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Identification of Bitemark Perpetrators in Forensic Dentistry- A Review.

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ABSTRACT

“Forensic Dentistry”, a challenging and fascinating branch of dentistry often illustrates the proper handling & evaluation of dental evidence, which are presented in the interest of justice. Teeth are often used as weapons when one person attacks another (or) when a victim tries to ward off an assailant. It is relatively simple to record the evidence from the injury and the teeth for comparison of the shapes, sizes & pattern that are present. Additionally traces of saliva deposited during biting can be recovered to acquire DNA evidence. If dentist are aware of the various methods to collect & preserve bitemark evidence from victims, it may be possible for them to assist, identify & prosecute violent offenders.

Keywords: Forensic odontology, Bite mark, Salivary DNA

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INTRODUCTION

Forensic Odontology or Forensic Dentistry is a science that encompasses three professions namely Dentistry, Forensic Science and the Legal Profession. Forensic odontologists are responsible for providing testimony that can have very severe consequences on individuals and this especially applies when bitemark evidence is the only physical source of evidence [1]. Bitemarks are featured in some of the most violent and heinous crimes [2]. Bitemark analysis can be defined as the analysis of the unique dental imprint that can be accurately recorded on skin or any other object. There are many barriers that prevent scientists from undertaking a lot of active research in this field. The main barrier is the absence of a gold standard which is forensically relevant as well as acceptable for diagnostic research.

Forensic Dentistry / Forensic Odontology: defined by (FDI) as that “branch of dentistry which, in the interest of justice, deals with the proper handling and examination of dental evidence & with the proper evaluation & presentation of dental findings.” [PAUL REVERE-1st forensic dentist]

Contentious Issues

The amount of research dedicated to bitemark analysis is very low. There are several issues that are of concern in bitemark analysis. They are critically reviewed here [1].

Physical Comparisons

There are a number of different methods used to physically compare the suspect dentition and the physical bitemark injury. Some of the methods are confocal scanning electron microscope, reflex scanning electron microscope, fingerprint dusting powder, overlays, impressions and 3D Laser scanning of dental casts. Some of these methods such as computer generated overlays are peer reviewed and have a high degree of specificity and accuracy. Overlays are still the most common method employed by a majority of forensic odontologists. It is of great concern that computer generated overlays are still not being employed by the majority of forensic odontologists. There is no standard applicable [1, 3].

There are also many methods for the production of computer generated overlays. Some of these methods have a regional bias. There are two main techniques for production of computer generated overlays. They are 1. Naru Technique – preferred by Europeans and 2. Sweet Technique – preferred by Americans. Both these methods scored low reliability coefficients for area of individual teeth which is very worrying [1, 6].

Biological Techniques

Recovery of salivary DNA has been the main focus of biological techniques in bitemark analysis. The advantage of this method is that the DNA recovered from the saliva on the bitemark is usually sufficient to produce a profile. There are certain areas of concern. Extreme environmental circumstances are to be taken into consideration. The salivary DNA may be highly degraded. It can be assaulted by the environment [1].

A new area in biological techniques is the use of the bacterial fingerprint. There are over 2000 recorded species of oral bacteria and each individual has a unique bacterial population. A bacterial fingerprint or a bacterial profile can be generated by recording the different species of bacteria present. This can be used to create a database in future. As of now this technique can be used to match a suspect's bacterial profile. This technique is still nascent and has not undergone a lot of active research. There is a lot of scope for research in this area [1].

Uniqueness of The Human Dentition

The human dentition is unique. Occlusal (bite surface) profiles of all people are different from each other. There is just a small hypervariation that occurs in the dentition which is unique. This hypervariation can be used to create a dental occlusal profile database. This has its drawbacks. It is not constant throughout life as compared to DNA which is constant. To overcome this concern, the dental records of suspects can be routinely updated with a bite registration taken every year or so. This is also a new area and a lot of research has to be done in this field [1].

An upcoming area with a certain amount of research being done is "Anterior Teeth Rotation". Anterior teeth have a certain specific numerical rotational value. Tooth patterns observed on skin usually contain the anterior teeth indentations. Changes such as rotations or chippings or malplaced anteriors can help in the creation of a unique database [4].

Human Skin as Bite Registration Material

Skin is a very resilient and elastic material. The skin stretches during the bite due to elastic fibres in the dermis. This effect is only temporary. Due to damage control action taken by the skin cells, the skin reverts back to its normal position if it is not affected beyond its threshold limit. It also has the capacity to form a new layer of skin on the affected area if it is affected beyond its threshold [3].

There is usually an expansion, shrinkage or distortion of the skin in the area of the bite mark. This can affect the accurate recording of the bite mark. Considering this factor, photographic evidence in bitemarks is highly contentious. Some anatomic areas are prone to more distortion than other areas. This is the most important factor that prevents bitemark analysis from becoming a very accurate form of expert evidence [1].

Bitemark Severity Index

The bitemark severity index is a scale from 1 to 6 that measures the severity. The bitemark severity index should have certain ideal characteristics such as 1. Easy to use, 2. Be reproducible, 3. Be able to use on the living as well as the dead, 4. Universally applicable and 5. integration to allow future statistical analysis.

The bitemark severity index is scaled from 1 to 6 with 1 being very mild bruising, no teeth marks present, diffuse arches visible, may be caused by something other than teeth

and of low or no forensic significance. The scale gradually progresses in severity with 6 being complete avulsion of tissue, possibly some scalloping of the injury margins suggesting that teeth may have been responsible for the injury and of low forensic significance. However forensic significance is low on either end of the scale with 3 and 4 having the highest forensic significance. The drawback of this index is its low knowledge levels with the crime scene police officers. Bitemarks distort easily so crime scene police officers need to be educated in the usage of this index which would prove useful to the forensic odontologist at a later stage [5].

CONCLUSION

Bitemark Analysis has been used as a valid and court approved procedure of expert evidence. However, the process and methods have not been peer reviewed to a very great extent. There exists a lot of scope for active research in many areas. Bitemark analysis still has a long way to go before it becomes a mainstream form of expert evidence.

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