Comparative analysis of lip with thumbprints: An identification tool in personal authentication

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INTRODUCTION

Dental profession is not only restricted to examination, investigation, diagnosis and treatment of oral- and oro-facial lesions of local origin but also to serve in other community services and legal matters. Dentist has a pivotal role in the identification of person as mouth provides with infinite evidence because of the distinctive features of teeth, lips and palate.[1] The wrinkles and grooves on labial mucosa, called as sulci laborium forms a characteristic pattern called as lip prints. “Cheiloscopy” (from the Greek word cheilos: Lips, e skopein: See) is the name given to lip print studies. The importance of cheiloscopy is linked to the fact that lip prints are unique to one person except in monozygotic twins.[2] The second prints of interest, which are highly individualistic and forms the basis for personal identification

Context: Identification of person living or dead using diverse characteristics is the basis in forensic science. The uniqueness of lip and fingerprints and further, association between them can be useful in establishing facts in legal issues.

Aims: The present study was carried out to determine the distribution of different lip print patterns among subjects having different thumbprint patterns and to determine the correlation between lip print patterns and thumbprint patterns.

Materials and Methods: The study sample comprised 100 students randomly selected from Bapuji Dental College Hospital, Davangere, Karnataka, 50 males and 50 females aged between 18 and 20 years. Red colored lipstick was applied on the lips by a lipstick applicator brush. Lip and thumb impressions were made on No. 1 Whatman filter paper and visualized using magnifying lens. Three main types of fingerprints (loop, whorl and arch) were identified; Tsuchihashi Y classification of lip print patterns was followed in the study. Chi-square test was used to see the association between lip and thumbprints.

Results: The correlation between lip and left thumb print patterns for gender identification was statistically significant. In both males and females, Type II lip pattern associated with loop finger pattern were most significant and in males, Type III lip pattern with whorl type of finger pattern showed statistical significance.

Conclusion: We conclude that the correlation found between lip print and thumbprint can be utilized in the field of forensic science for gender identification.

Keywords: Gender determination, lip prints, thumbprints

Access this article online

Quick Response Code: www.jomfp.in

DOI: 10.4103/jomfp.JOMFP_189_14

How to cite this article: Naik R, Ahmed Mujib BR, Telagi N, Hallur J. Comparative analysis of lip with thumbprints: An identification tool in personal authentication. J Oral Maxillofac Pathol 2017;21:171-5.
in forensic examinations are fingerprints. Each individual possesses a unique set of minute raised ridges on volar pads called “friction ridge skin.” These clear and apparent unique outlines of the ridges are called fingerprints.[3] Due to the immense potential of fingerprints and lip prints as an effective method of identification an attempt has been made in the present work to investigate whether the lip prints are unique to any fingerprint in the population under investigation and to see if this association will help in the identification of the person at the scene of crime.

MATERIALS AND METHODS

Study sample

The study sample comprised 100 students randomly selected from Bapuji Dental College Hospital, Davangere, Karnataka, 50 males and 50 females aged between 18 and 20 years. Lips and fingers free from any pathology were included in the study. Consent for the study was taken from all the individuals and ethical clearance from the institution was obtained for the same. Lip prints and fingerprints were recorded.

Materials used for recording lip prints and thumbprints were: Red colored lipstick and lip brush, No. 1 Whatman filter paper, magnifying lens.

Technique

Recording of lip prints

The lips of the individuals were cleaned and outline of the lip was marked with sharp lip liner pencil No 15. Then a thin coat of red-colored “High wattage” lipstick was applied uniformly on the lips by a lipstick applicator brush starting at the midline and moving laterally. The lips were allowed to dry after which lip impression was made on a No. 1 Whatman filter paper. The subject was asked to make a lip impression in the normal rest position of the lips by dabbing it in the center first and then pressing it uniformly toward the corners of the lips. While studying the various types of lip prints, each individual’s lips were divided into six compartments, i.e. three compartments on each lip, and were allotted the digits 1–6 in a clockwise sequence starting from the subject’s upper right quadrant. Lip prints were studied in all the quadrants and the type of pattern which was repeated maximum number of times was considered as described by Acharya and Sivapathasundharam.[4]

Recording of thumbprints

First digits of left hands were cleaned, and the red-colored lipstick was rolled over the left thumbs. The smeared finger was printed on a No. 1 Whatman filter paper laid down on a pressure pad, and primary patterns (loops, whorl and arches) were observed.

Classification schemes

Lip print classification

In this study, the classification of patterns of lines on the lip proposed by Tsuchihashi Y has been followed as this is the most widely used classification in the literature. Tsuchihashi Y classification of lip prints is as follows:

• Type I - A clear-cut groove running vertically across the lip
• Type I’ - Partial-length groove of Type I
• Type II - A branched groove
• Type III - An intersected groove
• Type IV - A reticular pattern
• Type V - Grooves do not fall into any of Type I–IV and cannot be differentiated morphologically (undetermined).[5]

Fingerprint classification

Fingerprint classification of Michael Kucken was used.

(1) Loop pattern. (2) Arch pattern. (3) Whorl pattern.[6]

Chi-square test was used to see the association and proportions was used to see the percentage.

RESULTS

The overall patterns of lip and left thumbprints in both the sexes are given in Figures 1 and 2, respectively. Type II pattern of lip print was predominant in both males (60%) and females (59), followed by Type III pattern, 31% in males and 26% in females, Type IV, 6% in males and 8% in females and Type V 1% in both males and females [Figure 3]. Loop fingerprint pattern was most commonly seen a pattern in both males (68%), and females (61%) followed by whorl (39% females and 27% males) and arch 5% in males [Figure 4].

Correlation of lip prints with thumbprints

The overall correlation of lip prints with thumbprints in males is given in Figure 5. In males, Type II and Type III of lip pattern showed statistical significance. Although it was associated with all three finger patterns, Type II lip print associated with loop fingerprint is highly

![Figure 1: Types of lip prints. (a) Type I, (b) Type II, (c) Type III (d) Type IV](image-url)
significant (68%) \( (P < 0.001) \) followed by arch fingerprint pattern and whorl fingerprint pattern. Type III lip print showed a significant relationship with whorl type of fingerprint (69%) \( (P < 0.001) \).

In females, highly significant relationship was seen between Type II lip print and loop type of thumbprint (68%) \( (P < 0.001) \) followed by whorl type of thumbprint [Figure 6].

**DISCUSSION**

Identification of the individual plays a vital role in any crime investigation. Various established techniques have been utilized in the personal identification. To accurately identify an individual, the association between two variables in the forensic science is of utmost importance as it can possibly be a supplementary tool along with the routinely used techniques. Theory of uniqueness is a strong point to convince the court of law. Lip print is unique of an individual and hence beholds the potential for identification purpose. Synder was one of the France’s greatest criminologists who first recommended the use of lip print in personal identification and criminalization.\(^7\)

They are considered to be most important forms of transfer evidence and are analogous to fingerprints. It is possible to identify lip patterns as early as the 6\(^{th}\) week of in uterine life.\(^1\) From that moment lip print pattern rarely changes resisting many afflictions, such as herpetic lesions.\(^2\) The lipstick marks produce persistent lip prints that can be recovered for investigations even after a lapse of few days.\(^4\) Alvarez and associates have shown that these prints can be developed and visualized using agents such as aluminum powder and magnetic powder.\(^3\) Ball states that vermilion border has minor salivary glands and the edges of the lips have sebaceous and sweat glands. The secretions of oil and moisture from these enable development of latent lip prints in most crime scenes, analogous to latent fingerprints, where there was a close contact between the victim and culprit.\(^9\) It has been noted that lip prints recover after undergoing alterations such as minor trauma and inflammation. However, major trauma to the lips may lead to scarring and the surgical treatment rendered to correct the pathosis may affect the size and shape, thereby altering the pattern and morphology...
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of the grooves, but the use of lip prints in criminal cases is limited as compared to fingerprints because the credibility of lip prints has not been firmly established in our courts. The analysis of fingerprints as a form of identification dates back to prehistoric times. Fingerprints of an individual have been used as one of the vital parts of identification in both civil and criminal cases, because of their unique properties of absolute identity. No two fingers are found to have identical prints, and it is an overwhelming mathematical probability that no two ever will be found to match. The ridge patterns are formed in the human fetus before birth and remain the same throughout a person’s life and even after death until they are lost through decomposition. Fingerprint proved important due to the fact that unlike most human traits; dermal ridges and the configurations formed by them are not affected by age. The detailed structure of individual ridges is extremely variable, and throughout postnatal life they are not affected by environment.

The present study aimed to correlate the lip pattern with that of finger pattern for personal identification. Many studies have been done till now on lip prints for gender identification showing varied results. Sharma et al. had concluded that undetermined lip pattern (27.5%) in males, vertical and partial vertical lip patterns in females (25%), are common. Saraswathi et al. reported that intersecting pattern was most common both in males (39.5%) and females (36.5%) and their finding was similar to that of Sivapathasundharam et al. In the study done by Gondivkar et al. criss-cross lip pattern was reported in 51.05% males and 37.06% branched lip pattern in females. Srilekha et al. showed Type I to be predominant in females and Types I and IV to be predominant in males. Nagasupriya et al. reported predominant pattern to be branched type, 49% in males and 40% in females. Our study also showed branched type to be most common one, 59% in females and 60% males. Among the fingerprints, our observation showed loop pattern to be most common, followed by whorl pattern, arch pattern, which was similar to many other studies.

Identification by lip print only, was of meager use, so a correlative study was designed between lip prints and finger prints to have a broader view for personal identification. There was significant relationship seen between the Type II lip print and loop type of thumbprint in both males and females. An association was seen between Type III lip print and whorl type of thumbprint in males which was not seen in females. This finding will help in identification of gender at crime scenario, thus helping in ruling out or positively identifying the suspect or victim. A study done by Nagasupriya et al. showed a significant relationship between branching type of lip print and arch type of thumbprint followed by loop type thumbprint in males and females they found an association between Type I and arch type of thumbprint. This difference in results may have occurred due to heterogeneous group of population, our study population included subjects of different ethnic background and also because of interobserver variation in classification of lip print types.

CONCLUSION

A lot of scientific researches are based on lip prints and finger prints, but a study comparing and correlating these two variables is minimal. Detecting and identifying lip prints at the crime scene may provide important evidence, and its correlation with thumbprint found in this study will act as an additional tool in forensic science for personal identification. The association found between Type III lip print and whorl type of thumbprints in this study may be used as an effective tool in gender identification thus helping to prove facts in crimes where there are few evidence available.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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Figure 6: Relationship between lip print and thumbprint in females
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