Review

Forensic Odontology with Emphasis on Rugae Pattern, Lip Prints and Bite Marks

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Abstract

Forensic odontology is one field that has a wide scope for research and various studies have been done in this field. In case of death due to poisoning with heavy metal like arsenic, the same can be detected from the teeth after long time of death in some cases an offender can be detected from bite mark he might have left some material that can be used to identify the culprit.

Key Words: Forensic Odontology, Rugae pattern Bite marks, Lip Patterns.

Introduction

Forensic odontology or forensic dentistry is the application of dental knowledge to those criminal and civil laws that are enforced by police agencies in the criminal justice system. Keiser-Neilson defined forensic dentistry as "that branch of forensic dentistry that in the interest of justice deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of dental findings" Dr. Oscar Amoedo was considered as the father of the forensic odontologist. The thesis done by him entitled 'L' Art Dentaire en Medicine Leagale' to the faculty of medicine earned him a doctorate. This book is the first comprehensive text on forensic odontologist.(1)

Medico-legal importance:

1. Definite identification of a body from dental data can be made, if accurate & dated records are available.
2. Teeth are useful in estimating the age of an individual.
3. Loss of tooth due to assault is grievous hurt.
4. Dentures, partial or complete are useful in identification.
5. Criminals can be identified through bite marks left either in human tissues or in food stuffs.(2)

Rugae Pattern

Evaluating the rugae pattern is a useful method of identifying edentate individuals. The rugae pattern on the deceased's maxilla or maxillary denture may be compared to old dentures that may be recovered from the decedent's residence, or plaster models that may be available with the treating dentist. Palatal rugae are ridges on the anterior part of the palatal mucosa on each side of the mid-palatine raphae, behind the incisive papilla. These asymmetric and irregular ridges are well protected by the lips, cheek, tongue, buccal pad of fat and teeth in incidents of fire and high-impact trauma.

It has also been found that palatal rugae can also resist decomposition to an extent. Rugae pattern, like teeth, are considered unique to an individual. They seldom change shape with age and reappear after trauma or surgical procedures.

Classification of Palatal Rugae

The classification suggested by Lysell is quoted most often.

He measured rugae in a straight line, from their origin on the medial side to terminus on the lateral, and divided them into three types:

1. Primary rugae (>5 mm)
2. Secondary rugae (3–5 mm)
3. Fragmentary rugae (2<3 mm)
   (Rugae < 2 mm is not taken into consideration).

Thomas and Kotze have further categorized the various patterns of primary rugae as

- branched,
- unified,
- cross-linked,
- annular, and
- papillary.

Other authors, such as Kapali et al, have grouped the rugae according to shape as

- straight,
- curved,
- wavy, and
- circular.

Analysis of Rugae Pattern

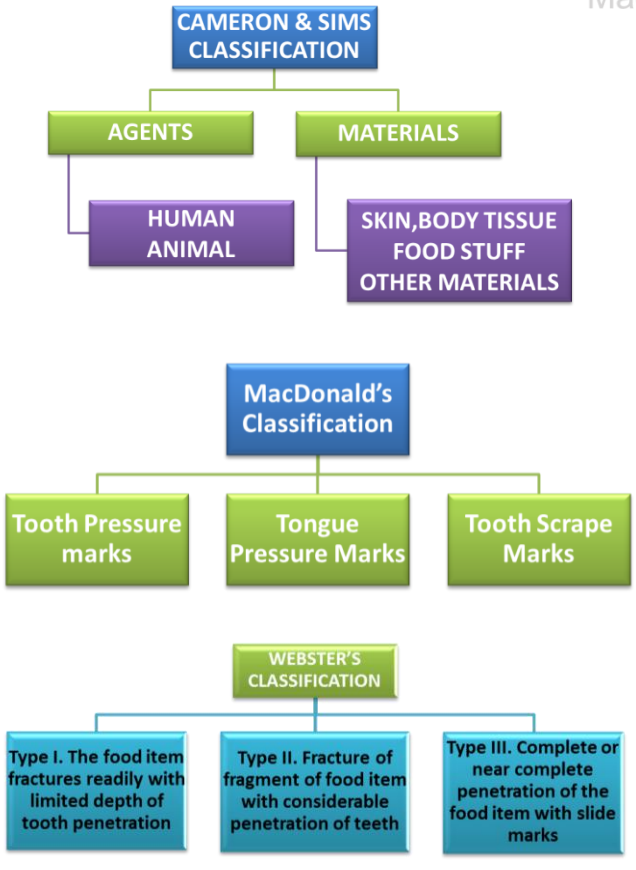
Various methods have been adopted to trace out the rugae patterns.

- Thomas and van Wyk have manually traced rugae patterns from post- and ante mortem dentures on to clear acetate (transparent plastic sheets) and then superimposed these tracings on photographs of plaster models.
- More recently, Limson and Julian have developed a computer software program which makes use of the principle commonly employed in fingerprint analysis. The method used digitized images of the palate on which characteristic points were plotted on the medial and lateral extremities of all rugae

- In fact, Thomas and Kotze state that, considering the complex nature of rugae patterns, a universally acceptable classification may not be feasible and, as long as the technique used to compare the rugae is accurate, one need not conform to a particular classification.
- Furthermore, a recent study by Ohtani and coworkers suggests that high accuracy rates in postmortem identification from palatal rugae can be obtained using straightforward visual comparison of post- and antemortem rugae patterns obtained from dentures, and neither a classification protocol nor computer aided method is mandated.
- These authors did, however, infer that more complex the rugae pattern, greater the tendency for non-identification.[2][3]

Bite Marks

Bite marks have been defined by MacDonald as "a mark caused by the teeth either alone or in combination with other mouth parts". Bite marks may be caused by humans or animals; they may be on tissue, food items or on objects. Biting is considered to be a primitive type of assault and results when teeth are employed as a weapon in an act of dominance or desperation. As a result, bite marks are usually associated with sex crimes, violent fights, and child abuse. Bite marks have also been recovered from scenes of theft. Hence, matching the bite mark to a suspect's dentition may enable the investigating officers to connect the suspect to the crime.



Bite Mark Appearance

Type of Injury: Compression of the skin surface due to tooth pressure during a bite initially causes indentations.

- Indentations, while ideal for bite mark analysis, seldom persist for more than a few minutes unless the victim is dead (note that indentations may also be seen on healing lacerated wounds).
- Owing to the elastic nature of skin, indentations soon disappear as the skin regains its original contour.
- This is followed by a brief period of edema over the bite area, which usually obscures the bite mark completely.
- Once the edema subsides, subcutaneous bleeding is apparent. These are referred to as contusions or bruises and are the most common presentation of bite marks.
- Depending on the skin color they appear as reddish or purplish or dark brown discoloration on the skin surface and are due to the blood escaping into subcutaneous tissue from ruptured minute vessels.
- When the intensity of the bite is great, there may be a break in the integrity of skin surface, resulting in lacerations. The most extreme form of bite mark injury is avulsion, where part of the tissue is bitten off.

Identifying the Injury as a Bite Mark: Sweet has suggested that a human bite mark may be identified by the following characteristics.

Gross Characteristics: A circular or elliptical mark found on the skin with a central area of ecchymosis. The circular/elliptical mark is caused by the upper and lower arches while the central area of ecchymosis is apparently due to sucking action. A typical bite mark is usually distinct from an injury caused by anything else.

Class Characteristics: The marks produced by different classes of teeth are usually distinct, allowing one to differentiate the type of tooth within a bite mark. Incisors produce rectangular marks; canines are triangular or rectangular, depending on the amount of attrition; premolars and molars are spherical or point-shaped.

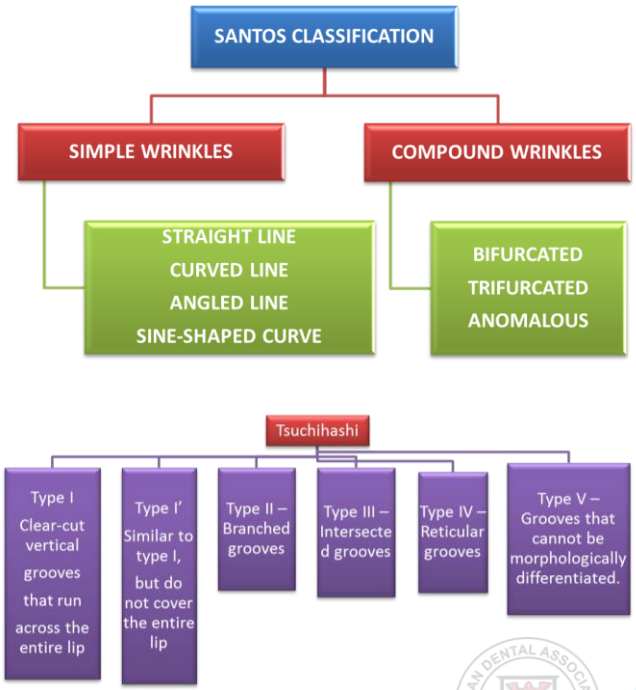
Individual Characteristics: Class characteristics may, in turn, have features such as fractures, rotations, spacing, etc. Such attributes are referred to as individual features and make the bite mark distinct.[2][3][4]

Lip Prints

The wrinkles and grooves visible on the lips have been named by Tsuchihashi as 'sulci labiorum rubrorum'. The imprint produced by these grooves is termed 'lip

print', the examination of which is referred to as 'cheiloscopy'. These grooves are heritable and are supposed to be individualistic.

Lip prints, therefore, can constitute material evidence left at a crime scene, similar to fingerprints.



A combination of these grooves may be found on any given set of lips.

To simplify recording, the lips are divided into quadrants similar to the dentition—a horizontal line dividing the upper and lower lip and a vertical line dividing right and left sides.

By noting the type of groove in each quadrant, the individual's lip print pattern may be recorded. This classification and method has enabled differentiation of lip print pattern between two individuals.

Lip prints can be recorded in a number of ways.

1. Photographing the suspect's lips.
2. On a non-porous flat surface such as a mirror they can be photographed, enlarged and overlay tracings made of the grooves.
3. Applying lipstick, lip rouge, or other suitable transfer mediums to the lips and then having the individual press his or her lips to a piece of paper or cellophane tape or similar surface.
4. By having the subject impress his or her lips (without lipstick or other recording medium) against a suitable surface and then processing these prints with either conventional finger print developing powder or with a magna brush and magnetic powder.[2][5][6]

Conclusion

Along with other traditional method, cheiloscopy can also serve as a very important tool in identification of a person. The uniqueness of lip print needed to be conformed and accepted. A standard and uniform procedure has to be developed for the collection, development and recording of lip prints and the ensuring comparison. Along with that rugae pattern assessment and bite marks are also widely used in forensics.

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