ABSTRACT
As we enter a new millennium, society is faced with fresh challenges in every conceivable area. Despite leaps in modern technology, medical breakthroughs and the geographical changes that the last century has brought, crime still persists in all aspects of our lives. Violent and heinous activities that shatter the lives of victims, their friends and families occur everyday. Often, little can be done to repair such damage. The apprehension and subsequent prosecution of the perpetrator(s) is essential to maintain law and order. This article main aim to bring to highlight the vast and major role of forensic odontology in various aspect.

KEYWORD- forensic odontology, identification, age determination, lip print.

Through the specialty of forensic odontology, dentistry plays a small but significant role in the process of identifying the victims of crime and disaster through dental records, dentists assist those involved in crime investigation. Always part of a bigger team, such personnel is
dedicated to the common principles of all those involved in forensic casework: the rights of the dead and those who survive them.\textsuperscript{[1]} 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.\textsuperscript{[2]}

The most basic concept in forensic odontology is centered on a form of pattern recognition and comparison. 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.

Forensic odontology has three major areas of utilization\textsuperscript{[2]}:
1. The identification of individuals, especially casualties in criminal investigations and/or mass disasters.
2. Identification, examination and evaluation of bite marks which occur with some frequency in sexual assaults, child abuse cases, and in personal defense situations.\textsuperscript{[3]}
3. Diagnostic and therapeutic examination and evaluation of injuries to jaws, teeth and oral soft tissues.

**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.\textsuperscript{[4,5]} There also appear to be greater differences in size between maxillary central and lateral incisors in females as compared to males.\textsuperscript{[3]}

**Role of DNA in dental identifications**

Because of the resistant nature of dental tissues to environmental assaults, such as incineration, immersion, trauma, mutilation and decomposition, teeth represent an excellent
source of DNA material.\textsuperscript{[6]} When conventional dental identification methods fail, this biological material can provide the necessary link to prove identity.\textsuperscript{[7]} 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. 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.\textsuperscript{[8]}

**Age Determination**

Dental structures can provide useful indictors to the individual’s chronological age. The age of children (including foetuses 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.\textsuperscript{[9]}

**Methods used for identification**\textsuperscript{[10]}

1. Visual
2. Personal or medical information:
   i) General information: height, weight, build, age, presence or absence of hair, its colour and style, eye colour, facial hair, facial characteristics
   ii) Specific information: scars, tattoos, birthmarks, operations, amputations, breast implants, old injuries, medical conditions, body piercings
   iii) Radiological information: anatomical abnormalities, foreign bodies (prostheses)
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. Dentistry
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.
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.\[11\] 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.\[12\] 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.\[13\]

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.\[14\] 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.\cite{15} 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. 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 orofacial 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.\cite{16} 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.\cite{17}

**Cheiloscopy- Examination of lip prints**

Cheiloscopy is a forensic investigation technique that deals with identification of humans based on lips traces.\cite{18} 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.\cite{19} 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.\cite{14} 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. Use of lip prints in personal identification and criminalization was first recommended in France by Edmond Locard.\cite{20} 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\cite{21}**
Suzuki’s classification and Tsuchihashi’s classification (1970)

- **Type I** - A clear cut groove running vertically across the lip
- **Type I’** - Partial length groove of
- **Type II** - A branched groove
- **Type III** - An intersected groove
- **Type IV** - A reticular pattern
- **Type V** - Undetermined

Lip print pattern depends on whether the mouth is opened or closed. In closed-mouth position lip exhibits well-defined grooves, 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.\(^{[22]}\)

**Rugoscopy - Study of palatal rugae**

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.\(^{[23]}\) 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.\(^{[24]}\) 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.

**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.

REFERENCE


