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ROLE OF DENTIST IN FORENSIC ODONTOLOGY: A REVIEW

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ABSTRACT

Objectives - Forensic Odontology is a branch of dentistry that utilizes the dentist's knowledge to solve the criminal and civil cases. It has established itself as an important indispensable science in medicolegal matters and in particular in identification of the dead and living individuals like refuges and incorrect birth records. Worldwide, dentists qualified in forensic science are giving expert opinion in cases related to human identification, bitemark analysis, craniofacial trauma and malpractice. **Methods-** 1. Visual 2. Personal or medical information: a) General information b) Specific information c) Radiological information 3. Clothing 4. Personal effects and documentation 6. Fingerprints 7. Feet 8. DNA profiling. **Conclusion-** Dental professionals have a major role to play in keeping accurate dental records and providing all necessary information so that legal authorities may recognize malpractice, negligence, fraud or abuse and identify unknown humans. This article presents a literature review referring to the understanding the various methods employed in forensic odontology.

KEYWORDS: Forensic Odontology, Dental Identification, Bite marks, medicolegal.

INTRODUCTION

Forensic Odontology is the forensic science that is concerned with dental evidence. 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.[1]

Forensic odontology has three major areas of utilization

1. Diagnostic and therapeutic examination
2. The identification of individuals,
3. Identification, examination and evaluation of bite marks

As far as the legal matters are concerned, the dental surgeon has the responsibility of studying teeth and jaw as an evidence to law and justice. The study of teeth and jaw as evidence in law and justice is called **forensic dentistry**.[2] The most basic concept in forensic odontology is centered on a form of pattern recognition and comparison. As dental surgeon has to actively involved in various objectives of forensic dentistry like age and sex determination, personal identification of unknown deceased person, analyzing bite marks as evidence, participating in mass disaster, studying lip prints, giving evidence in child abuse and in civil and criminal litigation, his role in personal identification and criminal investigation is very much important, as his evidence would be very much useful in law and justice. Personal identification is very much necessary for unknown deceased person in homicide, suicide, accident, mass disasters, etc., Personal identification is also necessary for living individual who are missing person due to amnesia and culprits hiding his identity. Dentist's role in criminal investigation includes collection of information from bite marks, lip prints and teeth found in the crime sites like, quarrel, robbery, murder and rape.

Methods used for identification

1. *Visual*
2. *Personal or medical information:*

a) General information: height, weight, build, age, presence or absence of hair, its colour and style, eye colour, facial hair, facial characteristics

b) Specific information: scars, tattoos, birthmarks, operations, amputations, breast implants, old injuries, medical conditions, body piercings

c) Radiological information: anatomical abnormalities, foreign bodies (prostheses).[3]

3. *Clothing*: items last seen wearing, patterns of fabrics, labels, alterations/ repairs
4. *Personal effects and documentation*: contents of pockets and bags, jewellery may be recognizable or have specific inscriptions/engravings.[5]
6. *Fingerprints*: may be on record, but it is often necessary to take them from personal items in the home or workplace for comparison purposes

7. *Feet*: footprints are kept on record by some armed forces. Records from a chiropodist/podiatrist may hold useful information

8. DNA profiling.

DENTAL RECORD AND IDENTIFICATION

Dental identification assumes a primary role in the identification of remains when postmortem changes, traumatic tissue injury or lack of a fingerprint record invalidate the use of visual or fingerprint methods. The identification of dental remains is of primary importance when the deceased person is skeletonized, decomposed, burned or dismembered. The principal advantage of dental evidence is that, like other hard tissues, it is often preserved after death. Even the status of a person's teeth changes throughout life and the combination of decayed, missing and filled teeth is measurable and are comparable.[4] Dental identification is dependent on the availability, adequacy and accuracy of antemortem dental records that can be compared with the postmortem dental findings. For dental identification to be successful, ante-mortem data need to be available. This relies heavily on dental professionals recording and keeping dental notes, radiographs, study models, clinical photographs etc. The availability of dental records will allow comparing the dental characteristics of the person during life with those retrieved from the person after death. The dental record is a legal document owned by the dentist and contains subjective and objective information about the patient. The results of clinical laboratory tests, study casts, photographs and radiographs become components of the record and should be kept for 7 to 10 years. Computer-generated dental records are becoming more common for dental records. The obvious advantage of the electronic record is that it can be easily networked and transferred for routine professional consultation or forensic cases requiring dental records for identification.[5] Whether dental records are preserved in written form or on a computer database, following the principles of record management ensures that all dental information that may be required to resolve a forensic problem is properly maintained and retrievable.[6]

Collection of dental postmortem examination information

The following will be noted:

1. Dental arch shape, alignment, occlusion
2. Number and position of teeth present and missing
3. Size, shape, position and material of any restorations, presence and position of decayed surfaces

4. Denture and other appliance design and material
5. Individual tooth characteristics, for example tooth wear, fractures, anomalies of size, shape and colour
6. Hard tissue and soft tissue (if present) status, abnormalities or pathologies
7. Any other findings of interest, or clues to age, race, diet, occupation etc.

Good quality radiographs (whether film or digital) are invaluable for revealing 'hidden dental information' along with tooth-coloured restorations that are easily overlooked in less than ideal mortuary conditions. Radiographs may reveal signs of recent or old trauma (accidental or deliberate) that could lead to identi-fication from pins, wires and plates that maxillofacial colleagues may have used.[3] It may be possible to trace the plates and implants (for example) if they have manufacturer's numbers or codes. Postmortem dental radiography can also help with age estimation. It is especially useful for estimating the age at death of children and young adults. However, once the wisdom teeth are fully developed (root formation completed) more invasive methods may be required such as racemisation techniques. Good quality dental records are an essential part of patient care, a medico-legal requirement, and are necessary for dental identification.[6] Their availability and accuracy have a huge impact upon the speed and efficiency with which identification can be accomplished. However, the quality of the antemortem record varies between different dentists, areas and countries.[3]

Bite marks analysis

Bites on human tissue may be observed in violent incidents where the attacker may bite the victim or the victim may bite the attacker during defensive responses. In more passive incidents, a person may bite him or herself or an inanimate object left at a scene, e.g., an apple core or children, in cases other than those of domestic violence, or physical or sexual abuse, biting can represent a form of expression that occurs when verbal communication fails. Biting injuries can result from playground altercations or sports competition. They are also common in daycare centres.[7] On occasion, nonhuman bite injuries are found on victims. Animal bites are usually distinguished from human bite injuries by differences in arch alignments and specific tooth morphology. Animal bites often cause shear rather than impact injuries, producing lacerations of the skin and open wounds.[8] Dog bites, perhaps the most common nonhuman bite, are characterized by a narrow anterior dental arch and consist of deep tooth wounds over a small area. The biting surfaces of the individual groups of teeth are related to their function, such as teeth that incise, or tear, or grind. In addition, also seen are

individual characteristics, such as rotations, fractures, or missing or extra teeth. The size relationships of the bitemark, as described by the width of the dental arches, could relate to a child or adult bite.

Another area in which the forensic odontologist is being consulted more frequently is in cases of alleged human abuse, especially in the case of children. Usually in cases of child abuse with apparent bitemarks. 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 mucosae, lacerations to the frenum and bruises to the lips, face and neck.[9] It is important to realize that all members of the dental team have a unique opportunity and a legal obligation to assist in the struggle against child abuse. This special opportunity exists because a high proportion of abused children suffer injuries to the face and head, including the oral and perioral regions. These injuries may be observed during the course of dental treatment and in some cases even before the child is seated in the dental chair.[10]

Cheiloscopy

Cheiloscopy is a forensic investigation technique that deals with identification of humans based on lips traces.[11] Lip prints have to be obtained within 24 hours of time of death to prevent erroneous data that would result from post mortem alterations of lip.[12] A series of forensic odontological studies on the morphology of the lips and the pattern produced when they are impressed on to a variety of surfaces forms a worthy additional weapon for personal identification.[7] The biological phenomenon of systems of furrows on the red part of human lips was first noted by anthropologists. R Fischer was the first to describe it in 1902.[13] Use of lip prints in personal identification and criminalization was first recommended in France by Edmond Locard.[14] While recording, the teeth and restorations as anti mortem records sometimes, we find loss of teeth and destruction of restorations which may lead to difficulty in comparing the anti mortem records and post mortem records. Apart from the teeth and their restorations, soft tissues of oral cavity may help for personal identification. Anatomical structures like rugae, pigmentation, lip prints remain constantly and this can be included in the anti mortem records. Among the soft tissues structures, lip prints can be recorded and used as evidence in personal identification and criminal investigation.

Classification of lip prints

In 1967 Santos[16] was the first person to classify lip grooves. He divided them in to four types namely

1. Straight line
2. Curved line
3. Angled line
4. Sine-shaped line

Lip print pattern depends on whether the mouth is opened or closed. In closed-mouth position lip exhibits well-defined grooves, whereas in open position the grooves are relatively ill defined and difficult to interpret. Any pathology of the lip such as mucocele or any postsurgical alteration of the lip can change the lip print pattern. Also, loss of support due to loss of anterior teeth can cause changes in lip prints. Any debris or fluid on the lip surface, application of a thick layer of lipstick, or over stretching of cellophane tape can alter lip print recording.[16]

Rugoscopy

Use of human palatal rugae has been suggested as an alternative method for identification when teeth are lost due to any reason, the most common of which is trauma. Palatal rugae are formed in the third month in utero from the hard connective tissue covering bone. The pattern orientation is formed by about 12th to 14th week of prenatal life and remains stable until the oral mucosa degenerates after death. The palatine rugae possess unique characteristics that can be used in circumstances when it is difficult to identify a dead person through fingerprints or dental records.[17] The application of palatal rugae patterns for personal identification was first suggested by Allen in 1889. Palatal rugoscopy was first proposed in 1932, by a Spanish investigator named Trobo Hermosa.[18] A common concern about palatal rugae voiced by many researchers is the possibility of rugae pattern changing with age and other outside influences. Orthodontic movement, extraction of teeth, cleft palate surgery, periodontal surgery and eruption of an impacted canine are only some of the concerns. This method of identification can be used only when an antemortem record of the palatal rugae is available. This could simply consist of existing dental casts.

DNA Analysis

With the advent of the polymerase chain reaction (PCR), a technique that allows amplification of DNA at pre-selected, specific sites, this source of evidence is becoming increasingly popular with investigators. When conventional dental identification methods fail, this biological material can provide the necessary link to prove identity.[19] Comparison of DNA preserved in and extracted from the teeth of an unidentified individual can be made

to a known antemortem sample (stored blood, hairbrush, clothing, cervical smear, biopsy, etc) or to a parent or sibling.[20]

Recently personal identification is made by analyzing the DNA profile of deceased persons with that of their relatives DNA profile. But this procedure is sophisticated and requires long time and is not available in rural and remote parts of the town. Though it is accurate, sometimes it is not readily available for easy and immediate examination. Hence conventional methods have to be followed.

Age Determination

Dental structures can provide useful indictors to the individual's chronological age. The age of children (including fetuses and neonates) can be determined by the analysis of tooth development and subsequent comparison with developmental charts. Third molar development is used by some forensic dentists to assign age to young adults. Periodontal disease progression, excessive wear, multiple restorations, extractions, bone pathosis and complex restorative work may indicate an older individual. Labelled dentures can be of great assistance in the identification of individuals. Unlabelled dentures have been recovered from patients and then fitted to casts retained by the treating dentist or laboratory and this has been an accepted method of identification.[21]

Sex Determination

Sex determination is usually based on cranial appearance, as no sex differences are apparent in the morphology of teeth. Microscopic examination of teeth can confirm sex by the presence or absence of Y-chromatin and DNA analysis can also reveal sex. Sex determination based on dentition is difficult for most forensic investigators. Sex differences in dentition are based largely on tooth size and shape. Male teeth are usually larger, whereas female canines are more pointed and a narrower buccolingual width. There also appear to be greater differences in size between maxillary central and lateral incisors in females as compared to males.[20]

CONCLUSION

Forensic odontology plays an important role in medicolegal death investigations in mass disasters, especially transportation mishaps such as aircraft accidents where fragmentation and thermal injuries are common. A consistent effort has been made to computerize much of the data to improve comparative efforts. Today it is not unusual to observe a forensic

odontologist working alongside identification teams at an air crash, gathering bitemark evidence at a crime scene, or examining a victim of child abuse. Therefore, dental professionals working on the field of Forensic Dentistry should incorporate new technologies in their work to improve their investigations.

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