



Evaluation of palatal rugoscopy in dentulous and edentulous cases for human identification in forensic dentistry

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ABSTRACT. The search for identity is based on a set of characteristics, which defines the uniqueness of a person. Principles such as classificability, immutability, persistence, practicability and uniqueness must be considered when applying an identification technique. This study aimed to evaluate the use of palatal rugoscopy in dentulous and edentulous volunteers, with or without upper removable denture, for purposes of human identification. In this study 60 subjects were asked to give dental casts and photography of the upper dental arch, defined in the following groups: Group A (n = 30, edentulous patients with full upper removable dentures) and Group B (n = 30, dentulous without upper removable partial denture). The rugoscopy analysis method used was Martins-dos-Santos classification, for checking the applicability and success in human identification. It was found that it is possible to use this technique and it has an application of 40% in the group A and 86.66% in the group B. In conclusion, the identification method by palatal rugoscopy is satisfactory for dentulous patients, however in cases of tooth loss and friction cases generated by prosthetic devices, the region of the palate lose its characteristics, but even then it is still possible to be applied.

Keywords: forensic anthropology, expert testimony, palate.

Análise da rugoscopia palatina em indivíduos dentados e edêntulos para identificação humana em odontologia legal

RESUMO. A busca pela identidade baseia-se em conjunto de caracteres permanentes que torna uma pessoa única e, para que uma técnica de identificação seja aplicável, alguns princípios devem estar presentes, tais como unicidade, imutabilidade, perenidade, praticabilidade, classificabilidade e reprodutibilidade. O presente trabalho objetivou avaliar a possibilidade de uso da rugoscopia palatina em indivíduos dentados e edêntulos, portadores e não-portadores de prótese total removível em arco superior, para fins de identificação humana. Foram selecionados n = 60 sujeitos da pesquisa que foram convidados a ceder moldes e fotografia do arco dental superior, definidos nos seguintes grupos: Grupo A (n = 30, edêntulos e portadores de prótese total removível superior) e Grupo B (n = 30, dentados e não-portadores de prótese parcial removível superior). O método de análise da rugoscopia utilizado foi por meio da classificação de Martins-dos-Santos, com o intuito de verificar a aplicabilidade e possibilidades de sucesso na identificação. Foi verificado que é possível aplicação e uso da técnica em 40% no grupo A e de 86,66% no grupo B. Conclui-se que o método de identificação pela rugosidade palatina é satisfatório em pacientes dentados, enquanto que a perda dental e o atrito gerado por aparelhos protéticos na região do palato conduzem a prejuízos nas características da rugosidade palatina, mas, ainda assim, com possibilidade de aplicação.

Palavras-chave: antropologia forense, prova pericial, palato.

Introduction

Human identification aims the study of the man as a whole and in his individuality, examining the morphological and psychological aspects, determining identity; therefore, identification is the act of identifying something (DARUGE-JUNIOR et al., 2001). In certain situations, the identification by teeth is impossible, for example in edentulism. This is why other less used techniques emerged, such as palatal rugoscopy, which can also conduct to a successful

human identification (CALDAS et al., 2007). Among the evidence taken from edentulous victims, the palatal rugoscopy is relatively easy to obtain from the confrontation of morphological characteristics, however, some events may contribute to changes, such as, the use of upper denture, which could eventually handicap the identification process (MARTINS-FILHO et al., 2009; TORNAVOI; SILVA, 2010).

In this way, the present study aimed to evaluate the applicability of the palatal rugoscopy as a method for

human identification in Forensic Dentistry, according to the methodology described by Martins-dos-Santos (1946), in edentulous patients, with upper removable denture and in dentulous patients without dentures.

Material and methods

Initially, the research project was submitted to and approved by the Research Ethics Committee of the School of Dentistry of Ribeirao Preto (FORP), University of São Paulo (USP), São Paulo State, Brazil, under the case number of 2009.185.58.8 (CAAE 0005.0.138.000-09).

The sample was composed of 60 subjects, volunteers, all above 50 years of age, who were invited to give the dental casts and photography of the upper dental arch. They were divided into two distinct population groups: Group A (edentulous patients with full upper removable dentures), Group B (dentulous without upper removable partial dentures), which underwent examination of the forms of the palatal rugae using the method described by Martins-dos-Santos (1946), in order to verify the applicability and possibilities of success in examining the edentulous and dentulous arches.

Initially, for the cleaning of the mouth, they were asked to use a mouthrinse (Plax®, Colgate-Palmolive®, São Bernardo do Campo, Brazil). After this procedure, some intraoral photographs were taken (Sony Cybershot HX1®, Tokyo, Japan), using lip retractors (Arcflex Lip Retractor, FGM Dental Products®, Joinville, Brazil), allowing a better positioning of occlusal and intra-oral mirrors, and also allowing the subjects a greater mouth opening, with less discomfort. After the retractor placement, the occlusal snapshot was conducted with the aid of an intra-oral mirror (Crystal Prism® Dental Instruments, São Paulo, Brazil) and with the application of air jets.

Then, the volunteer was positioned for molding the upper arch, so that the upper dental arch remained parallel with the ground. The dental tray (Trays Stainless Tecnodent®, São Paulo, Brazil) was selected with a clearance of 3mm between the tray and tissues of the dental arch to be molded. All models were taken with the use of an irreversible hydrocolloid - alginate (Cavex Orthotrace®, Haarlem, Holland), and the ratio of water/powder obeyed the manufacturer's instructions. Then, dental casts for the study were made (Plaster Rio®, Rio Claro, Brazil).

Then dental casts were photographed, images were revealed and the palatal rugae that were visible in the photos were contoured. After ending the contours, the photographs were scanned to evaluate

whether the palatal ridges could be observed and classified, both in the dental cast and in the palatal photograph.

After the analysis, the applicability was evaluated, and palatal rugae that could be visualized in the intraoral photograph and in the dental cast were classified as applicable, and those that have not fit this framework, were classified as non-applicable. Data were presented in a model of descriptive statistics.

Results

The formation of samples was established in relation to gender, being 30 volunteers (13 male and 17 female) in each group (A and B). In Table 1 are listed results of palatal rugae evaluation, and in Table 2 results are evaluated according to the classification of Martins-dos-Santos (1946). In the group of edentulous denture wearers, 40% (n = 12) of the analysis allowed the applicability of the technique and 60% (n = 18) of the analysis did not. In dentulous and non-users of removable dentures, in 86.66% (n = 26) of the cases the applicability of the technique was allowed and in 13.34% (n = 4) was not.

The result of the Pearson's correlation coefficient was $r = 1$, which means that the use of removable dentures and palatal rugae are directly correlated. And according to the Chi-Square Test, which measures the probability of differences in the two groups, the findings were that the probability was low and the use of removable dentures statistically interferes with palatal rugae.

Table 1. Preview of the palatal rugoscopy.

Preview of the palatal rugoscopy	Photo - Mouth		Cast	
	Yes	No	Yes	No
GROUP A	16	14	23	7
GROUP B	26	4	30	0
TOTAL	42	18	53	7

Table 2. Classification of the palatal rugoscopy.

Classification	Possible	Not possible
GROUP A	12	18
GROUP B	26	4
TOTAL	38	22

Discussion

Identification is an extremely specialized aspect in Forensic Dentistry, whose main goal is to ascertain, all the elements of the oral cavity, including those of individual character (GOULD, 2004; MARTINS-FILHO et al., 2009). Identity can be divided into subjective (considering the notion

that each individual has of himself, related to the structure of personality) and objective (one that allows stating that a certain person is technically himself) (FRANÇA, 2008).

For the technique of identification to be applicable, certain principles must be employed (FRANÇA, 2008): Uniqueness and Individuality (a single individual may contain certain elements that should be different in the other); Immutability (attributes do not change over time), Durability (persists over time); Practicability (the process of obtaining the characters and the cost should be simple and easy to apply); Classificability (it is fundamental to maintain the records obtained). Therefore, human identification by mouth analysis is based on the existing data in both dental records, photograph of dental arches, dental casts, prosthetic devices and rugoscopy (ALVARES, 2005).

And when the victim is edentulous, the methods available for identification in Forensic Dentistry become more limited, because among the evidence taken, palatal rugae are one of the few readily available morphological characteristics, whose patterns can not only be taken directly from the hard palate, but also from the surface of the dentures (OHTANI et al., 2008; TORNAVOI; SILVA, 2010). The palatal rugoscopy or palatoscopy is the process for human identification, by inspecting the transverse palatal rugae found in the palatal vault of the oral cavity (FRANÇA, 2008).

Identifying the palatal rugae, which are unique to each individual, is a method that fills technical and biological requirements, particularly the perennity, because it is a high strength tissue and therefore persists for some days after death (ARBENZ, 1988). However, to be applicable, it is important that the victim has valid records, such as, dental casts or photographs. One of the problems of this technique is that, despite its applicability and classificability (VANRELL, 2009), in scientific research and training in Forensic Dentistry (OHTANI et al., 2008) it is still very limited. Martins-dos-Santos (1946) facilitated the characterization of individual rugoscopy, by splitting palatal rugae, according to their location: Initial (corresponding to the most anterior ridge, on the right of the palate, which is always represented by a capital letter); Complementary (corresponding to the other ridges, on the right, in which, every papilla is marked by a number); Sub-initial (corresponding to the most anterior palatal ridge on the left also being represented by a capital letter) and Sub-complementary (corresponding to the other ridges, on the left, in sequence with the sub-initials, where each papilla is marked by a number).

Given the lack of a former record, this methodology is easily applicable, regardless of the classification system (TORNAVOI; SILVA, 2010). To apply the Martins-dos-Santos technique, the method used in this work, the analysis was performed using dental casts, given that they have the advantage of having a low cost for obtaining and are easily manipulated. The reduced cost, the easy application in any lab and the advantages of a simple analysis, contribute to the routine work of Brazilian forensic institutes that can provide differentiated resources and structures (MIRANDA et al., 2011; ROTHWELL, 2001).

When thinking about the immutability of palatal ridges, Souza-Lima (1964) studied dental casts of patients who have undergone orthodontic treatment and whose models were performed in the beginning and at the end of treatment to control the reduction of malocclusions, concluding that there were no mutations in the morphology or in the arrangement of palatal ridges. Therefore, the analysis of palatal rugae is an alternative method for identification, which confirms that they can be altered by several factors, such as the use of dentures, and other procedures that can cause trauma to the palate, like fissures of the fibrous tissue, presence or absence of teeth and heat, however, such situations do not compromise the process of identification (ENGLISH et al., 1988).

Over time, in edentulous subjects ridges move towards the alveolar ridge, however with a difference: the forms persist but become less apparent often due to prosthetic pieces that have masked total dentures, for instance. In our study, initially it was created a database which was confronted with 60 previously known individuals, classified according to the Martins-dos-Santos technique and confirmed by the results to be applicable in this method. Chronic injuries, poor adaptation of the prosthesis and the unsatisfying occlusal relationships are some of the predisposing factors to stomatitis. Prostheses with over-extended edges and unbalanced occlusion can also lead to the appearance of traumatic ulcers.

It is possible to observe in poorly-adapted prostheses and with incorrect palatal relief, the presence of inflammatory hyperplasia, and over the time these reliefs interfere with the ridges (TAMAKI, 1970). The lack of retention, motivated by the lack of stability of the prosthesis, especially in the presence of lower teeth in small number, traumatizes the palate and the gingival mucosa and results in hemorrhagic spots (petechiae) (TURANO; TURANO, 2004), however, such interference also is related with the time of use and conditions of the denture, in some of the

subjects the time has had already expired and the denture hygiene was unsatisfactory.

Conclusion

Under the conditions proposed in this study, it was possible to draw the following conclusions: (a) the method of rugoscopy is possible for both edentulous and dentulous patients, (b) the dental loss and the friction caused by prosthetic appliances in the palatal region, lead to losses in the palate characteristics.

References

- ALVARES, F. J. La boca y sus posibilidades identificativas. **Revista de la Escuela de Seguridad Pública de Andalucía**, v. 2, n. 88, p. 6-9, 2005.
- ARBENZ, G. O. **Medicina legal e antropologia forense**. São Paulo: Atheneu, 1988.
- CALDAS, I. M.; MAGALHÃES, T.; AFONSO, A. Establishing identity using cheiloscopy and palatoscopy. **Forensic Science International**, v. 165, n. 1, p. 1-9, 2007.
- DARUGE-JUNIOR, E.; GONÇALVES, R. J.; DARUGE, E.; FRANCESQUINI, M. A.; FRANCESQUINI-JUNIOR, L. Identificação humana pelos eventos odontológicos e alterações dentárias de um método computadorizado. **Revista do Conselho Regional de Odontologia de Pernambuco**, v. 4, n. 2, p. 99-106, 2001.
- ENGLISH, W. R.; ROBINSON, S. F.; SUMMIT, J. B.; OESTERLE, L. J.; BRANNON, R. B.; MORLANG, W. N. Individuality of human palatal rugae. **Journal of Forensic Sciences**, v. 33, n. 3, p. 718-726, 1988.
- FRANÇA, G. V. **Medicina legal**. 8. ed. Rio de Janeiro: Guanabara-Koogan, 2008.
- GOULD, G. A. Forensic Odontology: a global activity. **Journal of the California Dental Association**, v. 32, n. 5, p. 410-415, 2004.
- MARTINS-DOS-SANTOS, G. Ficha odonto-rugopalatina. **Revista Brasileira de Odontologia**, v. 4, n. 1, p. 36-42, 1946.
- MARTINS-FILHO, I. E.; SALES-PERES, A.; SALES-PERES, S. H. C.; CARVALHO, S. P. M. Palatal rugae patterns as bioindicators for identification in Forensic Dentistry. **Revista da Faculdade de Odontologia. Universidade de Passo Fundo**, v. 14, n. 3, p. 227-233, 2009.
- MIRANDA, R. F.; LIMA, L. N. C.; TINOCO, R. L. R.; RABELLO, P. M.; SILVA, A. P. S. C.; DARUGE-JUNIOR, E. Rugoscopia palatina como método de identificação humana. **Odonto (UMESP)**, v. 19, n. 38, p. 71-79, 2011.
- OHTANI, M.; NISHIDA, N.; CHIBA, T.; FUKUDA, M.; MIYAMOTO, Y.; YOSHIOKA, N. Indication and limitations of using palatal rugae for personal identification in edentulous cases. **Forensic Science International**, v. 176, n. 2-3, p. 178-182, 2008.
- ROTHWELL, B. R. Principles of dental identification. **Dental Clinics of North America**, v. 45, n. 2, p. 253-270, 2001.
- SOUZA-LIMA, J. **Considerações sobre o estudo das rugosidades palatinas** Belo Horizonte: Faculdade de Odontologia de Minas Gerais, 1964.
- TAMAKI, T. **Dentaduras completas**. São Paulo: Edusp, 1970.
- TORNAVOI, D. C.; SILVA, R. H. A. Rugoscopia palatina e a aplicabilidade na identificação humana em Odontologia Legal: revisão de literatura. **Saúde, Ética e Justiça**, v. 15, n. 1, p. 28-34, 2010.
- TURANO, J. C.; TURANO, L. M. **Fundamentos de prótese total**. 7. ed. São Paulo: Editora Santos, 2004.
- VANRELL, J. P. **Odontologia legal e antropologia forense**. 2. ed. Rio de Janeiro: Guanabara Koogan, 2009.

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