

**MEDICAL LEGAL INTEREST OF HUMAN BITEMARKS IN CRIMINAL INVESTIGATION****INTERÉS MÉDICO-LEGAL DE LAS HUELLAS DE MORDEDURA HUMANA EN LA INVESTIGACIÓN**

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**Abstract:** The bite mark have a value legal important in them cases of abuse physical, abuse sexual in children, violations, fights and in others criminal conducts, many times them teeth are used as a weapon additional due to the force of them muscles chewing and the hardness of them parts dental. The bite mark can find is both in the body of the victim as of the perpetrator, and even in food. In this aspect is necessary clarify some issues related with it collection of them samples, them prints, fixing of the same and the comparison to exclude or not to a suspicious. Also is necessary describe that type of injury generates the bite human to be able to identify it correctly. The aims proposal are the follows: To demonstrate the importance of the participation of the dental expert in the scientific team of criminology; generate a knowledge in the criminalistic and odontological sciences throught a literature review, about the value of human bite marks in criminal investigation as a probative sign for the identification of a subject.

**Keywords:** bite marks, research criminal, forensic dentistry.

**Resumen:** Las huellas de mordedura tienen un valor legal importante en los casos de maltrato físico, abuso sexual en niños, violaciones, riñas y en otros asuntos criminales, ya que los dientes pueden ser utilizados como un arma adicional debido a la fuerza de los músculos masticadores y la dureza de las piezas dentarias. Las huellas pueden encontrarse tanto en el cuerpo de la víctima como del victimario, y aun en alimentos. En este aspecto es necesario aclarar algunas cuestiones relacionadas con la recolección de las muestras, las impresiones, fijación de las mismas y el cotejo para excluir o no a un sospechoso. También es necesario describir que tipo de lesión genera la mordedura humana para poder identificarla correctamente. El trabajo presente tiene como objetivos los siguientes: evidenciar la importancia de la participación del perito odontólogo en el equipo científico de criminalística; generar un conocimiento en las ciencias criminalísticas y odontológicas, mediante una revisión bibliográfica, sobre el valor de las huellas de mordedura humana en la investigación criminal como indicio probatorio para la identificación de un sujeto.

**Palabras clave:** huellas de mordedura, investigación criminal, odontología legal.

**INTRODUCCIÓN**

The teeth are the hardest parts of the body. These remain unchanged before the passage of time, cadaveric transformation, external agents such as cold, fire, acids, etc. It is accepted that there are no two identical dentures.<sup>1-2-3-4</sup> They make a contribution in cases of identification of persons and / or bodies that cannot be recognized by traditional methods or that need complementary techniques for identity determination.<sup>2</sup>

Dental identification is possible thanks to the large number of combinations that exist due to restorations, missing parts, endodontic treatments, fixed and / or removable prostheses, etc. This information arises from the comparative study of the clinical history, odontogram, complementary imaging studies, plaster models and other items that can be collated.

1-2-3-4

Law 26812 of Public Health, sanctioned on 11/28/2012 and published in the Official Bulletin on 01/21/2013, modifies art. 15 of Law 26529 (National Legislative Power of the Argentine Republic.) and further on establishes<sup>5</sup>: “in the case of dental records, these must contain dental records that allow the identification of the patient (...) dental pieces must be individualized (...) in a standardized manner, according to the two-digit or binary system, according to the marking and color system established by the regulations”. However, there may be problems in this type of identification due to the lack of certainty that exists about the veracity of the data provided by dental professionals, adulteration of records, falsification of data, incomplete, inaccurate, confusing data, etc.<sup>2</sup>

In the legal framework, conventional DNA typing and fingerprint recognition techniques allow the investigation of identity<sup>6</sup>; but in many cases it is not possible to use them since the tissues have been lost or there is no relative or sample to perform the comparison and verification of identity or affiliation. In this regard, both dentistry and fingerprint can prove identity by themselves.<sup>7</sup>

The analysis and documentation of bite traces are considered as unconventional scientific identification tools.<sup>8</sup>

The dental imprint left by the victim or the aggressor in a criminal act of any kind can be detected by the specialist. The technique of collecting them is not simple, depending on the substrate where the fingerprint is located, the type of method to use will vary, in the case of elastic surfaces such as skin, the technique becomes even more difficult.<sup>9</sup>

Once the prints have been collected, a comparative analysis of the suspect's dentition is performed with the bite or bite mark found. This comparison is made with study models, transparencies and photographs. Currently there are computer programs that automatically and quantitatively check these, obtaining three-dimensional images, such as Adobe Photoshop, DentalPrint ©, Biteprint ©, the latter developed by the Department of Legal and Forensic Medicine of the UNG.<sup>2</sup>

Rawson et al., concluded after analyzing 397 bites and applying a statistical theory, that the probability of finding two equal dentures finding the teeth in the same position, including the anterior segment of the jaw and jaw, is  $1.4 \times 10^{13}$ . According to this study, a coincidence of 5 teeth in a bite should be sufficient evidence for the positive identification of an individual. Although these results should be taken with caution since they assumed that the position of one tooth was independent of the position of the others.<sup>8</sup>

For the aforementioned, the purpose of the present work is to demonstrate, through a literature review, the importance of including a dentist that is specialized in the subject, in the work force of the scientific police, medical staff and other institutions dedicated to criminal investigation, to perform the task of collecting, storing, registering and collating these indications, collaborating in perfecting and profiling the analysis of scientific evidence useful as evidence in the Justice administration.

## HISTORICAL BACKGROUND

The first case in which the bite traces were admitted in United States courts was in 1870. Mary Lunsford of Ohio was murdered and her husband Ansil Robinson was a suspect. He was charged after the comparison of the offensive bite marks found on the victim's arm with some plaster models of the suspect.<sup>8</sup>

The first criminal conviction in North America is the case of Wayne Boden who in 1972 was sentenced to three life sentences for the murder of four women. Evidence was presented by orthodontist Gordon Swann who linked the bite marks found on the victims with the suspect's teeth.<sup>10</sup>

The most resonant case due to its police connotation and cinematographic diffusion is the case of the serial killer of women Ted Bundy. On January 15, 1978, he attacked four women. A bite mark was found on the left buttock of one of the victims which coincided with the impression of his teeth.<sup>9</sup> He was electrocuted on January 24, 1989. 8-10 Bite injuries are admitted as evidence in court cases, in countries such as Canada and the United States.<sup>8</sup>

For these to be assessed as an expert test, they must conform to certain parameters related to the probative efficacy that arises from the Daubert standard. These are: that the theory or technique can be reproduced or demonstrable; that has been published or reviewed by members of the scientific community; the margin of error is known; that is accepted by the scientific community.<sup>11</sup>

It is possible that the specialized dentist may be summoned by the judicial authorities in cases of fatalities in sexual assaults, where bite traces have been found; to identify the victim; to collect both physical and biological evidence that could be found in the bite traces and then compare them with the samples obtained from the suspect. Subsequently,

the dentist must make the conclusions.<sup>12</sup> These can be of two types: consistent with and excludent.<sup>13</sup> According to the guidelines and guidelines of the guide to evaluate the bite marks of the ABFO (American Board of Forensic Odontology) the comparison can give the following results: excluded; not excluded; inconclusive.<sup>14</sup>

### **BITE MARKS. DEFINITION. IMPORTANCE AND LEGAL MEDICAL PROBLEM**

From the legal medical point of view, human bite traces are considered injuries and can be defined as: *“the marks left by the teeth on a relatively soft surface, which can be the skin of a living person or a corpse or on some substrate or inanimate object.”*<sup>8-15</sup>

They are also defined as: *“the marks left by any of the teeth in isolation or in combination with another part of the mouth.”*<sup>16-17</sup> In general, bites cause blunt injuries or incisions, although the range can vary along with the characteristics of the aggressor, the victim and the circumstances. It can range from abrasions, bruises, lacerations, ecchymoses, excoriations, to the start of the bite area by combination of pressure and traction. The skin has a tensile strength that varies between 40 and 90 kg per cm<sup>2</sup>.<sup>18-19</sup>

Puede ir desde abrasiones, contusiones, laceraciones, equimosis, excoriaciones, hasta el arrancamiento de la zona mordida por combinación de presión y tracción. La piel tiene una resistencia a la tensión que varía entre 40 y 90 kgs por cm<sup>2</sup>.<sup>18-19</sup>

The Argentine Criminal Code classifies injuries as minor, serious and very serious (Arts. 89, 90 and 91 respectively)<sup>20</sup>

The “typical” mark of the bite left on the skin is semilunar, rounded, oval or elliptical, with a double arch. From outside to inside it presents a diffuse area left by the lips, the mark of the dental pieces between 25 and 40mm, more noticeable in the area of incisors and canines, separated from an unscathed area and a central ecchymosis.<sup>18-19</sup> In the case of “atypical” marks, the finding and clinical diagnosis is more difficult. It is important to differentiate if it corresponds to a human or animal bite. If it is human, it is evaluated if it is “defensive” or “offensive”. A defensive mark is characterized by leaving well marked teeth and being deeper. It can be found in cases of abuse, where the victim tries to defend him/herself by biting the aggressor, using the teeth as a “weapon”. An offensive bitemark, on the other hand, is more superficial and occurs in attacks or sexual homicides, of the aggressor towards the victim, leaving a central ecchymosis by suction.<sup>9</sup>

One of the problems posed by the bite traces is its difficult recognition, since many times they can go unnoticed depending on the pressure exerted by the attacker, the elasticity and flexibility of the victim's skin and the time elapsed until the completion of the forensic medical exam. In the case of corpses, this dental imprint can be erased by cadaveric phenomena. The lack of a single criterion on the uniqueness of the denture could also be regarded as a problem, although most authors agree that the denture is unique and that even in identical twins there are variations.<sup>2</sup> In the case of bites, the Probability that more than one person can coincide on the same footprint is a challenge that must be addressed in each specific case.<sup>17</sup>

### **BITE MARKS AS A MATERIAL INDICATION**

The bite print as an indication in the criminal investigation, can contribute elements that can be transformed into evidence, aiding in the exclusion or inclusion of suspects and providing evidence in the judicial stage.<sup>15</sup> (It is recommended to see in annexes the difference between evidence, evidence and test).

Bite marks can be analyzed by their class characteristics, which are the features seen in a group that indicate a specific origin. These would be: number, size, shape of teeth, pattern of dental arches, etc. And the individual characteristics are the features that present an individual variation, for example, teeth rotated, enamel fractures, restorations, fixed prostheses, missing parts, etc.<sup>17</sup>

The value of individual characteristics, is because they can locate or relate a subject in a crime scene.<sup>9-13-17</sup> We can infer then, that if the procedure of collecting the prints by human bite in a criminal case, is performed correctly and by an expert in the field, these anatomical features present, can help to find the identity of a person. Another important aspect to take into account in bite traces, is the probability of obtaining a biological substrate such as saliva, which can be used to obtain DNA profiles that will then be checked against the profiles of the suspects.<sup>12</sup>

#### **LOCATION OF BITE INJURIES ACCORDING TO CRIME**

Bite injuries are generally found in cases of homicide, sexual assault, fighting, rape, domestic violence, cases of physical abuse and child abuse.<sup>12-15</sup> Most victims are women, and in the case of bites by those victims, the examined are men. The areas most affected by the injuries are: the arms, legs, chest, face, neck, and genitals.<sup>8-12-15-17</sup> Also depending on the sex and age of the victim.

#### **BITE CHARACTERISTICS ACCORDING TO THE TIME OF PRODUCTION**

Antemortem: there is blood circulation, therefore all coagulation and tissue retraction processes are present. The ecchymosis produced by the incisal edges is in resorption pathways with ad-integrum restitution of the injured area. This injury has extraordinary medical-legal value, since it determines that the injury was done in life. Traces from bruising can last up to 36 hours after they are produced.<sup>13-21-22</sup>

Postmortem: there are no signs of bleeding or coagulation, nor are the phenomena of tissue retraction. There are changes in enzyme activity.<sup>13</sup>

#### **BITE CLASSIFICATION**

- a) Depending on the context: offensive; defensive; erotic-sexual; self-inflating or self-inflicted.
- b) According to the injured body area: face, back, upper and lower limbs, genitals, etc.
- c) According to the pressure exerted: it will depend on factors such as: existence of natural teeth or prostheses, the pleasure that the attacker bites, the feeling prevalent at that time, the resistance of the skin, the resistance of the victim, etc.<sup>22</sup>

The protocol for collecting and analyzing bite traces accepted by ABFO will be briefly detailed below, as it is not the purpose of this study, but it is worth mentioning.

The comparison and analysis of the marks should be carried out in three phases:

- 1) Recognition of the bite and subsequent analysis on the skin or object;
- 2) collection of the suspect's samples;
- 3) comparison of the bite with the suspect's sample.<sup>8</sup>

The task of collecting and analyzing the bite marks is quite complex and, as mentioned above, requires the performance of a professional that specializes in the field. The steps to be performed are the following:

1) Photography with scale: It is convenient to take at least two black and white photos, and two color photos. A metric indicator or measuring device must be used. The scale used is that recommended by ABFO, No. 2<sup>12-23</sup>.

2) Sample collection: saliva is collected with the intention of obtaining blood group, tissue amylase and especially DNA samples.

Saliva can be obtained with the double hyssop technique: a cotton swab rubbed in saline solution is rubbed on the periphery of the mark to rehydrate the dried saliva, and then another dry swab is passed. It is important to let the swabs dry before packing.<sup>8-12-23</sup>

3) Impression of the bite mark: the material used is vinyl polysiloxane of medium and low density, because it has stability and precision. The print material is placed on the bite mark, on it a rigid support. After a few minutes it is carefully removed and the plaster model is made.<sup>8-17</sup>

4) Collection of samples of the suspect: once the identity of the suspect is verified and with the corresponding court order, intra and extraoral photos are taken, where the dental arches are observed in occlusion, with the mouth slightly open, and the incisal edges. The intraoral examination must be performed with the preparation of the dental record. We proceed to take the dental impressions of the suspect with alginate, to make plaster models that will then be used for comparison, along with an interocclusal record.<sup>8-13-17</sup>

5) Comparison of the mark with the suspect's samples: the comparison is made by comparing transparencies obtained from the suspect's model with those obtained from the bite marks. This method is called transparency. It also tends to compare the photographs of the bite marks with the models. All the elements obtained are liable to be collated.

The points taken into account in the comparison are: presence and / or absence of teeth, shape and position of the teeth, measurements of each tooth, shape of the arch, occlusion, rotation or angulation of the teeth, etc.<sup>9</sup>

Currently there are computer tools such as the Adobe® Photoshop® program, which scans models, generates transparencies and obtains digital images that are then compared with the photographs of the fingerprint or with the digital image of the bite.<sup>8-13-17</sup> DentalPrint © program, developed in Spain by the Department of Legal Medicine, Toxicology and Forensic Psychiatry together with the Department of Computer Languages of the University of Granada, with the objective of optimizing the forensic analysis of the bite marks, obtaining 3D images of a plaster model of the alleged aggressor's mouth and the photograph of the skin bite that are then compared.<sup>2-8</sup> The BitePrint© program allows semi-automatic identification of dental marks of bite prints photographs, calculating parameters quantitatively to characterize a subject. This software was also developed at the University of Granada.<sup>24</sup>

6) Conclusions of the report: the comparison can give the following results:

Consistent with: the suspect may have produced the bite marks.

It is excluded: the analysis of the bite mark is very different from those found or collated/compared with the suspect(s).<sup>13</sup>

In any case, since the results cannot be expressed in numerical data, it is not possible to have absolute certainty.<sup>12</sup>

However, the presence of a bite mark is a physical indication that can be used to place a suspect in a certain place or relate it to a particular victim.

In summary, the value of the analysis of the bite marks is because it allows:

- Know if it was dental structures that left the mark;
- Differentiate between human or animal bite;
- Evaluate if the bites were caused by third parties or by themselves;
- Obtain evidence to identify the suspect;
- Collaborate on the research hypothesis;
- Support the judge in the judicial process;
- To collaborate in the construction of the criminological profile of the aggressor;
- Include or exclude a suspect with a certain victim and / or place of fact.<sup>13</sup>

## PSYCHOLOGICAL ASPECT OF BITE MARKS

A no less important aspect, although not the purpose of the present study, is the psychological aspect of bite marks.

The mouth is the means through which we connect with our environment, it is the link between our interior and the outside world. It has an important function in the psychosexual development of individuals.<sup>25</sup> The teeth, a fundamental part of the mouth, represent the walls of man in his physical and material aspect.<sup>22</sup>

The act of biting in children can be interpreted as the result of a situation that they cannot control, which causes them fear, anger, jealousy or frustration. Even in children's drawings, teeth represent, depending on the context, verbal or physical aggressiveness. In an adult, the act of biting can occur as a result of an aggression, as a manifestation of violence by the person who bites, as if he wanted to control his "prey". It is an action that is performed by instinct.

Biting is characteristic of the oral stage, it is the first aggressive drive. If there is a fixation, the individual will seek to satisfy that demand through the mouth and teeth, causing some damage.<sup>22-25</sup>

A criminal bites their victim as a manifestation of their power and control over him/her, satisfying their aggressive and primitive impulses. In some cases, it turns out to be their "modus operandi", with bite traces found in most of their victims. It is somehow a link between the victim and the offender.<sup>22</sup>

## DISCUSSION

In some cases, the results of the comparison of the bite marks can lead to subjective interpretations, because it is not a categorical test such as the fingerprint that has 100% certainty.

It is difficult to express in numerical data the coincidences found in the collation, as in the technique of DNA typing and fingerprints, the latter are computerized in the automatic fingerprint identification system: AFIS (Automatized Finger Print Identification System). This technique is characterized by rapid results and analytical concentration.

Bite traces are considered as evidence that may result in the existence of some other fact yet to be proven. If they are associated with other evidence, they can play a fundamental role in identifying a suspect.

If the collection of samples was carried out correctly, it would be possible to find traces of saliva or cells containing DNA. In the case of corpses, it can be established whether they are lesions before mortem or post mortem.

Findings in cases of child abuse are very useful, since bite traces are not usually unique and can be found in different stages of evolution, thus determining if the abuse is frequent.

It is important for dentists to know the injury as such and to be attentive to the attitudes of children in the dental office that is often indicative of some problem.

## CONCLUSION

The finding of bite traces is an important part of the criminal investigation. Its collection, processing and comparison must be carried out by qualified professionals such as a legist dentist, with knowledge of both clinical practice, dental materials, techniques and legal issues to carry out such a sensitive task.

Its incorporation into the scientific work team should not represent any obstacle. However, in our country, their presence is not yet as required in the criminal investigation team. The dentist could not perform this task isolated from the rest of the professionals, but a multidisciplinary and interdisciplinary approach is necessary together with other specialists in the forensic field, which would allow them to be able to illustrate the judge when it requires the opinion of the experts.

In other countries with greater development in criminal investigation sciences or forensic sciences, such as Spain or the United States, the contribution of dentistry in these areas is very important.

It is also demonstrated that one must work intensively in the development of new technologies aimed at comparing bite traces to obtain results with greater sensitivity and reliability so that their probative efficacy is recognized.

This article aims to collaborate to change the paradigm of Legal Dentistry, opening new expectations in the profession.

## ANNEXES

Hint: action or signal that reveals something hidden.



Evidence: patent certainty, clear and so perceptible of a thing that nobody can rationally doubt about it.

Proof: justification of the truth of the controversial facts in a trial.

(Definitions provided by Prof. Dr. Fernando Cardini. Criminal Matters. Specialist Career in Legal Dentistry.

USAL)

Figure 1



*Bite mark left on a girl's chest.*

*The photograph was taken a few hours from it.*

Figure 2



*The same injury with an evolution of 24 hours.*

*Note the dental imprint left by the aggressor.*

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