also indicate (with different levels of certainty) who the biter was [12]. The process of comparing bite marks with a suspect's dentition includes measurement of shape, size, and position of the individual teeth with those of the suspect(s) [13]. Forensic Odontologists can include or exclude suspected persons causing the bitemarks.

However, several erroneous bitemark analysis, rendered this type of evidence questionable, mainly from the United States courts [12]. In last 10 years the validity of bitemark analysis has undergone decent review, aiming at boosting the scientific weight and improving the technique in a manner that can be reproducible. New research allow digital comparison of teeth and bitemarks at a 3-dimensional level [14].

Domestic Violence and Child Abuse

The World Health Organization (WHO) has

declared that violence is a major and growing public health problem across the world [15]. This landmark declaration meant that healthcare providers are involved in detecting and managing cases of violence, including abuse to vulnerable populations.

The WHO further distinguishes four types of violence; physical, sexual, psychological and neglect. Prevalence of physical violence ranges from 3.3% to 41% in various countries [16]. In different countries the wide range is probably due to different reporting thresholds.

Injuries during abuse can manifest oro-facial region in various forms, like fractured alveolar bone, fractured anterior teeth, lacerations to the frenum, lacerations of the labial and buccal mucosae, and bruises to the

lips, face and neck. Non-accidental injuries can be recognized by certain characteristics (Table 1) [17]. The most common site to be non-accidentally traumatized is the head [18]. Therefore, injuries to the oro-facial region should raise reasonable suspicion to the treating dentist. In various countries there are many laws that govern violence reporting. Some laws penalize healthcare workers, by fines and imprisonment for not reporting violence that are manifested on patients [20].

However, due to the sensitivity of this matter, reporting has to follow a mechanism, and be addressed to a proper authority with trained personnel. Readers are advised to look for proper reporting authority in their respective countries.

Table 1: Feature of non-accidental (abusive) injuries

History of injury is vague and inconsistent with clinical findings.
Injuries appear in places away from bony prominences.
Injuries are inconsistent with the child's age-dependent activities, such as crawling, walking or playing sports.
Unexplainable delay in seeking healthcare.
Injury occurred in the absence of witness or a sibling is blamed for causing injury.
Evidence of neglect, such as malnutrition, head lice and poor hygiene.
Presence of other injuries and/or repeated attendance to healthcare facilities with similar complaints.
Injuries appear in groups, and of different ages.

Conclusion

Now a day's the dental practitioners must be aware of the application of forensic dentistry. Dental records that are used to provide patients records with dental service also be very beneficial to legal authorities during an identification process. Therefore, the dental treatments should be properly recorded and kept. Dental clinicians, as other healthcare workers, should be in front in detecting violence signs appearing on patients. They should be aware of abusive injuries, to ensure a correct response by the concerned authorities.

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