Original article

Comparative analysis between dactyloscopy and rugoscopy

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Abstract

Records form the evolutional history show primitive attempts of human individualization by hand printing on cave walls. Later, still under the need of differentiating among other animals, the ancestral used developed processes for personal identification. Nowadays, the human individualization continues based on unique morphological characteristics. This study aims to analyze the correlation between the fingerprints and the palatal rugae. A sample of 93 patients, out of 100, aged between 18 and 35 years, was selected. Fingerprints were collected by impression on paper, and palatal rugae were registered through intra-oral photography. The Vucetich's method was applied for the fingerprints analysis and the Carrea's method was utilized for the analysis on palatal rugae. Frequency of distribution was applied to describe the incidence of fingerprints and palatal rugae patterns. The Chi-square test was used for correlation analysis between the two variables. The external clip was the most common pattern among fingerprints on the right hand (48,39%), on the opposite side the internal clip had major incidence (50,54%). The pattern type IV was observed as the most common among the palatal rugae (42,55%). The Chi-square test demonstrated significant result only when correlated right and left hands. No statistical correlation was found involving palatal rugae. It is possible to conclude that genetic intervention is the main factor to explain relevant results on correlations between opposite hands. Considering the absence of previous studies in the literature, this research aims to provide initial support for further investigations.

Keywords: anatomy, fingerprints, identification, morphology, palatal rugae.

1 Introduction

Several history remains were found in the last decades. Valuable findings are observed in places occupied by primitive groups. Examples of the human evolution are the hand prints on cave walls, which are considered registers of time (ELKIN, 1952). During ancient periods the individualization process became important among the other animals. Consequently, the ancestral began to implement different techniques for self identification such as hand impressions on fresh clay. These attitudes were the pioneer signs of interest on morphological features (PERANDRÉA and PERANDRÉA-JUNIOR, 2006). After the organization of groups into societies, the needs for individualization became more evident. In order to provide proper differentiations, distinct attempts for personal identification were tested (SCHMIDT, 1999; COTRIM and JAIME, 2007). Nowadays, the most common techniques for accessing personal identity are based on morphology (PERANDRÉA and PERANDRÉA-JUNIOR, 2006). The most common methods for data collection are related to anthropometric (BERAR, TILOTTA, GLAUNES et al., 2011) photographic (HEMANTH, VIDYA, SHETTY et al., 2010), and radiographic acquisition (NUZZOLESE and DI VELLA, 2012).

The morphological sciences have demonstrated that many anatomic features can be representative to differentiate individuals (PALIWAL, WANJARI and PARWANI, 2010). The fingerprints and the palatal rugae are broadly used because of its feasibility and accuracy, which are matters of relevance for practical usefulness. Dactyloscopy (PERANDRÉA and PERANDRÉA-JUNIOR, 2006) and rugoscopy (CAMPOS, 2008; CALABIUG, 1998) are the names given to the study of fingerprints and palatal rugae respectively. Both systems for personal identification are characterized by the criteria of durability, immutability and individuality (CALDAS, MAGALHÃES and AFONSO, 2007). The aim of this study is to verify possible correlations between the fingerprints and the palatal rugae.

2 Material and methods

The initial sample consisted of 100 individuals, aged between 18 and 35 years, and examined at the Pontifícia Universidade Católica do Paraná, Brazil. Individuals with dermatologic alterations, systemic diseases and/or deep palate were removed from the study. The final sample consisted of 94 individuals, 72 females and 21 males. All the examined participants received previous information about the study and signed an informed consent.

Aiming the dactyloscopy analysis the left and right thumbs were selected. The collection of fingerprints was performed by impression on paper using the Black pigment Ink - Perfect Ink® (Perfect Ink®, California, USA). The palatal rugae was accessed and registered digitaly (Figure 1) by using the Gnatus® intraoral microcamera InCam LX (Gnatus®, São Paulo, Brazil). In order to manipulate contrasts and generate a better imaging quality, the palatal pictures were added into the software Adobe Photoshop® CS5 (Adobe Systems®, Califórnia, USA).

The fingerprints were categorized according to the classification of Vucetich (VUCETICH, 1904), which divides the fingerprints into 4 main groups: 1) Arch; 2) Internal Clip; 3) External Clip; and 4) Verticil (Figure 2). The palatal rugae were organized into 4 different groups, named I, II, III, and IV according to Carrea's classification (CARREA, 1937) (Figure 3).

Figure 1. Picture of palatal rugae obtained with the intraoral microcamera.

Figure 2. Arrangements of fingerprints according to Vucetich's classification. The arrangements are divided into: Arch; Internal Clip; External Clip; and Verticil. Addapted from: Dactiloscopia. Londrina PR: GE Idealiza. 2006.

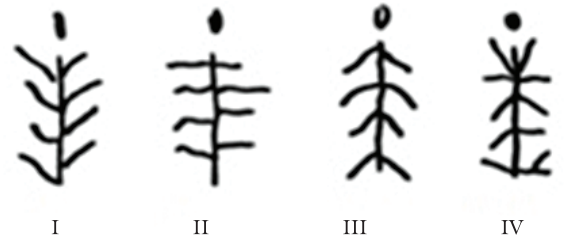

Figure 3. Arrangements of palatal rugae according to Carrea's classification. The arrangements are divided into: Type I; II; III; and IV. Addapted from: Compêndio de Odontologia Legal. São Paulo, SP: Medsi. 1997.

2.1 Statistical analysis

The variables left thumb, right thumb and palatal rugae were analyzed by frequency of distribution. In order to verify possible correlation between the variables gender, left thumb, right thumb, and palatal rugae were considered and the Chi-square test was applied. Chi-square test is the most used method for data comparison in a categorical nominal scale (ARANGO, 2009). Through this method the analysis is made based on the existence of dependency between the variables under observation (VIEIRA, 2003).

3 Results

The most common pattern for the fingerprints of the right thumb was the External Clip corresponding to 47,87% of the cases. Verticil, Arch, and Internal Clip were observed in 42,55%, 7,44%, and 2,12% of the sample, respectively. The left thumb showed the Internal Clip as the most frequent pattern, present in 50,00% of the individuals. Verticil, Arch, and External Clip were represented in 35,10%, 11,70%, and 3,19% respectively. Among the palatal rugae, the arrangement type IV was found in major scale, 42,55% of the cases. Palatal rugae type II, I, and III were represented by 35,11%, 17,02%, and 5,32% of the individuals respectively. The gender distribution was divided in 23,40% of males and 76,60% of females. Table 1 represents the distribution of the variable on frequency values.

The statistical analysis did not show relevant significance between the palatal rugae and the fingerprints ($p > 0,05$). No statistical significance was observed when correlated the variable gender to the other variables ($p > 0,05$). A significant correlation between left and right thumbs was observed through the Qui-square test ($p = 0,000$).

4 Discussion

Vucetich's classification for fingerprints and Carrea's classification for palatal rugae were addressed in this study regarding the broad use of these techniques in south-American researches. The advantage of using the mentioned classifications is related to the fact that both were derived from the same region of the sample used in this

Table 1. Distribution of variables represented on frequency values.

Variables	Classification	Frequency
1. Right Thumb	1.1 Arch	7
	1.2 Internal Clip	2
	1.3 External Clip	45
	1.4 Verticil	40
2. Left Thumb	2.1 Arch	11
	2.2 Internal Clip	47
	2.3 External Clip	3
	2.4 Verticil	33
3. Palatal Rugae	3.1 I	16
	3.2 II	33
	3.3 III	5
	3.4 IV	40
4. Gender	4.1 Male	22
	4.2 Female	72

research. The main objection in the use of these classifications is the lack of experiments found in other continents, which trend the discussion to south-American publications.

The use of fingerprints and palatal rugae, as morphological patterns in this study, is justified by the utility and feasibility that these identity indicators have nowadays (NAYAKI, ACHARYA and KAVERI, 2007; HEMANTH, VIDYA, SHETTY et al., 2010). The same reason explains the selection of only left and right thumbs for fingerprint collection. In some of the south-American countries the identity cards of civilians present a single fingerprint of the right thumb (VALID, 2012). The collection of palatal rugae as a document is also applied in south-American countries. Some authors consider the palatal rugae an identification tool equivalent to the fingerprints (PALIWAL, WANJARI and PARWANI, 2010; ENGLISH, ROBINSON, SUMMIT et al., 1988; NAYAKI, ACHARYA and KAVERI, 2007; MARCO, PHILIPS, KULA et al., 1995). In Brazil, for example, the palatal impressions are collect from the pilots of the Brazilian Air Force in order to facilitate identification cases (CALDAS, MAGALHÃES and AFONSO, 2007).

Considering the statistical analysis, the simple frequency of distribution demonstrated that the most frequent fingerprint pattern, according to the Vucetich's classification, is the External Clip for the right thumb and the Internal Clip for the left thumb. On the other hand, Holt indicates the Verticil as the most common pattern for both hands (HOLT, 1955). Despite that, the Verticil was observed as the second most common pattern for right and left thumbs.

The palatal rugae type IV, according to Carrea's classification, was the most common pattern among the individuals analyzed. Unfortunately, there is no other study with the same classification found in the literature to support or contrast this finding.

The absence of correlation between the fingerprints and palatal rugae, demonstrated by the Chi-square test, shows that no dependency is verified between the variables. The absence of correlation between the gender and the palatal rugae also represents no dependency between the variables, and it is confirmed by previous studies (SIMMONS, MOORE and ERICKSON, 1987; KASHIMA, 1990). The straight correlation observed between left and right thumbs can be explained by the genetic intervention during the dermatoglyphic formation (FRASER and NORA, 1988). Dermatoglyphs is the name given to the several components of the fingerprints and it has a polygenic genetic origin, which means that the fingerprints patterns are determined by the action of different genes spread in the human cells (SALDANHA, 1968; TOLEDO, SALDANHA, LAURENTI et al., 1969). Additional examples of the genetic intervention during the fingerprints formation are found on studies which demonstrate that syndromes such as Down (FRASER and NORA, 1988), and dermatological diseases such as Psoriasis and Vitiligo are represented by similar fingerprint arrangements (KUMAR and GUPTA, 2010). The genetics influence during the morphological formation is also the most accepted answer for the differences on palatal rugae arrangement. Most of the studies based on this concept were performed on population trials (KAPALI, TOWNSEND, RICHARD et al., 1997); (HAUSER, DAPONTE and ROBERTS, 1989; THOMAS and KOTZE, 1983). Thomas and Kotze explains that, by the genetic factor, even when palatal patterns discriminate individuals from certain region, if distinct individual from the same region but out of the original sample were taken, the results could be different (THOMAS and KOTZE, 1983). The mentioned explanation support the fact that, in the present study, both fingerprint and palatal rugae are not correlated to each other, neither to the gender.

5 Conclusion

No statistical significance was observed between the fingerprints and the palatal rugae. The gender is not associated with the frequency of specific fingerprints or palatal rugae. Significant statistical result was obtained by the correlation between right and left thumbs fingerprints.

The limitation of establishing a comparative analysis without similar researches made difficult the methodological discussion. More studies on the present classifications must be performed in order to improve the literature support. Yet, the informative profile of the present paper benefits the methodological approach for further investigations.

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