

SCIENTIFIC EVIDENCE OF FORENSIC DENTISTRY RELATED TO TECHNIQUES OF HUMAN IDENTIFICATION BY BITE MARKS

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RESUMO

O trabalho do profissional em Odontologia Legal é de extrema importância para a justiça. A análise odontológica é um mecanismo amplamente utilizado para identificar suspeitos em casos criminais e de cadáveres, especialmente em casos de desastres em massa. Portanto, o objetivo do presente estudo é caracterizar os casos de marcas e ferimentos causados por mordidas humanas descritos na literatura, bem como descrever as principais técnicas utilizadas para a identificação humana por meio das marcas de mordidas. A literatura tem demonstrado que a análise de marcas de mordidas é um mecanismo muito importante para auxiliar na identificação humana em odontologia legal. Essas impressões podem ser encontradas na pele, alimentos e outros objetos. Portanto, é necessário que o dentista tenha os conhecimentos necessários para o correto reconhecimento e análise dessas lesões.

Palavras-chave: Odontologia Legal; Mordida; Identificação Humana; Arcada dentária.

ABSTRACT

The work of the professional in Forensic Dentistry is extremely important for justice. Dental analysis is a widely used mechanism for identifying suspects in criminal and corpse cases, especially in cases of mass disasters. Therefore, the objective of the present study is to characterize the cases of marks and injuries caused by human bites described in the literature, as well as to describe the main techniques used for human identification through the bite marks. The literature has shown that the analysis of bite marks is a very important mechanism to assist in human identification in legal dentistry. These impressions can be found on the skin, food and other objects. Therefore, it is necessary that the dentist has the

necessary knowledge for the correct recognition and analysis of these injuries.

Keyword: Legal Dentistry; Bite; Human Identification; Dental arch.

1. INTRODUCTION

Caries treatment using ART has been recognized by the World Health Organization (WHO) as a restorative dental treatment for people who do not have access to oral health care (Navarro, 2009). Much of the published research on ART has shown positive For the correct identification of dental changes, it is necessary for the forensic dentist to know the dental anatomy and its individualities, in addition to having the necessary knowledge about the methods of collecting and preserving the bite marks. All of this has the objective of helping justice in the identification of evidence and conviction of criminals (Almeida, 2012).

Thus, the interest in the topic arose from my affinity with the specialty of Legal Dentistry and the perception of the importance of odontologist in solving crimes through the use of bite marks. It is extremely interesting to highlight the role of the dental surgeon in Forensic Dentistry, elucidating the importance of this professional's knowledge about bite marks and new techniques that contribute to effective human identification. In this context, the study aims to characterize the cases of marks and injuries caused by human bites described in the literature, as well as to describe the main techniques used for human identification through the bite marks.

2. LITERATURE REVIEW

A primeira publicação oficial em que a odontologia legal foi definida como ciência apta a colaborar com a Medicina Legal, foi realizada em Paris no ano de 1898, pelo então dentista cubano, Oscar Amoedo. No entanto, a expressão Odontologia Legal foi criada somente em 1924, pelo professor paulista Luiz Lustosa Silva, que neste mesmo ano publicou a obra “Odontologia Legal”, relacionada a disciplina com esse título e determinou os primeiros limites do seu campo de atuação. A Odontologia Legal é a especialidade que tem a finalidade de pesquisar os acontecimentos de cunho psíquico, físico, químico e biológico nos seres humanos (tanto vivo, como morto, ou ainda sua ossada); em fragmentos ou vestígios; que podem resultar em danos parciais, totais, reversíveis ou irreversíveis (Silveira, 2008).

In the forensic context, forensic dentistry works in different ways, both in the investigation and preservation of evidence, as well as in the organization and exposure before justice. Through this specialty it is possible to recognize and analyze the signs and marks made by human bites on food or on the skin (Coutinho, 2013). The examinations carried out by odontologists include administrative, criminal and civil jurisdiction. In the criminalist environment, the expert can act in the identification of living people or corpses, performing bodily injury forensics, determining age, spotting forensics, and in other expert examinations (Dário, 2016; Peres, 2007).

Peres (2007) define the experts as experts called by legal authorities, in order to comply with the duty to clarify justice regarding certain facts, persons or things, as the beginning of evidence. According to Silveira (2008), expertise means, analysis, investigation, verification and search for the truth, or reality of certain occurrences by individuals who have adequate professional qualification; distinct experience with regard to matter and moral suitability.

The medical record is considered a document of great importance in Dentistry, which must be composed of anamnesis, treatment plan, radiographs, plaster models and other documents. In addition to its undeniable importance in the clinical environment, the dental record also has great relevance in the legal environment, as it can be used as an important instrument in human identification expertise (Almeida, 2012; Terada, 2011).

Through efficient human identification techniques, the forensic dentist can achieve positive results in relation to the identity of an individual suspected of a crime, in addition to the identification of a corpse, usually in mass disasters (Dário, 2016; Peres, 2007). The work of the professional in Legal Dentistry is of great importance, and dental analysis is a widely used mechanism, and the main use of this area is aimed at the identification of suspects in criminal proceedings and of corpses in cases of mass disasters (Coutinho, 2013). Forensic dentistry, through its precise techniques and scientific knowledge, makes it possible to acquire important information in human identification, especially when you have ante-mortem documents, such as the individual's dental record (Terada, 2011).

Human identification is conceptualized as a means by which an individual's identity is defined, the dental method, as part of this process is widely used simultaneously with other techniques such as papiloscopia, iris analysis and DNA analysis (Coutinho, 2013). In the process of human identification, the dentist can use the comparative method. In these cases, the identification is carried out through analysis and comparison with the data obtained through the individual's dental documentation. In addition, the dental method is considered to be one of the most effective in identifying a victim, as it provides reliable results. Its main advantages are: low cost, ease and speed of execution (Dário, 2016; Magalhães, 2015).

It is important that the dentist has correctly filled out and kept the dental record, in order to assist in the identification of the victims. In this way, the dentist will confront the information in the medical record with the characteristics obtained from the individual (Scoralick, 2013). For the identification of victims of mass disasters, the application of the usual techniques presents great difficulty due to the high bodily destruction. Thus, identification through the dental arch becomes the most efficient method due to the great inability of two individuals to have equal characteristics in the referred arches (Figueira, 2014).

One of the biggest advantages of the identification technique through the analysis of teeth is its ability to resist adverse situations, due to the characteristics of the dental structure such as: mineralized tissue, great durability, longevity and resistance (Araujo, 2013). The use of photographs of the smile for human identification is widely accepted worldwide because the technique is fast and safe, in this method a comparative analysis is performed between the dental characteristics observed in

the photograph and in the individual (Terada, 2011).

In addition to the dental arch, the palatal rugoscopy technique is also relevant due to the specificities of the area. This method is defined as the study of the particularities of the palatal folds, and aims to define the identity, both of a recent corpse and of a living individual (Tornavoi, 2010). Palatal wrinkles in toothless individuals have great value, despite the need for ante-mortem records to perform the comparison, such as plaster models and intraoral photographs (Ribas, 2015).

Another method of identification used is cheiloscopy, which is characterized by the analysis of the lip ridges and their dispositions, the lip commissures and the thickness of the person's lip (Lima, 2016). Complementing, Coutinho (2013) bring that, the lip impressions can be easily detected through the use of fluorescent methods. In this way, all lip evidence is of utmost importance, even though it cannot be seen as in a lipstick print. The use of cheiloscopy is very useful to arrive at the identity of a criminal who leaves his lip impressions on objects at the scene of a crime. Therefore, the marks found are compared with the lip grooves obtained from the suspect (Herrera, 2013).

An area of activity that is of great importance for forensic dentistry is the recognition and investigation of marks and injuries produced by bites, both of human and animal origin, which are left on the skin of living people, corpses or objects, especially in crime scenes (Nadal, 2015). According to Vanrell (2009), the recognition of the bite marks is carried out in three stages: exploration of the lesion and collection of the material, through molding; collection of samples of the accused, through molding; and finally, the comparison between the mark and the suspect's samples.

The investigation of the bites is done through an analysis of the shape, location, size and other particular characteristics of the teeth, as well as their marks on the skin, food or other objects, taking into account the intensity with which it was caused (Oliveira, 2010). In the bites, the impressions left by the anterior teeth are frequently observed, however in some cases the marks of the premolars and molars are also noted, thus, the intercanine distance becomes very important in this process. Because of this, injuries caused by canines are the most constant and studied (Almeida, 2012).

The normal distance between the upper canines, in adults, varies from 25 to 45 mm, it is noted that the impressions are deeper or more prominent. In children, on

the other hand, the distance is less than 30 mm (Almeida, 2012). The appearance of the bite varies in relation to the ante-mortem and post-mortem injuries. Ante-mortem marks are characterized by the presence of hemorrhagic infiltrate, inflammatory response, blood clot and tissue shrinkage. In the post-mortem there are yellow marks, without vitality and without crusts, in addition to there being no hemorrhage and shrinking tissues (Pereira, 2017).

It is extremely important that the recording and preservation of evidence is done, so that a correct analysis and an effective conclusion of the case can be made. Thus, photography, as it has an unquestionable value before the court, is the most used registration method for bite marks (Santos, 2014). It is recommended to position a rigid scale at the same level as the lesion and keep the camera lens positioned perpendicular to the bite mark, in order to reduce angle distortions. Because many injuries are not noticeable because of the weather, it is suggested to use ultraviolet (UV) photography to increase the contrast between the bite mark and the surrounding tissue (Mânica, 2016).

Couto (2011), states that due to the change in the aspect of the bite mark over the days, both in corpse and in live, it is important that the photographs are taken at regular intervals throughout the days. 24-hour intervals for 5 days are recommended for proper reproduction of the maturation of the lesion. There are guides that can be used to assist in the analysis and interpretation of bites, such as the injury severity guide, which indicates the degree of violence of the action, the colorimetry guide, which will help to age the injury and guides to assist in the elaboration of the report. A very challenging issue in the investigation of bites is the distortion of dental impressions left on the skin, due to its viscoelasticity. In addition, the anatomical position of the impressions can also interfere in this process due to the presence of fat and the underlying musculature (Mânica, 2016).

The techniques used to compare the bite marks are performed in two ways. The first refers to metric analysis, in which specific locations are measured, such as the intercanine distance. The second is called a comparison of the form of injury or standard association, which refers to physical matching (Nascimento, 2012). When using the metric analysis method, all aspects and particularities of the suspect's dentition found in the lesion must be measured and recorded. Both the length, the width and the depth of the marks of each particular tooth; as well as the extent and shape of the injury site

and other aspects such as the intercanine distance, the space between the marks, poor positioning and the absence of teeth must be noted and calculated. The measurements obtained from the lesions are recorded in millimeters and can be recorded according to the score recommended by ABFO (Santos, 2014).

In the standard association, the main technique is the overlapping of the images, in which the same and different points between the bite and the suspect's dental arch are analyzed. The overlay of the images can be performed manually or through scanned images. In the manual method, transparent acetate sheets are used, which are placed on the plaster models of the individuals' arches, providing a copy of the incisal surfaces and, later, superimposed on the bite marks. With regard to digitized techniques, they can be done through the digitization of images or digital photographs and can be used and analyzed using computer programs (Marques, 2004).

Forensic procedures can take advantage of technological devices developed for other purposes and which assist in the investigation of crimes. In this perspective, an option to be used for reproducing bitten objects found in crime scenes and which cannot be portrayed by traditional techniques, is reverse engineering and rapid prototyping (Nascimento, 2012). In order to make impressions of the bite lesions, addition silicones can be used, which are considered materials of choice, due to their dimensional stability. The models must be obtained using plaster type IV (Pereira, 2017). In cases where it is necessary to analyze bite injuries in cadavers, it is recommended to dissect the skin in the area of the bite or to perform a removal, en bloc, of the mark site, and then fix it with buffered formaldehyde (Vanrell, 2009). Bite injuries, in addition to being physical evidence, also consist of biological evidence, having great value in investigations. During the bite, the saliva on the skin has a considerable degree of deoxyribonucleic acid (DNA) (Santos, 2014).

Couto (2011) reports that for the recovery of saliva, the double swab technique, proposed by David Sweet, is recommended. In this technique two sterile swabs are used, the first swab is moistened with distilled water and then passed through the skin in circular movements, in order to moisten the dry saliva. Soon after, the second dry swab is passed using the same circular movements, in order to recover the remaining mixture on the skin. The two swabs must be dried in the open air and placed in paper envelopes. Mânica (2016) shows that, the injuries caused by bite, often do not present

evidence that contribute to relate a specific person to a certain crime. However, depending on the intensity, pattern and location of the bite, the suspect's psychological and criminal profiles can be traced. Although the use of DNA is more scientifically accepted, it is not always possible to recover DNA due to its deterioration or contamination.

In the literature one can find several studies that reveal the importance of human identification techniques through the bite marks. These techniques are intended to contribute to the recognition of individuals, in addition to the conviction of suspects before justice as described in the following topic. A survey conducted by Almeida (2012) with 600 individuals, 300 male and 300 female, aimed to investigate the intercanine distance according to sex, in addition to examining the effectiveness of this methodology. It was observed that in men, the upper intercanine distance averaged 34.239 mm, ranging from 27.5 mm to 40 mm. In the lower dental arch, the mean was 27.14 mm and ranged from 21.7 to 32.2 mm. In women, the upper intercanine distance averaged 33.159 mm, ranging from 27 to 40 mm, whereas in the lower arch, the average was 26.511 mm and ranged from 21.7 mm to 35.4 mm. Thus, it was found that there were no significant results in relation to gender discrimination from the intercanine distance.

Maji (2018) evaluated the bite marks of men and women for sex determination using a computer program. The intercanine distance of men and women was 32.95 mm and 29.84 mm, respectively, with an average difference of 3.11 mm. They found a highly significant difference and that it is a simple, reliable, easy to reproduce and economical method. Almeida (2012) examined 600 people, divided into three age groups, to verify the relationship between intercanine distance and age. The model used did not show a significant response to age prediction from the intercanine distance. The error rate was lower in the 35-40 age group.

Nascimento (2012) in their research found the effectiveness of reverse engineering and rapid prototyping in helping human identification by bite marks on foods (chocolate and cake). The chocolate showed better results in relation to the cake, both in 3D technique and in rapid prototyping, in which it was possible to analyze the coincident points between the bite and the suspects, being able to discover exactly the identity of the author of the bite. Both techniques were effective in identifying through bites on some foods, so further studies with other types of food should be done to verify the use of rapid prototyping, thanks to its effectiveness in con-

frontation and its possibility to convert a deteriorable evidence into something manipulable and lasting.

Naether (2012) used 3D scanning and 3D comparison methods to compare bites in different types of food (slices of bread and butter, apples, chocolates and cheeses) with the teeth of the suspects. The identification of the suspects was possible even with the food left at room temperature for several days, so digitalization and 3D comparison becomes an accurate and efficient technique for this purpose. Marques (2013) used the cone beam computed tomography to study the surface and interior of bitten foods (chocolate, cheese, apple, chewing gum, pizza and cream pie) and the models of the accused. The impressions of both arches were present in all foods, it was possible to measure the mesio-distal diameter and the intercanine distance successfully in all foods, except for pizza. Thus, Cone Beam computed tomography becomes a tool of great relevance for recording and analyzing bites on objects found at a crime scene.

Daniel (2015) compared the effectiveness of the analysis of bites in three different foods (chocolate, cheese and apple), using two techniques - that of manual fitting and that of the computer method. It was found that chocolate and cheese obtained better results in relation to apples, both in the manual technique and in the computer method. In addition, computer overlay is a reliable, easy, cheaper and faster technique for analysis, but more studies are essential for the development of more specialized software for this practice. Araújo (2019) analyzed the stability of bite marks on foods under different temperature conditions to test their reliability in the investigations. It was noted that the storage temperature had no significant influence. Chocolate and cheese showed the best results when measurements were taken afterwards, however the chocolate was more stable over a longer period of time (3 and 7 days).

Maloth (2011) examined the reliability and effectiveness of five methods (manual tracing of the mold, manual tracing in wax, xerographic method, radiopaque printing method and 2D method by computer) used to overlap the bite marks. The computer-based 2D method was considered the gold standard, as it produced digital images of the study models, which were considered very accurate. In one study, Khatri (2013) evaluated the best overlapping technique among three techniques - manual, photocopy and the computer-assisted method. They concluded that the computer overlay showed better results when compared to the photocopying and manual technique. Therefore, it is an objective method,

easy to produce, low cost and well researched.

Pajnigara (2017) compared three techniques used to generate overlap in the analysis of bites: manual tracing of the wax printing method; radiopaque wax printing method; computer-assisted method. They observed that the computer method obtained better precision, moreover, of the two manual methods, the one that obtained the best result was the radiopaque wax printing method. Afsin (2014) exposes three cases of victims who were assaulted and who had bite marks on their faces. There were four suspects, however, the bites were compatible with only one individual. In this way, the relevance of the bite marks is noticed in order to obtain the identity of the aggressor and to draw his profile.

Weeratna (2014) reports a case in which marks on a child's skin were initially identified as dermatological lesions and then with burn injuries before they were finally characterized as bite marks. These marks generated relevant evidence for the investigations, although the injury produced was not enough to point out the aggressor, it is possible to exclude probable aggressors and the case had an appropriate resolution. Chávez-Briones (2015) describe a case in which it was possible to identify a suspect through DNA from the saliva present in bite marks on a female corpse. The single swab technique was used to collect evidence and DNA isolation was performed. The sequencing of the DNA found on the victim was compatible with that of the suspect. Based on this, they found that the unique swab technique for collecting evidence and an organic method for DNA isolation can be very useful in solving these types of crimes.

Costa (2011), made an analysis of the medico-legal reports prepared between 2004 and 2011, in the Northern Delegation of the National Institute of Legal Medicine (INML), in Portugal, of individuals under 18 years of age, victims of abuse, totaling 1240 cases, in order to find out the prevalence of bites in victims of abuse. Through the results it was found that 1.5% of the cases reported the existence of bite marks. Most of the victims were female (n = 11, 64.7%). The injuries sustained occurred more frequently at the level of the upper limbs (n = 14; 53.8%).

A study carried out by Amorim (2016), aimed to describe the prevalence of bite marks in expert victims at the Instituto Médico Legal de Feira de Santana, from 2007 to 2014. Of the 1,045 cases of expert violence, it was observed that 32 of the cases were related to injuries caused by bites. It was observed that 78.1% of the

victims were female, the regions most affected by injury were head and neck (29.2%) and upper limbs (29.2%), in addition the majority of the victims had more than one lesion, presenting clinically as abrasions (34.2%) and ecchymosis (31.6%).

Vallim (2019) examined the cases of bite injuries at the São Paulo Court of Justice, in order to explore characteristics that may contribute to the study of bite marks. From the 1,125 results, it was noted that domestic violence constitutes the crime with the highest number of cases (n = 316), in addition, most of the accused were male (n = 889) and female victims (n = 562). With a number of 641 investigated cases, in only 3 cases, the identity of the suspects was investigated.

3. CONCLUSÕES

The literature has shown that the analysis of bite marks is a very important mechanism to assist in human identification in legal dentistry. These impressions can be found on the skin, food and other objects. Therefore, it is necessary that the dentist has the necessary knowledge for the correct recognition and analysis of these injuries.

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