Forensic Dentistry

Forensic odontology is the practice related to law. Forensic is derived from the Latin word 'forum' which means court of law. Odontology refers to the study of teeth. It's one of the most unexplored and intriguing branches of forensic sciences. It primarily deals with identification, based on recognition of unique features present in individual's dental structures.

Forensic Odontology has been identified by Federation Dentaire International (FDI) as that branch of dentistry which, in the interest of justice, deals with the proper handling and examination of dental evidence, and with the proper evaluation and presentation of dental findings.

Forensic dentistry, or forensic odontology, is the application of dental and para dental knowledge to the solution of legal issues in civil and in criminal matters.

Dentition and finger prints form the most scientifically reliable identification methods due to their individuality (the uniqueness of individual's dentition) and specificity. Dental identification , like fingerprint identification, is a definitive means of positive identification of unknown human remains .

Constituents of Forensic dentistry

Forensic odontology mainly constitutes the following headings:
1. Postmortem dental identification and disaster victim identification.
2. Age estimation.
3. Anthropology.
4. Bite mark analysis.

Forensic dentists are responsible for six main areas of practice:
1. Identification of found human remains.
2. Identification in mass fatalities.
3. Assessment of bite mark injuries.
4. Assessment of cases of abuse (child, spousal, elder)**.**
5. Civil cases involving malpractice
6. Age estimation.

Means of Identifications in Forensic Dentistry:
1. Teeth: Natural and synthetic (fixed and removable)
2. Bone: Trabecular pattern, tori and osseous anomalies
3. Presence of foreign bodies: Implants, unretrieved amalgam particles, surgical instruments, bullets, fragments of various origins
4. Sinus configuration: Maxillary and frontal
5. Skull sutures

6. Soft tissue features: Rugae and lip prints.
7. Photographic comparison: Facial or dental superimposition or approximation
8. DNA.

ROLE OF TEETH IN DETERMINATION OF HUMAN IDENTITY

Important of Dental Identification

Dental evidence tends to survive much better than does soft tissue evidence such as facial characteristics or fingerprints. Teeth are calcified structures and are the hardest substance in the human body, even harder than bone. Because they are calcified, they are resistant to the environmental effects that destroy soft tissue evidence. Thus teeth are not destroyed by immersion in water, by desiccation (drying up), or by decomposition In addition, the dental restorations are frequently completely intact..

Application of Forensic Dentistry:

The dentist may help with problem involving →

1. Ageing. Determination of age:
   - ✓ In children→ concerning with the pattern of teeth eruption, root length(degree of completion of roots erupted teeth and resorption of roots of deciduous teeth). Teeth wear.
   - ✓ In young adults → development of wisdom (third molar).
   - ✓ Older adults →include parameters like attrition, gingival recession periodontal disease progression multiple fillings and complex restorative work, extractions ,formation of physiological secondary dentine, formation of cementum.
2. Gender. Determination of gender can be assessed from:
   - ✓ Skull shape and form, (no gender differences regarding teeth morphology).
   - ✓ Sex or Y- Chromatin presence or absence (DNA analysis can also reveal sex, tooth pulp tissue is a source of Y - Chromatin).
   - ✓ Development and eruption of teeth (teeth eruption is accelerated in early maturing girls)
   - ✓ Mandibular canines size.
3. Race: can be assessed from skull shape and form, anatomical characterization,cusp numbers, grooves and pattern of molars, such as Carabilli cusp, Leong's premolar(6 and 7 cusp),shovel - shaped incisors.
4. Socio-economic status and geographical factors: Endemic fluorosis, dental caries and type of dental restorations.

DNA Analysis

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. DNA analysis, also known as DNA fingerprinting, is a fairly new technology that may replace dental identification and fingerprint identification as the most definitive means of identifying unknown remains. **Dental DNA analysis** (the coronal pulp chamber and radicular canal are obvious target for DNA sampling).

Genomic and Mitochondrial DNA in Forensic Dentistry

The genomic DNA is found in the nucleus of each cell in the human body and represents a DNA source for most forensic applications. The teeth are an excellent source of genomic DNA because PCR analysis allows comparing the collected postmortem samples to known antemortem samples or parental DNA.

Mitochondrial DNA is another type of material that can be used for body identification. Its main advantage is the high number of copies per cell (from hundreds to thousands of organelles). Second advantage is that mtDNA is inherited from mother only, not from father. Thus, an identical mtDNA can be obtained from siblings, their mother and maternal relatives. When the extracted DNA samples are too small or degraded, such as those obtained from skeletonized tissues, the likelihood of obtaining a DNA profile from mitochondrial DNA is higher than that with any marker found in genomic DNA.

Bite marks:

Dental evidence most commonly used in the criminal court is the bite marks, which provide details of a kind comparable with infinitive detail that was provided by finger prints Bites are common in violent crime and child abuse.**Bite marks** is defined as" a mark made by teeth alone or in combination with other oral structure", bite marks can be found on:

- The victim(by the attacker)
- The attacker(suspect) when a victim attempts to defend himself
- An object found at the crime scene.

Characteristics of human Bite marks:

Human Bite marks include an elliptical or ovoid pattern containing tooth and arch marks. Alternatively, it may be composed of two U- shaped arches that are separated at their bases by an open space. It is possible to identify specific types of teeth by their class characteristics (incisor mark are rectangles ,canine mark are triangles ,premolars mark are triangles, circles or diamonds). The injuries caused by teeth can range from bruises to scrapes and cuts or laceration or avulsion of tissue.

Guidelines for bite mark Analysis:

The collection of bite mark evidence falls in to several categories.

1. Description of bite mark with demographics like location, shape, color, size and type of injury.
2. Collection of evidence from victim by :
   - Photographs. Both color and black –and white films.
   - Saliva swabbing: collection and analyzing of saliva that deposit on the skin during bite, and a sample of whole blood must be collected from the victim at the same time to assess DNA of victim. Recently saliva can also be isolated from objects(chewing gum, cigarette butts, postage stamps) and tested using genomic DNA.
   - Impression . the bite mark are usually analyzed by making cast from fabricating impression of bitten surface and overlying on the specimens or the tracings of the marks obtained to record any teeth irregularities.
3. Collection of evidence from suspect by:
   - Clinical examination. Extra and intra oral examination(dental health, occlusion, mobility of teeth, periodontal condition, fractures, restoration , dental caries, articulation— etc.).
   - Photographs . facial and profile Photographs , also frontal and lateral views of the teeth in occlusion.
   - Study cast of teeth. To record all characteristics of dentition.
   - Occlusion of suspect. By taking a bite sample in centric using wax.
   - Saliva is also collected for DNA testing.

The physical characteristics of both the bite mark wound and the suspect's teeth include:

- The distance from cuspid to cuspid

• The shape of the arch

• The evidence of a tooth out of alignment

• Teeth width and thickness, spacing between teeth

• Missing teeth

• The curves of biting edges

• Unique dentistry

• Wear patterns such as chips or grinding.

Factor that may affect the accuracy of bite mark Identification include:

- ✓ The effects of where the bite mark was found.
- ✓ The damage on soft tissue.
- ✓ The time dependent changes on the bite mark on living bodies.
- ✓ Poor in technique of bite mark.

Person Identification:

- ■ It's a procedure by which , data concerning an individual unknown, are shown to match data concerning a known missing person to such an extent(The forensic dentist compares antemortem (before death) records with postmortem (after death) findings to determine if there is a positive match).

Dental Identification: dental identification help in person identification includes:

- ▪ Dental restorations→ types, their outline, unusual fracture**s of** design of filling, also root canal therapies, rehabilitation.
- ▪ Dental prosthesis. Denture found in the mouth or in the scence of activity are useful aid in identification.
- ▪ Palatine Rugae . the shape and the form of rugae is highly variable between people.It can be recorded by means of dental impression and casts made from them.
- ▪ Lip print. Lip prints are unique to the individual in a manner similar to finger prints .

- Dental DNA. The suspect's DNA profile obtained from saliva or blood of bite mark area and it's surrounding proves a more reliable form of identification.