Review Article

ROLE OF TONGUE-PRINTS IN FORENSIC ODONTOLOGY – A REVIEW

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ABSTRACT

Tongue is a vital organ that is well encased in the oral cavity. Tongue imprints in forensic odontology for person identification is a novel technique and can be used as a biometric tool too. The role of forensic odontologist is of utmost importance in forensic investigations. In case, all the sources of information are lost, tongue can be used as an effective alternative as it is difficult to be forged. However, few conditions such as developmental malformations, systemic illnesses and associated syndromes, limit the use of tongue as forensic tool. But few researches have been conducted which prove the efficacy of tongue-prints as an effective investigative tool.

Key Words: Personal identification; sexual dimorphism; tongue imprints; forensic dentistry

INTRODUCTION:

Forensic odontology is an integral part of forensic science(1). Over the years, dental and oro-facial characteristics have been crucial in person identification in judicial system. Dentist have a major role in maintaining all dental records so that legal authorities may recognize any abuse or fraud in the identity of person(2). Tongue imprints in forensic odontology for person identification is a novel technique and can be used as biometric tool. The tongue is a muscular organ situated in the floor of the mouth. The tongue comprises of skeletal muscles that are voluntary and is associated with the functions of taste, speech, mastication and deglutition. Tongue has an oral part that lies in the mouth and

pharyngeal part that lies in the pharynx. Oral and pharyngeal part are separated by a V- shaped sulcus called sulcus terminalis. Tongue is anchored to hyoid bone, mandible and soft palate. Four intrinsic and three extrinsic muscles of tongue are supplied by hypoglossal nerve. Studies have shown that even identical twins have different tongue morphology. This review focuses on the different techniques of tongue print collection and application of morphological characteristics of tongue in forensic identification.

Tongue as forensic tool: The tongue is the only internal organ which can be drawn out for the purpose of inspection and palpation. On the basis of tongue morphology, texture shape and color, the tongue can be analyzed. There are many obvious differences from one individual to other which can be studied using tongue impressions and tongue images. The individual tongueÕs shape is constant and physiological texture is invariable as it is protected inside the oral cavity, so difficult to forge(3). Lingual impressions (impression of the dorsal surface along with lateral borders) have been proved to be useful in forensic dentistry for personal identification, when used along with methods such as cheiloscopy and rugoscopy[4]. Various studies have shown its role in sexual dimorphism on the basis of differences between males and females tongue characteristics[5]. Various studies have proven efficacy of tongue impressions in assessing sexual dimorphism. Abraham johnson et al[6] conducted a study to evaluate tongue morphology and texture using tongue impressions and photographs and concluded that features like color shape and texture can be used as an effective method in person identification. However, its use in natural calamities is yet to be documented[7].

Tongue prints collection and Tongue assessment: There are various techniques by which tongue prints can be collected for evaluation and person identification. Visual examination done by the help of digital imaging is a simple technique in which digital images of the tongue can be taken and matched with the database for verification. Tongue images can also be used for identification of tongue shape which is done by joining 3 reference points[7]. A study was conducted in Hong Kong polytechnic university in 2007 which was designed to develop tongue image database that included both tongue geometric shape and surface texture of individual[8]. For studying minute details and 3 dimensional analysis of the tongue, alginate impressions can be done followed by cast preparation[5,6]. Alternate method includes sublingual vein analysis[9]. An ultrasound technique has been employed

using an ultrasound transducer placed in the sublingual area to analyse the function of the tongue[10]. Histological examination of the tongue can also be used as a mode of tongue analysis.

Tongue print as biometrics: All the currently used biometric systems like fingerprints, retinal scan, signature check, face scan, voice recognition have their own advantages and disadvantages they can be easily forged; like fingerprints can be altered surgically or by injuries and burn. Even voice can be altered in various illnesses like cough and cold. Retinal scans are sensitive and get affected by intensity of light. Among all these biometric systems, tongue as a biometric tool has several advantages as its well encased in oral cavity and protected by external environment, hence difficult to forge and not subjected to alterations. So the physiological texture and shape remains constant throughout the life. Moreover, tongue is unique to every individual. Therefore, tongue print is a novel technique which can be employed for biometric authentication[7].

Advantages of tongue as diagnostic tool	**Limitations of tongue as diagnostic tool**
ÅWell protected from the external environment	ÅRole is not documented in deceased person
ÅUniqueness in terms of surface texture and shape	ÅTongue characteristics altered due to any disorders
ÅEasy accessibility	ÅCoated tongue
ÅPresence of evidence at crime site - unaltered	ÅAny potentially malignant lesion
ÅIt is resistant to decomposition and carbonization due to its location in the humid closed cavity and thus can be used in post-mortem evaluation.	ÅDevelopmental deformity
ÅPhysiological texture and shape remains constant throughout the life	ÅKnown allergy to alginate
ÅDifficult to forge	\Åwith systemic illness like anemia, syphilis, hyperthyroidism, gigantism, dwarfism
ÅPotential role in differentiating between healthy and unhealthy individuals (colour)	ÅPregnancy
ÅCan be used as for biometric	ÅAssociated syndromes like Melkerson-

authentication	Rosenthal syndrome, Down syndrome

CONCLUSION:

Forensic identification based on tongue imprints is a novel technique. Very few studies have been carried out on the same. More studies are needed to validate the role of tongue in forensic investigations and in biometric authentication, thus enhancing the role of forensic odontologists in the same.

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REFERENCES

1. Dinkaran j, Dineshkumar T, Nandhini G, Priyadharshini N, Rajkumar K. Gender determination using dentition. SRM J Res Dent Sci. 2015;6:29-34.
2. Verma AK, Kumar S, Rathore S, Pandey A. Role of dental expert in forensic odontology. Natl J Maxillofac Surg. 2014;5(1):2-5.
3. Stefanescu C L, Popa M F, Candea LS. Preliminary study on the tongue-based forensic identification. Rom J Leg Med 2014; (22): 263-266. DOI: 10.4323/rjlm.2014.263.
4. Nagalaxmi V, Ugrappa S, Naga Jyothi M, Ch L, Maloth KN, Kodangal S. Cheiloscopy, palatoscopy and odontometrics in sex prediction and discrimination ï A comparative study. Open Dent J 2015;8:269-79.
5. Jeddy N, Radhika T, Nithya S. Tongue prints in biometric authentication: A pilot study. J Oral Maxillofac pathol 2017;21:176-179.
6. Abraham J, Binita G, Sandra E J. A Morphological Study of Tongue and its Role in Forensics Odontology. J Forensic Sci & Criminal Invest. 2018; 7(5): 555723. DOI: 10.19080/JFSCI.2018.07.555723
7. Radhika T, Jeddy N, Nithya S. Tongue prints: A novel biometric and potential forensic tool. J Forensic Dent Sci. 2016;8(3):117-201.
8. Liu Z, Zhang D, Tang QL. A tongue-print image database for recognition. Mach Learn Cybern 2007;4:2235-8.
9. Yan Z, Wang K, Li N. Computerized feature quantification of sublingual veins from color sublingual images. Comput Methods Programs Biomed 2009;93:192-205.
10. Menard L, Aubin J, Thibeault M, Richard G. Measuring tongue shapes and positions with ultrasound imaging: A validation experiment using an articulatory model. Folia Phoniatr Logop 2012;64:64-72.