

# Tongue Prints Being A Distinctive Identity In Forensic Odontology – A Review

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## ABSTRACT :

A branch of dentistry called forensic odontology focuses on identifying people based on their oral anatomy. The use of dental identification to identify people has increased over the past several years and has been a significant aid in the identifying process. The tongue is a vital organ that is completely present inside the oral cavity. The tongue has distinctive characteristics in its size, shape, and sexual dimorphism. Even identical twins have different tongue features from one another. They can be obtained and secured from people using the least invasive and expensive methods. It might be applied as a brand-new technique for person identification. Its distinctive qualities make it a useful tool in forensic odontology. The tongue also offers information about both the texture and also geometric shape, which could be valuable in applications for identity verification. The aim of this review article is to describe the distinctive features of tongue, collection of tongue prints and its application in personal identification.

**Key Words :** Tongue Prints, Forensic odontology, personal identification, recognition.

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## I. INTRODUCTION :

In forensic identification, oral cavity offers a wide range of possibilities. Forensic sciences have employed a variety of methods for person identification. Tongue prints are one of the newest tools in forensic dentistry. Tongue is the only internal organ that can be exposed. It is present inside the mouth and can be easily inspected and palpated for its shape and texture.<sup>1</sup> The tongue is an important organ that carries out a variety of activities like speaking, tasting, and production of food bolus.<sup>2</sup> The science of forensics is still developing, and there is plenty of room for it to grow. Each person has unique morphological characteristics which can be used in criminological investigations<sup>3</sup>. Because of its distinctiveness, tongue prints, a novel technology that has emerged in recent years, is the focus of this review.

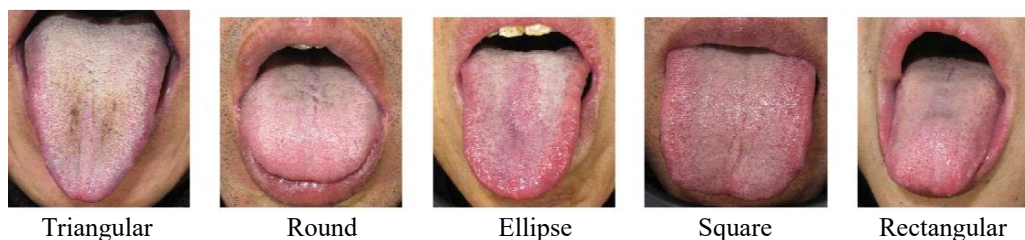
## II. MORPHOLOGY OF TONGUE :

The human tongue reflects the oral and general health. The voluntary muscles of the tongue comprises of four intrinsic and four pairs extrinsic muscles.<sup>4</sup> The tongue's muscles are incredibly flexible and well-supplied with blood and nerves. It is encased in the oral cavity and well-protected from the outside environment with palate superiorly, floor of the mouth inferiorly, mandibular teeth laterally, pharyngeal region posteriorly, and the lips anteriorly. A V-shaped sulcus terminalis divides the tongue into two halves. The tongue's root is firmly attached to the mouth's floor. The mucous layer of tongue has four kinds of papillae.<sup>5</sup> The filiform papillae are more in number but they do not have taste receptors. Circumvallate papillae are placed in an inverted V pattern at the base of the tongue, behind the sulcus terminalis.<sup>6</sup> Fungiform papillae are present in tongue's tip and edges. Foliate papillae are present towards the posterior part of the tongue found at the lateral border.<sup>3</sup> Some people also have crypts and fissures on the dorsal surface of the tongue.<sup>7</sup> There is no change in the geometric shape of the tongue usually. The tongue provides both static and dynamic features for identification.

## III. CLASSIFICATION OF TONGUE :

Classification of tongue features by Stefanescu et al.<sup>8</sup>

SHAPE	LONGITUDINAL GROOVES	LINGUAL APEX
Ovoid	Superficial/ Deep	Sharp
Ellipsoid	Rectilinear/ Twisty	Septate
Rectangular	Perceptible/ Imperceptible	
Pentagonal		
Asymmetrical		



#### IV. COLLECTION OF TONGUE PRINTS :

There are a variety of techniques to obtain tongue prints. The colour of the tongue, differences in surface texture, movement, and any other particular characteristics that may be present can all be examined by simple visual inspection.<sup>9</sup> The alginate moulding process can be used to preserve the lingual morphological characteristics and replicate the fine details that are unique to every person.(image 1)<sup>10</sup> Tongue recognition can be done by two features of tongue that is- Shape parameter and Texture Feature. Three reference focuses are used to analyse the shape of the tongue. The tip of the tongue and the point of the tongue that is in touch with the commissure of the lips when they are stretched outside of the mouth are reference points.(image 2) Texture Feature is calculate by SIFT Algorithm which is Pre-processed by Histogram Equalization<sup>11</sup>

A three-dimensional analysis is the most practical method for evaluating the tongue.<sup>3</sup> Alginate impression of the tongue is made, followed by the fabrication of a cast, three-dimensional analysis of the tongue can be done.<sup>12</sup> Analysing digital photos is another option. Digital software automatically corrects the colour, tint, and positioning changes before analysing the tongue to see whether it matches the data base for positive identification.<sup>3</sup>

Algorithm level design: The tongue image extraction module consists of reading pixels, reading tongue photos from a database, reading places on the tongue, establishing the display scale, and zooming in and out.

Histogram technique: In this technique, the tongue images are enhanced for achieving more information and data. Therefore this technique helps in getting better results by image processing.<sup>11</sup> Other methods that are tried are capturing the video of a tongue, sublingual vein analysis, an ultrasound technique and histological examination of tongue.<sup>8</sup>



Image 1 Alginate impression taken on dorsum of tongue

Image 2 Reference points on the tongue

#### V. ROLE OF TONGUE PRINTS IN FORENSIC ODONTOLOGY :

The tongue is the only internal organ that may be easily drawn out for inspection. Its form and surface textures are distinctive to each individual. The application of tongue prints to forensic identification is now in its infancy.<sup>13</sup> The major purposes of studying tongue prints are to understand the common characteristics of the tongue, to spot sexual dimorphism.<sup>14</sup>

The advantage of tongue as a forensic tool is that no two tongues are identical in terms of shape and surface textures due to genetic independence, Long-term stability, and also it is very well protected inside the mouth that forging it is very difficult<sup>15</sup> There are many other systems that are used for recognition of one's identity which includes fingerprint, face, palm print, iris etc. but the drawback is that they can be easily forged. The main disadvantage is that they can be eroded, modified by surgery, and might be imperiled to injuries which may lead to false results.<sup>16</sup> But tongue prints have distinctive features like colour, shape, and surface characteristics that differ from one person to another. They also differ amongst identical twins thereby serving as a better tool in personal identification. The texture and shape of the tongue are both used for identification. The bare part of the tongue provides information that have visible differences from one person to another; as a result, it helps in the identification of accused during forensic investigations.<sup>17</sup>

## VI. FUTURE SCOPE :

Tongue prints are being captured and inspected using multiple methods, including spectral analysis, the Gabor filter, and wavelet transformers, all of which produce varied outcomes. Because it needs expensive resources and specialized knowledge, the intricacy involved in data collection and processing that leads to reliable results becomes a limitation.<sup>3</sup> The key restriction is that because the tongue is a moving organ, it cannot always be in the same position when a tongue print is taken. Thus making it difficult to protrude it in the same position for an extended period of time. This makes the tongue impression technique a little tough.<sup>18</sup> Therefore, additional research using the videographic method to assess tongue movements may benefit us.<sup>19</sup> A database must be created to investigate the application of tongue prints in forensic dentistry. Dentists can help create the database by regularly gathering pictures of the tongue and making a cast of each patient who comes to the clinic. This information should be carefully stored alongside other dental records. A step toward personal identification would be made if the tongue recognition system for authentication is actually put into operation with the aid of sensors.<sup>20</sup>

## VII. CONCLUSION :

Fraudulent identification is the primary threat to the society. It is vital that this social problem be addressed with new and effective identification techniques.<sup>1</sup> The tongue is an unique organ with both stable and changing features that differ greatly between two people.<sup>2</sup> The form and texture of the human tongue promise to have a level of individuality that cannot be reverse engineered and is worthy in identification purposes.<sup>10</sup> Therefore this distinctiveness of tongue prints makes them an effective tool for personal identification. In this digital age, the use of tongue prints as a forensic dentistry tool is very much promising.<sup>3</sup> Since it is simple to examine, it acts as actual evidence of life. Only a small amount of investigation has been done on tongue analysis as a forensic tool. In order to improve human recognition, extensive research can be conducted in this field.

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