



ACCURACY IN SEX DETERMINATION USING CHEILOSCOPY AND PALATOSCOPY: A COMPARATIVE STUDY

Dental Science

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ABSTRACT

Aim and Objectives : The present study was aimed to find gender differences in lip prints and rugae pattern and also to correlate particular lip print and rugae pattern.

Methodology 150 individuals (75 male and 75 female) were included for the study. Lip prints were taken on the glued portion of cellophane strip and was stuck on the white bond paper. The grooves present on the middle portion of the lower lip was visualized as proposed by Sivapathasundram et al. Lip prints were studied according to the classification proposed by Tsuchihashi. For Palatoscopy casts were made on dental stone and the rugae pattern was studied according to the classification proposed by Kapali et al.

Results : The data obtained were statically analyzed using Chi square test and unpaired T test and significant difference was found between males and females for lip prints but no significant difference was found for the rugae pattern except for the wavy pattern.

Type IV pattern of lip print was common in both males and females but was more in males followed by type I and I' and wavy type of rugae pattern was more in females as compared to males. On correlating particular lip print and rugae pattern, wavy type of pattern was more followed by curved type in all lip prints.

Conclusion : Lip prints and rugae pattern are unique for a person so Cheiloscopy and Palatoscopy can be used as a simple and valuable tool for identification purposes.

KEYWORDS:

Cheiloscopy, Palatoscopy, identification

INTRODUCTION

The word forensic states Clark, is derived from the Latin *forensic*, which means 'before the forum'. On the other hand, odontology refers to the study of teeth or dentistry. Forensic odontology, therefore, has been defined by the Federation Dentaire Internationale (FDI) as 'that branch of dentistry which, in the interest of justice, deals with the proper handling and examination of dental evidence, and with the proper evaluation and presentation of dental findings.'¹ In its most literal sense, forensic odontology is the application of the art and science of dental medicine to the resolution of matters pertaining to the law.² The forensic odontology is of prime importance in mass disasters where trauma is likely to make visual identification impossible. Following mass disaster, identification of individual victims by dental means is one of the most reliable methods.³ The disasters are the worst happenings and one of the least anticipated events. They shatter the lives of the victims.⁴

Lip prints and palatal rugae patterns are considered to be unique to an individual hence hold the potential for identification.⁵

The wrinkles and grooves on the labial mucosa (called sulci labiorum) form a characteristic pattern called —lip prints, the study of which is referred to as cheiloscopy. This is considered unique to an individual and analogous to fingerprints.³ Fisher was the first to describe it in 1902.⁶ Use of lip prints was first recommended as early as in 1932 by Edmond Locard. In 1961 the first study on the lip print was carried out in Hungary. Two scientists, Y. Tsuchihashi and T. Suzuki in the period 1968-71, established that the arrangement on the red part of the human lip is individual and unique for each human being.^{7,8} Palatal rugae are the ridges on the anterior part of the palatal mucosa on each side of the midpalatine raphae, behind the incisive papilla. Rugae are protected from the trauma by their internal position in the head, and from heat by tongue and the buccal pad of fat. Palatoscopy or rugoscopy is the name

given to the study of palatal rugae. The application of palatal rugae for personal identification was first suggested by Allen in 1889. Palatal rugoscopy was first proposed in 1932, by a Spanish investigator named Trobo Hermosa.^{5,9}

MATERIALS AND METHODS

The materials used for this study were: Bright red colored and non glossy lipstick, White bond paper, Cellophane tape that was transparent and glued on one side, Scissors, Magnifying glass, Cotton buds for the application of lipstick, Alginate impression material, Perforated stock metal trays, Rubber bowl and spatula, Dental plaster, Dental stone.

Source of Data: 150 healthy individuals (75 males and 75 females) from age 17-30 years.

Inclusion Criteria: Healthy males and females from age group of 17-30 years with no lesions on lips and palate. **Exclusion Criteria:** Subjects with presence of congenital abnormalities, inflammation or trauma and undergoing orthodontic treatment were excluded. Subjects with known hypersensitivity to lipsticks and alginate were excluded. Informed written consent was obtained from the subjects prior to taking the lip prints and alginate impression.

METHOD

Cheiloscopy: The lips of the individuals were cleaned and made dry with sterile gauze piece and a bright red-colored lipstick was applied uniformly in the same direction with a cotton bud on both the upper and the lower lips. The subjects were asked to rub both the lips and spread the applied lipstick. A strip of cellophane tape was cut out with the scissors and after about 1min; the glued portion of the cellophane tape was placed over the lipstick. The cellophane tape was held in its place, mild and even pressure was applied for few seconds, to allow the print

to form on the tape. The tape was then lifted from one end to the other to avoid any smudging of the print. The print was checked for its quality. If the print obtained was not satisfactory the above procedures were repeated again. The cellophane strip was then stuck to the white bond paper to serve as a permanent record. The grooves present on the middle portion of the lower lip was visualized as proposed by Sivapathasundram et al, since this fragment is almost always visible in any trace. The pattern was then observed using a magnifying glass and was classified according to the pattern proposed by Tsuchihashi. Type I: clear cut vertical grooves that run across the entire lip, Type I': similar to type I but do not cover the entire lip, Type II: Branched grooves, Type III: Intersected grooves, Type IV: Reticular grooves, Type V: Grooves that do not fall in to any category from I to IV and cannot be differentiated morphologically (undetermined)(Figure 1).

Palatoscopy: Alginate impression of the maxillary arch was made with the impression material and poured with dental stone. Base was made using dental plaster to make a study model for interpretation. Rugae were delineated using sharp graphite pencil under adequate light and was analyzed using magnifying glass (Figure 2). Rugae were classified according to classification as proposed by Kapali et al. Curved, Wavy, Straight, Circular, Converging, Diverging (Figure 3).

RESULTS AND OBSERVATIONS

Study was conducted in 150 individuals that included 75 males and 75 females. Data obtained were analysed using Chi square test and unpaired T test. P values less than 0.05 ($p < 0.05$) were found to be significant. The analysis was done using SPSS version 16.

Lip prints: On comparing the patterns obtained none of the lip prints matched with each other thus showing the uniqueness of lip prints. In males 12% showed type I pattern, 14.66% showed type I' and type II pattern, 8% showed type III pattern, 48% showed type IV pattern and 2.66% showed type V pattern. While in females 25.33% showed type I pattern, 20% showed type I' pattern, 5.3% showed type II pattern, 6.66% showed type III pattern, 29.33% showed type IV pattern and 13.33% showed type V pattern. Type IV pattern was found to be more in males as compared to females and type I and I' was found to be more in females as compared to males. Using Chi square test statistically significant difference was found between male and female for lip print types I, IV and V ($p < 0.05$). (Table 1)(Figure 4) **Palatal rugae:** On comparing the rugae patterns no two rugae patterns matched each other showing uniqueness of rugae pattern. Total number of rugae were found to be more in females than in males. In males out of total number of rugae 58.39% were wavy, 20.20% were curved, 8.56% were converging, 8.04% were straight, 1.19% were circular and 0.34% were diverging.

While in females 71.38% were wavy, 14.46% were curved, 5.78% were converging, 5.46% were straight, 0.645 were circular and diverging pattern was not seen. Among all the patterns, wavy pattern was found to be more in females as compared to males. (Figure 5) Using Chi square test to observe the different types of rugae pattern in males and females, no significant difference was observed. ($p < 0.05$)(Table 2) Using T test for individual rugae pattern, wavy pattern showed statistically significant difference among males and females. Comparing the lip prints and palatal rugae pattern, wavy pattern were found to be more in all lip prints followed by curved pattern. (Figure 6)

DISCUSSION

Cheiloscopy and Palatoscopy are very useful tools in Forensic investigation and personal identification. Cheiloscopy is applicable mostly in identifying the living, since lip prints are usually left at crime scenes, and can provide a direct link to the suspect. In recent years, lipsticks that do not leave any visible trace after contact with surfaces such as glass, clothing, cutlery, or cigarette butts have been developed. Although lip prints have previously been used in a court of law, the use is not consensual and some authors believe further evidence is needed to confirm their uniqueness. Palatal rugae, in addition to being unique to an individual are protected from trauma by their internal position in the head and insulated from heat by the tongue and buccal fat pads, unlike fingerprints that can get destroyed. Once formed, they do not undergo any changes except in length, due to normal growth, remaining in the same position throughout an entire person's life. Even diseases, chemical aggression or trauma do not seem to be able to change the palatal rugae form. Contrary to lip prints, palatoscopy might not be so useful in crime scene investigation in the linking of

suspects to the crime scene. In fact, this kind of evidence is not expected to be found in such circumstances. On the other hand, palatoscopy may be used as a necroidentification technique.^{5,10}

The present study was aimed to find gender differences in lip prints and rugae pattern and also to correlate particular lip print and rugae pattern. Study was conducted on 150 individuals that included 75 males and 75 females. Lip prints were taken and the grooves present on the middle portion of the lower lip was visualized as proposed by Sivapathasundram et al. Lip prints were studied according to the classification proposed by Tsuchihashi. For Palatoscopy casts were made on dental stone and rugae pattern was studied according to the classification proposed by Kapali et al. The data obtained was statistically analyzed using Chi square test and unpaired T test, a significant difference was found between males and females for lip prints but no significant difference was found for the rugae pattern except for the wavy pattern.

In past, studies have been done to prove gender differences based on the lip prints and palatal rugae pattern but no correlation have been done between a particular lip print and rugae pattern.

In a study by **Preeti et al**⁵ on 100 subjects it was found that type I and I' was common in females and Type IV and V was common in males while no significant difference was found for the palatal rugae pattern. Similar type of results are obtained in our study also but a significant difference was found for the wavy pattern between males and females. In our study the common lip print pattern observed was type IV in males(48%) and females(29.33%) followed by type I and I'. The rugae pattern observed was wavy in males (58.39%) and females (71.38%) followed by curved. Similar type of results were observed in a study by **Mutalik et al**¹¹ on 100 females in which 33.3% of the subject showed type IV lip print followed by type II, I and I'. The most common palatal rugae pattern observed was wavy that was 52%.

In present study type IV lip print pattern was common in males and females. But **Vahanwala et al**¹ in his study found that type II pattern are more common in female and type III pattern are more common in males. **Sivapathasundram et al**¹ in his study found that type III pattern was common in both males and females. **Saraswathi et al**¹² studied all four quadrants of lips in 50 males and 50 females and found that intersecting pattern was more common among both males and females while the least common was the reticular pattern.

CONCLUSION

Identification of a living or dead individual is a difficult and time consuming process. Cheiloscopy and Palatoscopy are two easy and valuable emerging tools in forensic investigations as compared to the other complex and costly methods. Lip prints and the rugae pattern are unique to an individual and can be used in sex determination and personal identification under different circumstances. Cheiloscopy is useful in identifying individuals; also the lip prints are more reliable in identifying the sex of the individual as compared to palatal rugae patterns. Palatoscopy has been successfully used in necroidentification as they are present inside the oral cavity and are well protected from all sorts of environmental changes. The present study proves that lip prints and rugae pattern are unique to an individual and both Cheiloscopy and Palatoscopy are valuable tools in identification of an individual in forensic investigation, also comparing the lip prints and rugae pattern can add an extra value to the identification process.

Legends

Figures

Figure 1: Different types of lip prints

Figure 2: Palatal rugae on cast

Figure 3: Different shapes of palatal rugae

Figure 4: Gender wise distribution of different types of lip patterns

Figure 5: Gender wise distribution of different types of rugae patterns

Figure 6: Comparison of lip print pattern and palatal rugae

Tables

Table 1: Showing gender differences between different types of lip patterns (chi square test)

Table 2: Gender wise differences as related to different types of palatal rugae forms (chi square test)

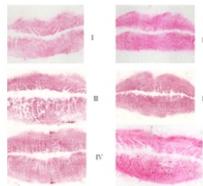


Figure 1: Different types of lip prints



Figure 2: Palatal rugae on cast



Figure 3: Different shapes of palatal rugae

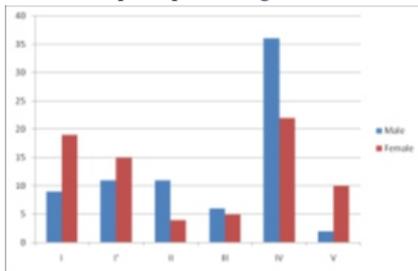


Figure 4: Gender wise distribution of different types of lip patterns

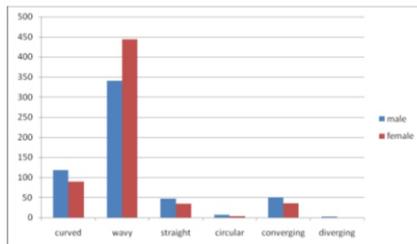


Figure 5: Gender wise distribution of different types of rugae patterns

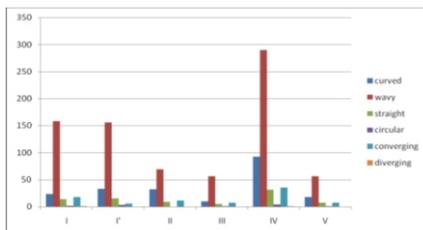


Figure 6: Comparison of lip print pattern and palatal rugae

Table 1: Showing gender differences between different types of Lip Patterns (Chi Square test)

Lip Patterns Type	Male	Female	P value
I	9	19	.036*
II	11	4	.057
III	6	5	.754
IV	36	22	.019*

V	2	10	.016*
I'	11	15	.388
	75	75	

* Shows Statistical Significance

Table 2. Gender wise differences as related to different types of palatal rugae forms (Chi Square test)

Gender	P value	Curved	Wavy	Straight	Circular	Converging	Diverging
Male		0.282	0.316	0.99	0.347	0.414	0.155
Female							

No Statistically significant difference between Different types of palatal rugae forms and gender (Chi Square test)

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