Descrição de Técnica para Reprodução de Gomas de Mascar para Análise de Marcas de Mordida em Odontologia Legal

Chewing Gum Reproduction Technique for Bitemark Analysis in Forensic Dentistry

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Recebido: 22 de agosto de 2013; Aceito: 08 de dezembro de 2013

Resumo

A análise pericial de uma goma de mascar presente na cena de um crime e a sua ligação com um suspeito é mais uma ferramenta de identificação que as Ciências Forenses dispõem. A goma de mascar possui a capacidade de registrar, com relativos detalhes, as superfícies oclusais dos dentes posteriores, contendo informações únicas e incomuns do indivíduo, sendo que a combinação das características e das singularidades apresentadas pelos dentes, somadas às características do arco dental, podem ser de grande valia na inclusão ou exclusão de um suspeito. A característica elástica dessa prova dificulta o trabalho pericial, não permitindo a adequada manipulação que esse processo exige. Nesse sentido, o objetivo desse trabalho foi descrever uma técnica para a reprodução da goma de mascar em silicona de adição e de condensação, adaptando técnica inicialmente descrita para a duplicação de próteses, por meio da inclusão em alginato, em um duplicador ou qualquer outro objeto adaptado para esse fim. A adaptação dessa técnica para a duplicação da goma de mascar mostrou ser de fácil execução, garantindo a preservação da prova real e a reprodução fiel do material questionado, permitindo ao perito odontolegista uma análise minuciosa e precisa das gomas de mascar quando constituem elemento de análise pericial.

Palavras-chave: Odontologia Legal. Registro da Relação Maxilomandibular. Goma de Mascar.

Abstract

The forensic analysis of a chewing gum found at a crime scene and its connection to a suspect is a further tool for forensic identification. Chewing gums have the ability to record biting surfaces of posterior teeth in detail, providing unusual and unique information of an individual. The combination of these characteristics and peculiarities of teeth and the characteristics of dental arch may be valuable for inclusion or exclusion of a suspect. The elastic characteristic of these evidences hinders the work of the expert,,preventing the proper handling that this process requires. In this sense, the objective of this study was to describe a technique to reproduce gum with vinyl polysiloxane and silicone impression material, by adapting a technique initially described for prosthesis duplication using alginate in a container or any object adapted for this purpose. This technique showed to be easily performed, ensuring the preservation and reproduction of the material, and allowing a thorough and accurate analysis to the expert when chewing gum is a factor of proof.

Keywords: *Forensic Dentistry. Jaw Relation Record. Chewing Gum.*

1 Introduction

Forensic Dentistry is the science that correlates dental to legal principles, under the inspiration to clarify data interests to justice, including the human identification process[1-4]. One of possible acting fields for dental forensic experts is the analysis and study of patterns and injuries created by human bitemarks[5,6]. The scientific basis of these analyses consists in the human dentition individuality and the assumption of its being reproduced on different supports. The support can be animate, like animals or persons, or inanimate, such as objects, food and even chewing gum left at a crime scene[5]. This allows the recovery of valuable clues, like saliva samples for forensic DNA testing and/or blood test types, and collection of dental impressions[7-9].

A material evidence only has probation value if correctly registered and preserved, assuring its custody chain. In this way, the study of chewing gum evidence makes the work of the expert more meticulous, due to its characteristics including the elasticity and easily-deforming, increasing evidence disturbance and consequently, its invalidation. In this way, the present study aims to describe a technique to duplicate chewing gum by using a vinyl polysiloxane and a silicone impression material.

2 Material and Methods

This technique requires a small plastic recipient with fitting, that permits its replacement; alginate (Avagel®; Dentsply Industry and Trade Ltd., Catanduva, Sao Paulo, Brazil); spatula; plastic bowl; disposable syringe; glass mixing slab; cement spatula number 24; vinyl polysiloxane (soft and catalyst paste) (Elite HD® Light Body; Zhermack, Badia Polesine, Rovigo, Italy) with dispenser; silicone material (soft and catalyst paste) (Perfil®; Vigodent Industry and Trade Ltd., Rio de Janeiro, Rio de Janeiro, Brazil); and impression syringe (Figure 1).

Figure 1: Materials required for the technique

The plastic recipient should permit replacement for an accurate reproduction of the gum. The internal face should present retentions that can be made by the operator or become incorporated into the recipient. This detail is important to improve alginate retention. It is also important to mark the right position of replacement.

The chewing gum must be refrigerated at the time of its manipulation to prevent distortions (Figure 2a). First, the alginate is manipulated according to the manufacturer recommendations, and half of the plastic recipient is filled. A small amount of this material is reserved for inclusion with the disposable syringe.

Figure 2a: Chewing gum used on replication and ABFO #2 scale

The syringe containing alginate is used to mold the gum and then it is incorporated into the recipient with alginate previous placed. The gum is submersed by half (Figure 2b). After the cure of the material, another portion of alginate is manipulated. The proceeding of inclusion on the disposable syringe is repeated, by this time the other half of the recipient is filled.

Figure 2b: chewing gum included in the plastic recipient containing alginate

The alginate in syringe is always the first material to come in contact with the chewing gum (Figure 2c). The recipient is then closed until the final settlement position. After the second cure, the recipient is opened (Figure 2d) and the gum is carefully removed (Figure 2e). It is recommended to use a triple air syringe for displacing chewing gum.

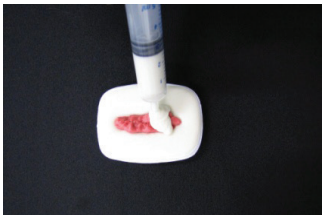

Figure 2c: Alginate application with disposable syringe

Figure 2d: Mold after material cure

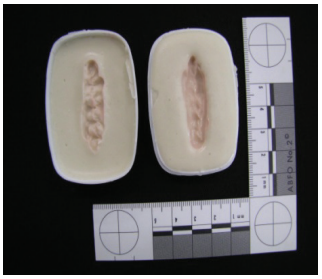

Figure 2e: Chewing gum mold

The pattern obtained of the anatomic mold of the chewing gum is then used for the reproduction of the elastomeric material that is going to be inserted (Figure 3a).

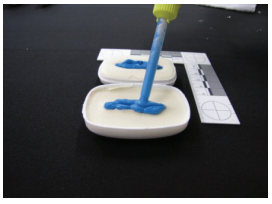

Figura 3a: Elastomeric deposition by dispenser

The recipient should be maintained closed until the material cure. After this, the model of the gum may need clippings to remove the elastomeric excess (Figures 3b and 3c).

Figura 3b: Chewing gum replication after material cure; notice that the excess material must be removed

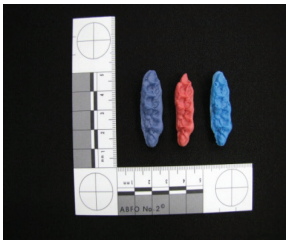

Figura 3c: Chewing gum replication using silicone (left side) and vinyl polysiloxane material (right side), and the original chewing gum (middle).

3 Results and Discussion

If carefully analyzed, manipulated and preserved, chewing gum left at a crime scene, under favorable conditions could provide crucial information about suspects of a crime, as reported in the literature[10-12]. This proof may be the only material clue available to experts[13]. The compressible property of a chewing gum gives to this material ability to almost instantly record marks of a bite, behaving as an impression material[14,15], faithfully reproducing marks when compared to other substrates, like food, providing a fast and secure way to identify an individual[16]. The surfaces commonly recorded are the oclusal back teeth[17].

On the other hand, the same property that gives elasticity and compressibility to this material also increases the propensity of deformation, dehydration and decomposition[14,15]. This fact contributes to questionings about its validity in a trial, settling to expert proper collecting, manipulating and preserving methods aiming to decrease undesirable changes and increase the probation value[5].

The greater number of bitemarks left in food dehydrates faster the product and distorts the mark [14,15]. Most perishable foods received by forensic analysis, including chewing gum, offer insufficient information to form some confided conclusions about its authorship[5]. Even when the analysis of tooth prints is not possible, oftentimes they give sufficient samples to genetic profiling analyses. Saliva samples, blood (in exceptional cases) and even semen can be recovered[17].

Chewing gum suffers less dehydration and distortion when conserved in a zip lock plastic bag[18,19]. Deterioration is retarded when conserved in refrigerator, even over an year, without compromising its dimensions, at a temperature of -10º to 4 ºC[18,19]. When more than one piece of evidence is collected and placed in the same wax recipient, these must be separated by bubble wrap[18,19]. Changes of temperature and pressure of collected sample recipient also contribute to its distortion[20].

Also in this analysis, experts often need to interpose the dental arches on the material proof for the comparison of their characteristics. This factor confirms the need to develop techniques that allow a faithful reproduction of such proof, without damaging or compromising the original material[20]. The glucose present in chewing gum is a factor that could make the blood type exam impracticable by the saliva sample, due to substances inhibition of the blood group substances[21].

Regardless of the material used for the chewing gum reproduction (vinyl polysiloxane or silicone), both resulted in reliable copies. Despite initial fidelity reproduction, silicone material releases late by-products that contribute to dimensional changes. For this reason, the choice in using a material lies on vinyl polysiloxane[22]. At the principle, two materials were used for this reproduction in order to establish which of them provides greater malleability in interposition among dental plaster models. Although vinyl polysiloxane exhibits higher elasticity modulus than the silicone material[22], both materials expressed equal flexibility, perhaps by the silicone material thickness, which creates an indistinguishable clinic elasticity.

The dispenser for silicone has many advantages regarding the manual manipulation and application with disposable syringe, such as minimize the error handling and decrease the air bubbles in the mixture, thereby increasing the fidelity of the result[22]. Accordingly, vinyl polysiloxane has a higher dimensional stability than the silicone material, and together with dispenser, can be the one of choice for chewing gum reproduction. Finally, it is also worth mentioning that the saliva sample collected from the chewing gum to laboratory exams must be held, whenever possible, previously to its

manipulation.

The use of three-dimensional laser scanner to digitalize a chewing gum, including its use in the prototyping for reproducing the sample can be used and demonstrates to be a reliably reproduction method[20]. Although this technique represents an easy and fast execution method, the process of prototyping demands time, as well as the need for equipment, digitalization and handling. This factor could make this technique impracticable, mainly considering its unenforceable implementation and maintenance in most of forensic institutes. Therefore, the description of a simple, quick, effective and cheap method, demonstrates more viability in forensic practice.

4 Conclusion

This adapted technique demonstrates to be an easy executing method for duplicate chewing gum, ensuring the preservation of the real evidence, providing a reliable reproduction of the questioned material, and enabling forensic dental experts to have a meticulous and accuracy analysis of chewing gum, when emerging as a relevant element of expert analysis.

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