Preliminary study on the tongue-based forensic identification

Corina Laura Stefanescu¹, Marius Florentin Popa²*, Lavinia-Simona Candea³

Abstract: By means of the present study we intend to analyse lingual morphological aspects and demonstrate their importance and reliability as main criteria with force of evidence in using forensic dentistry to identify a person.

To that end, we conducted the examination of 270 female and male adults between 21 and 40 years old, whose tongues were photographed front and side view. The purpose of the direct examination of the tongue was to emphasize morphological features: shape, type, characteristics of the longitudinal medial septum and the related grooves, as well as the lingual apex type, all of these being preserved using the alginate moulding, which helped taking the impression of the dorsal surface through direct application (from the level of the oral commissures up to the lingual tip) and that of the lateral lingual edges up to the lingual apex level. Thus, we demonstrated that the lingual impression, next to its photographic image, may constitute secure methods for forensic dentistry identification, showing that the inspection of the tongue is a real proof of life and genetic independence, in the sense that there are no two tongues with shape and texture, since lingual morphological aspects are difficult to copy and display stability over time.

Key Words: lingual impression, forensic identification, dentistry, lingual morphological aspects, uniqueness.

The tongue is the only internal organ which can be easily drawn out and displayed for inspection and palpation purposes. By means of its shape and texture, its aspect and colour analysed in a particular moment, this organ is helpful due to its exposed portion comprising information with visible differences from one individual to another, and may be easily called and used as a "lingual impression".

The individual lingual shape is consistent and the physiological texture is invariable.

The human tongue is encased within the oral cavity, where it lies isolated from and protected against the external environment, just as the palatine folds do, unlike the other notorious elements employed in human identification.

The analysis of the lingual morphological aspects preserved using the alginate moulding technique, the most reliable technique for duplicating the most minute details, represents a criterion with force of evidence up on uniqueness for each and every individual, with the help of which forensic dentistry identification provides information with predictive values as far as a person's identity is concerned.

MATERIALS AND METHODS

This study was carried out on 270 female and male adults between 21 and 40 years old, whose tongues

1) "Ovidius" University, Faculty of Dentistry, Department of Mobile Prosthetics, Constanta, Romania
2) "Ovidius" University, Faculty of Medicine, Department of Forensic Pathology, Constanta, Romania
* Corresponding author: Associate Professor, MD, PhD, Department of Forensic Phatology, Faculty of Medicine, "Ovidius" University Constanta; Forensic County Service, 2 Zmeurei Alley, Constanta, Romania; Tel. +40744297697, Email: marius_popa2005@yahoo.com
3) "Mina Minovici" National Institute of Legal Medicine, Bucharest, Romania
were photographed front and side view, thus allowing the creation of a database that contains 824 pictures of the respective subjects’ tongues (Fig. 1.1 and Fig. 1.2).

The pictures were taken under the same environmental and lighting conditions and from a predetermined distance using a professional Nikon D5100 camera placed on a tripod.

The examination of the tongue was carried out after a its prior cleaning with sterile compresses, together with abundant rinsing of the oral cavity. Additionally, the subjects were asked not to suddenly protract their tongue up to maximum protraction, but in a relaxed position which would prevent a marked contraction of the striated lingual muscles, which would alter the characteristic aspects, as well as the shape of the tongue (Fig. 1.3).

The purpose of the direct examination of the tongue was to emphasize morphological features such as: shape, type, characteristics of the longitudinal medial septum and the related grooves, as well as the lingual apex type.

The most faithful impression intended for study models is the alginate-moulded impression, which has the advantages of duplicating the most minute details and coming off the model easily; we thus performed the detailed analysis for identification purposes, by taking the impression of the dorsal surface and the lingual lateral edges, with the help of the alginate which was directly applied from the level of the oral commissures up to the lingual tip in order to avoid the regurgitation reflex (Fig. 1.4).

The moulds resulted as such were filled, in the dental technology laboratory, with class IV dental stone, so as to have a relevant positive image for identification (Fig. 1.5, Fig. 1.6).

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**RESULTS AND DISCUSSIONS**

In the current study, as far as tongue types are concerned, we encountered two particular types in a number of 9 subjects, namely: the “geographical” tongue (Fig. 2.1) and the “scrotal” tongue (Fig. 2.2).

Analysing the sample from the point of view of the incidence of these tongue types, we can assert that, out of a total of 270 subjects, 0.3% display a geographical tongue and 0.7% have a scrotal tongue and, in regard to sexual dimorphism, the scales are tipped by female subjects (Fig. 3).

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**Figure 1.** 1. Female subject, 22 years, examination of dorsum tongue; 2. Female subject, 22 years, examination of tongue edges; 3. Tongue aspects in physiological protraction; 4. Applying alginate on the surface of the dorsum tongue from the level of the oral commissures up to the lingual tip including edges; 5. The aspect of the tongue mold; 6. Class IV dental stone casting.

**Figure 2.** 1. Geographic tongue aspect, 23 years, female subject; 2. Scrotal tongue aspect, 25 years, female subject.

**Figure 3.** Types of tongue distribution in the studied groups.
Three of the examined subjects displayed the presence of a visible fibrous belt in the lingual tip area, a presence observed in 1% of the total number of examined subjects (Fig. 4.1, Fig. 4.2).

As far as the shape analysis, the morphological aspects of the longitudinal medial septum and the related grooves (since their presence was substantiated by the individual lingual inspection, we implemented this “morphological notion” in our study in order to study the features of these related grooves and quantify the manner in which these contribute to defining a person’s individuality), as well as the location of the taste buds – criteria with force of evidence upon each individual’s uniqueness- are concerned, we shall exemplify a number of cases for guidance purposes (Fig. 5.1).

The longitudinal septum has a twisty, interrupted, narrow and barely deep aspect, taking up more than 2/3 of the dorsal surface of the tongue, except for the tongue tip. The related grooves are multiple, small, narrow, located on both sides of the central septum and connected to it through various shapes: straight, curved, jagged. Their bearing is random, oblique, perpendicular, in a circular arc, forked. The shape resembles a “U”, with a slightly rounded off tip. We see a multitude of fungiform papillae on the left side, as well as on the same side of the tip, as opposed to the right side which is smooth and displays few papillae, more present within the anterior 1/3 of the tongue (Fig. 5.3).

Deer, triangular medial septum, with the tip towards the lingual apex and the base towards its “V”, extending up to the anterior third of the dorsal surface. Close to the tip we see a superficial, narrow and thin continuation of the septum. Another peculiarity of this tongue is the presence of two thin, fibrous masses, which form a “compasses” on the right side, towards the tip of the tongue. We see a general “U” shape (Fig. 5.4).

The longitudinal medial septum is barely visible and has two features: central visibility with irregular bearing and shape, and small lateral grooves, followed by a discontinuity and then a small twisty area, which turns into a wide and superficial area only to change its nature by becoming narrow, deep and shaped as a “4”. The related grooves have various directions, shapes and sizes, being distributed irregularly over the dorsal surface of the tongue. The general shape is trapezoidal, with a small anterior base and the large base at the level of the oral commissures. The fungiform papillae are in larger numbers on the tip of the tongue, and are significant in size. With regard to the analysis of the lingual apex, following the examinations carried out, the following aspects are revealed: sharp tips are characteristic to female subjects, whereas septate tips were common for male subjects, with a prevalence of rounded off tips out of the total number of analysed cases (Fig. 6.1, Fig. 6.2).

Thus, relying on these substantiated aspects and pursuant to the results gathered by analysing the 824 images of the 270 subjects in this study with regard to the morphological aspect of the tongue dorsal surface, we were able to come up with a classification of the tongue tips encountered in the examined persons, as follows: physiological tongue (as far as aspect, colour and texture are concerned), “scrotal” tongue and “geographical” tongue. The present study revealed no tongues with a pathological aspect. No cases of black pilous tongue were encountered. Two of the examined subjects displayed
an asymmetrical tongue, which called for a preemptive oncological examination that, eventually, detected no subjective or objective sign confirming a pre-existing pathology. Another morphological characteristic monitored was the shape of the tongue, which we classified based on the examinations carried out from ovoid, ellipsoidal, rectangular, pentagonal, trapezoidal to asymmetrical, the last of these being ruled out of any geometrical shape. The morphological analysis of the longitudinal septa and the related tongue grooves of the 270 subjects showed us that each individual displays a specificity of their location, which shapes up the individual nature, an extremely useful criterion in the tongue-based forensic dentistry identification. Thus, it was noticed that the longitudinal grooves may be perceptible/imperceptible, may be extended over any segment of the dorsal surface, and in some cases over its entire length, displaying various shapes, a rectilinear/ twisty course and a superficial/deep profile.

CONCLUSIONS

Taking into account the fact that we cannot carry out debates on this topic as compared with other studies conducted by other authors, we shall conclude this preliminary study, which is bound to be further developed through more ample research, as follows:

- The morphological aspect of the tongue dorsal surface is unique for each and every individual. The lingual impression, together with its photographic image, may constitute secure methods for forensic dentistry identification, in addition to rugoscopy and cheiloscopy.

- The dorsal surface of the tongue provides significant details from a morphological and structural point of view, particularities which have not been studied to date.

- From a sexual dimorphism standpoint, the following aspects may be specified: a) The scrotal tongue is characteristic to female subjects; b) The geographical tongue is characteristic to female subjects;

- We wish for the classifications formulated depending on the anatomic aspects of the tongue dorsal surface to constitute reference points within the morphological analysis of the lingual surface, both for educational, as well as forensic purposes.

References

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