Review Article

Importance of dental records in post-mortem identification: A comprehensive review

ABSTRACT: Forensic dentistry or forensic odontology involves handling, examination and evaluation of dental evidence in criminal justice cases. Forensic dentists are involved in assisting investigative agencies to identify recovered human remains in addition to the identification of whole or fragmented bodies. Forensic dentists have also been known to use their investigative techniques to identify burn victims by using the victims previous dental records. Forensic dentists may also be asked to assist in determining age, race, occupation, previous dental history and socioeconomic status of unidentified human beings.

Keywords: Disaster victim identification, human identification, radiology identification, Forensic odontology, DNA Analysis, Bite Marks.

INTRODUCTION:

Dental identification is an establishment of the individuality of a person either dead or living. Dental identification may be required in living persons in the case of absconding criminal, soldiers, missing persons, impostors, escaped prisoners, etc. Identification may be essential where unclaimed dead bodies are found, when grossly mutilated bodies or skeletal remains are found. The use of the unique features of the human dentition to aid in personal identification is well established within forensic odontology. Although in a number of cases, the identification of the individual is unknown because antemortem records cannot be found. In such a cases, a dental profile of the individual is developed to aid in searching for the individuals identity by dental indicator of age, ethnicity, habits, professional status and gender.[1] They include identification of human remains in mass disasters (enamel is the hardest material produced by the body and intact teeth are often found), post-mortem x-rays of the teeth can be compared to ante-mortem x-rays, and the comparison of bitemarks.[2] The fundamental principles underlying dental identification have their basis on comparison and exclusion. The comparison between ante-mortem and post-mortem information will be effective as long as the dental consultant has completed the data collected during the patient's life in an accurate, rational and as comprehensive as possible.[3] At times a single feature may be so extraordinary or unique that, it alone may be sufficient to make a positive identification.

Imperative of whichever the employed method that is being used in order to identify a disfigured face (person), the results of the comparison of ante-mortem and post-mortem data would lead to any one of these four situations.[4,5] Positive identification: The items that are compared are sufficiently distinct in both ante-mortem and post-mortem databases, hence, observations show no major difference between the two. Possible identification: A few common findings exist among the comparable items in the ante-mortem and post-mortem databases, but not sufficient enough to prevent the establishment of a positive identification. For example, one restoration among many post-mortem radiographs. Insufficient evidence for identification: Insufficient evidence to support the comparison (ante-mortem and post-mortem findings) for definitive identification, but the identity of the deceased cannot be fully ruled out and is deemed inconclusive. Exclusion: Unexplainable discrepancies exist among comparable items in the ante-mortem and post-mortem databases.[6] The purpose of the present review was to create awareness and importance of dental records in post-mortem identification using the comprehensive review method.

METHODS:

The present review literature was done using online and offline modes. The literature consisted of different articles, textbooks, studies, etc. The keywords used for the search were: Disaster victim, human identification radiology, disaster victim identification, Forensic odontology, DNA Analysis, Bite Marks, etc. The objective of the present review was to create awareness and importance of dental records in post-mortem identification using the comprehensive review method. The only literature from English language was selected. No patient was involved in the present study.

MASS DISASTER VICTIM IDENTIFICATION:

Dental identification has been considered one of the main members of the International Criminal Police Organization disaster victim identification protocol. The orodental structures and dental restorations may be the only parts of the body not affected. The definite establishment of identity of a body essentially comes from a detailed comparison and matching of tangible antemortem records and post-mortem finding. It is rarely the case that the two matches in all aspects, so some judgement is required.[1] Dental interventions are not limited to fillings alone, but may include dental extractions, implants, prostheses such as full or partial dentures, and a range of surgical treatments. Teeth may be missing because they have failed to develop. The presence of disease or pathology including periodontal

(gum) conditions and dental caries (tooth decay), the presence of tooth crowding, or unusual arrangements of teeth in a dental arch and the relationships between teeth in the top and bottom jaws can all add additional features for comparison.[7] When good-quality antemortem data are available, forensic odontology classically identifies approximately 60% of victims, and contributes to approximately 30% of further identifications in collaboration with other identifying methods. The usual pattern in a "classical" incident is that the early matches are made by the fingerprints section, followed by a larger contribution from the dental section, with the DNA section providing late results, especially for children without fingerprint or dental records. The DNA section is also able to link fragments to a previously-identified body portion. An excellent systematic review of the role of forensic odontology worldwide in major mass disasters is given by Prajapati et al.[8]

SEX DETERMINATION:

Sex determination is very important subdivision of forensic odontology, which plays a major role in identification of the unknown individuals in natural disasters; chemical and nuclear bomb explosion scenarios. It can be done by four methods [9]:Craniofacial morphology and dimension: The morphology of the skull and mandible, pattern formed by six traits those are mastoid, supraorbital ridge, size and architecture of the skull, zygomatic extensions, nasal aperture, and mandible gonial angle and Frontal sinus dimension are taken into consideration. Sex difference in tooth dimension: Sex determination by measuring mesiodistal and buccolingual dimensions is most simple and reliable method for sex determination. Both the dimensions are more in male than in female. Tooth morphology: In male, the distal accessory ridge in canines is more prominent than in female. In female, there is less number of cusps in mandibular first molar (distobuccal or distal). These features can be because of evolutionary reduction in the female lower jaw size. Sex determination by DNA analysis: The study by Das and his associates stated that the sex determination could be obtained from the studying the X and Y-chromosomes up to four weeks of the death.

THREE DIMENSIONAL (3D) SURFACE SCAN SCANS DATA:

Three Dimensional (3D) scanners are replacing conventional dental impression techniques.[10] During the latter, a suitably-sized tray containing a thick paste is inserted into a patient's mouth and both the dentist and the patient must wait for the material to set before it can be removed to show a space representing the teeth and gums. This can be a traumatic process for both the dentist and the patient, particularly in patients with a trigger gag reflex.

Recent 3 D intraoral scanners comprise a wand connected to a computer passed over the teeth (or other item) and it records data which are processed in real time to produce an accurate 3 D virtual model. This can also be actualised with a 3 D printer. These scans are clinically accurate,[10, 11] and the process is very comfortable for the patient, especially if a powder-free technique is used. As they become increasingly widespread, 3 D surface scans comprise a new set of AM data. They do not rely on ionising radiation (unlike X-rays and Computed Tomography Scan) and are not affected by the presence of prior dental treatments. Unlike CT data, they are equally useful regardless of whether the teeth contain fillings (of any material).[12]

DENTAL STUDY MODELS:

Study models are classically poured from dental impressions in hard gypsum-based materials. They are 3 D casts representing a dentition, and they are extremely valuable because they function as a proxy for the patient. Their surfaces can be recorded using a 3 D scanner and compared with a similar scan of the teeth of a deceased person.[12]

DENTAL APPLIANCES:

Dental appliances may include such items as full or partial dentures, orthodontic appliances, occlusal splints, bleaching trays and mouth guards. All of these may be useful for comparison with the dentition or mouth of a deceased person. Not all such appliances need to be made in a dental surgery. For example, mouth guards may be fabricated in schools for students who play contact sports and may also be specially made for sports teams, and home mouth guard construction options are available. Partial dentures are especially valuable as they are made to fit a single mouth. Sometimes, dentures may be marked with a unique patient mark or number, particularly in hospices and nursing homes.[13] Dentures may be marked with identifying information, and this is most often the case if victims have been living in a nursing home or similar establishment. Numerous methods have been proposed for marking dentures over the years, but it is still far less common than forensic odontologists would wish.[1]

BITE MARK:

The bite mark is defined as the physical alteration in or on a medium caused by the contact of teeth. In few of criminal cases it is seen that suspect or victim has left his or her teeth marks on another person or inanimate object.[15] The concept of bite mark evidence is

interesting and is there from Roman times. There will be an outer edge of arches along with series of abrasion, with or without laceration that reflects the size, shape and arrangement of class characteristics of incisal or occlusal surfaces of dentition.[16] In more aggressive bites - The assailant may suck the soft tissues into the mouth so that images of palatal and incisal surfaces of teeth may appear. Bites show laceration of tissue and petechial hemorrhage's in the centre of the wound. In less aggressive bites -the skin may not be completely penetrated so there can be oval mark mostly of anterior teeth. Bite marks change over a time on living as well as dead. If the bite is on living person there will be post injury changes in the tissue, where bleeding, swelling and discoloration can be seen. If the bite is on dead Person, then photographs of marks are taken with standardized technique.[17]

Bites on objects:

If bite is present on objects such as apple, beer, chocolate etc. often yields more information because of lack of distortion of the material and we can obtain a good impression of biting edges. Taking swabs from this object is very necessary because it may reveal the blood group is the assailant and DNA analysis is possible.[1]

Lip print:

Cheiloscopy is a forensic investigation that deals with identification of human based on lip traces. Lip print wrinkle pattern has individual characteristics same as finger prints.[19] The wrinkles and grooves on the labial mucosa form a characteristic pattern called lip prints. The presence or absence of a person from the crime can be verified based on lip prints since the lip prints being uniform throughout the life. The 1967 Santos was the first person to classify lip grooves. There are four types of lip grooves[18]: Straight line, Curved line, Angled line, Sine shaped line. For collection, development and recording of lip prints a uniform and standard procedure has to be developed which helps ensuring comparison.[17]

ORTHODONTIC TRATMENT:

Radiographs: One of the most conspicuous finding that may be observed on a post treatment radiograph Orthopantomograph is the generalized root resorption due to orthodontic treatment.[20] At times, since orthodontic treatment warrants extraction of a few teeth for correction, the post treatment radiograph can form a very important tool in identifying the victim. Assessment and recording the post treatment findings is very important. Has the potential risk of causing significant damage to hard and soft tissues[21, 22]

and are called Orthodontic scars which can be of great help in identification process. A few of them of relevance to forensic odontology include: Lesions of Enamel- Enamel decalcification/White spot lesions,[23, 24] Physical damages on enamel [25, 26, 27] (Enamel Wear / Enamel Fracture; Periodontal tissues, Gingival recession[28] Dark Triangles[29]; Soft tissue damage, Direct damage by appliances and their component parts: Impingements (E.g. Lingual arch, TPA (Trans Palatal Arch), Loops, Arch wires, brackets, bands etc.); Lacerations (E.g.:- brackets, molar tubes, ligature ties etc.). Ulcerations (E.g.:- brackets, molar tubes, ligature ties etc. Injury to eyes[30, 31] (E.g.: Headgears, Face-bow injury). While soft tissue damage by impingements of bands, brackets and arch wires heal quickly and may not be of great help, injuries caused to enamel and periodontal tissues may result in permanent damage if untreated following orthodontic treatment.

RECOMMENDATIONS:

1. The unique characteristics of the teeth allow the forensic dentist to compare anti-mortem and post-mortem dental registers and to conclude on the identification of the victim.
2. Forensic nurses, dentists, pathologists, and forensic pathologists should all be educated in this area of medicine and work together for the preservation of evidence anti-mortem.
3. The criteria for abusive injury and reporting mechanisms should be understood to ensure that the concerned authorities respond correctly.

CONCLUSION:

AM profiles are the most important dental records for comparison with the deceased person. The future of forensic odontology in disaster victim identification will increasingly depend on 3 D datasets including CT and 3 D surface scan data. Digital data can be easily and rapidly transmitted with no loss of accuracy or detail, and this can greatly speed a response in a disaster victim identification operation

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