"Cheiloscopy & Rugoscopy" – In Sex & Racial Identification

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Abstract

Discussion -: Lip Prints And Palatal Rugae Patterns Are Unique To An Individual And Hence Can Be Used For Identification Of An Individual. Analysis Of The Lip Prints And Their Comparison With The Suspected Person May Be Useful For Identification. The Palatal Rugae are Protected From Trauma, Insulated From Heat By The Tongue And Survive The Post-Mortem Results. This Study Aims In Determining The Use Of Lip Prints And Palatal Rugae Pattern In Identification, Sex Differentiation And Racial Identification.

Aim : To Determine The Most Common Pattern Of Lip Prints And Palatal Rugae In The Study Subjects And To Determine If Any Racial Variation Exists In The Lip Print And Palatal Rugae Pattern And Their Role In Sex Determination.

Materials & Methods -: Sample Size Comprised Of Forty Students, Twenty Each From Two Different Racial Communities Namely Indians And Malaysians. Lip Prints Were Recorded Using Lipstick, Cellophane Tape, Bond Paper, Magnifying Lens &Analysed Using Tsuchihashi's Classification. Rugae Impressions Were Taken Using Alginate And Various Rugae Patterns Were Analysed Using Lysell's Classification.

Results -: Our Observation Showed That Lip Prints And Palatal Rugae Are Unique In Nature. Males Showed Predominant Type IV Lip Print And Females Showed Predominant Type II Lip Print Pattern And Indians Showed Wavy Rugae Pattern And Malaysians Showed A Curved Rugae Pattern.

Conclusion -: Even Though Lip Prints Have Been Established In Sex Determination, The Role Of Palatal Rugae Is Also Studied Here. The Racial Variation In Lip Prints And Palatal Rugae Has Also Been Analysed.

KeyWords: Cheiloscopy, Forensic investigation, Indian , Malaysian, Person Identification, Rugoscopy , Racial identification, Sex differentiation ,Palatal rugae.

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Introduction

The word forensic derives its meaning from the Latin word forensis which means the study of public (1). I.e. to say, the characteristics, the behaviour and the habits that are unique for every individual could be analysed with the help of forensic science. In this way forensic science plays an important role in analysing the cause and identifying the victims in natural calamities and accidents and also in solving complicated criminal cases. The dental records, finger printing and DNA comparisons are the most commonly used techniques for identification process, sometimes under certain circumstances they cannot be always used, at that instance lip prints and palatal rugae hold a supplementary tool to establish the identity of an individual (1,2).

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Identification of an individual, living or dead is based on the theory that all individuals are unique. Personal identification is becoming increasingly important not only in legal medicine but also in criminal investigation and identification (1).

Cheiloscopy is the study of lip prints. Lip prints are normal lines in the form of wrinkles and grooves present over the human lip also termed as SULCI LABIORUM ROBORUM (Tsuchihashi) (2, 3). Lip prints do not change during the life of the person. They are unique and distinguishable for every individual like fingerprints (4). Cheiloscopy is a forensic investigation technique that deals with the identification of a person based on the lip prints (1).

Rugoscopy is the study of Palatal Rugae Pattern. Palatal Rugae are the irregular, asymmetric ridges of the mucous membrane extending laterally from the incisive papilla. Palatal Rugae contain a core of connective tissue and are formed in about 12th week to 14th week of prenatal life and remain stable throughout the person's life. They are unique and distinguishable.Theuniqueness and stability of the palatine rugae to individuals has been recognized in forensic science as providing a reliable source of identification (5).

Materials & Methods

A total of 40 subjects of two different races, 20 Indians and 20 Malaysians, were taken as study group out of which were 10 males and 10 females from each group from our institution for assessing the pattern of lip prints and palatal rugae. An Institutional Ethical committee clearance was obtained and all the participants were briefed about the purpose of the study and their lip prints and maxillary impressions were obtained with their consent.

Subjects with congenital abnormalities, inflammation of lip, trauma, or any other disease of the lips, any known hypersensitivity to the lipstick, orthodontic problems, palatal pathologies, denture wearers, developmental disturbances, parafunctional habits were excluded from the study (6).

Figure 1. Armamentarium used for Cheiloscopy

Figure 2. Armamentarium used for Rugoscopy

For the analysis of lip prints, the materials used were dark coloured lipstick, lip applicator, cellophane
tape, A4 sheet white paper and magnifying glass (Figure 1 & 2).

The lips were initially cleaned using tissue paper followed by application of lipstick over the upper lip in a uniform single stroke with lip applicator. The subjects were asked to rub both the lips to evenly spread the applied lipstick. The glued portion of the cellophane tape was stuck over the lips to obtain the lip impression and the cellophane tape was stuck over the A4sheet white paper to transfer the recoded impression. This recorded impression was analysed using magnifying lens. The lip prints obtained were coded and the name, race and sex of the respective individuals were noted down separately. The sex and race of the lip print was not disclosed to the observer (6).

The classification followed for this study was proposed by TSUCHIHASHI & SUZUKI (5) (Figure 3)

Type I : Clear-cut vertical grooves that run across the entire lips

Type I' : Similar to type I, but do not cover the entire lip

Type II : Branched grooves

Type III : Intersected grooves

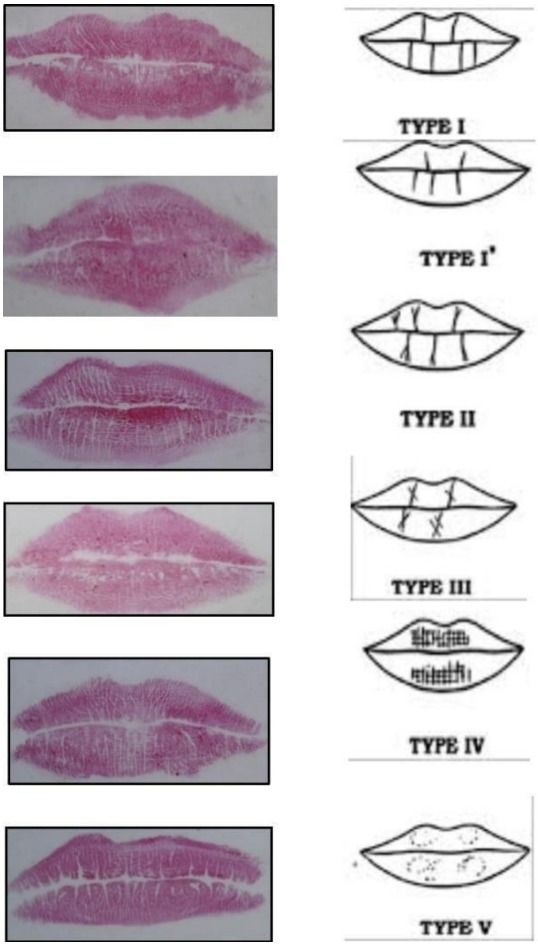

Figure 3. Patterns of lip prints

Type IV : Reticular grooves

Type V : Grooves do not fall into any of the type I - IV and cannot be differentiated morphologically (undetermined).

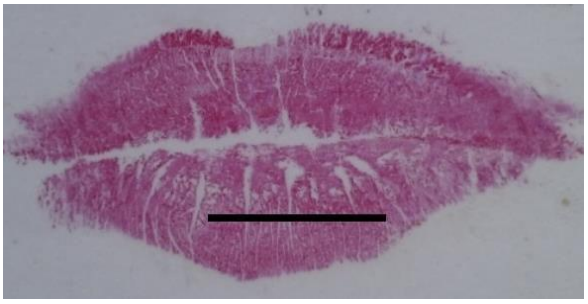

Figure 4. Selection of the area for studying lip

For analysis , the middle portion of the lower lip (10 mm wide) was taken as the study area, since this fragment is visible in any trace. The numerical superiority of the lines on this area determines the pattern of lip print (2).(Figure 4).

For the analysis of rugae pattern, the materials used were Maxillary impression dentulous trays, alginate impression material, dental stone, graphite lead black pencil and magnifying lens (Figure 2).

The maxillary alginate impression was obtained and the cast was poured using dental stone, plaster base was given and the outline of the rugae was drawn using sharp lead graphite pencil under adequate light and the rugae pattern was analysed using magnifying glass. The rugae patterns obtained were coded and the name, race and sex of the respective individuals were noted down separately. The sex and race of the lip print was not disclosed to the observer (2).

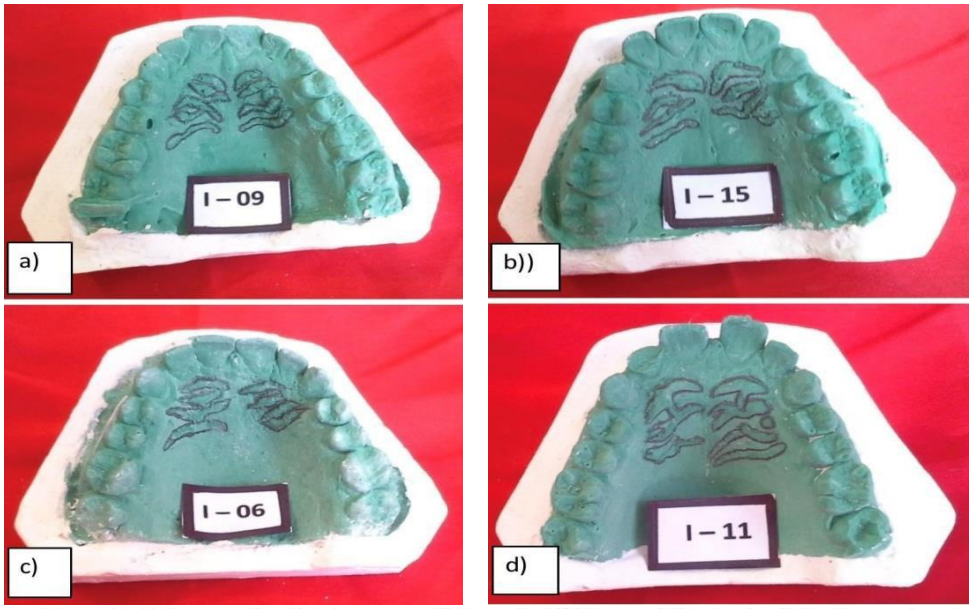

Figure 5. Patterns of palatal rugae . a) Curved b) Wavy c) Straight d) Undetermined

For analysis, the rugae pattern was classified based on their shape. When more than two rugae patterns (shapes) were observed in a same cast, the pattern that was predominant was taken into consideration. The classification followed for this study was proposed by LYSELL (6) (figure 5) :

Four Types Based On Their Shape

1) CURVED -: Crescent shape and Curved gently with slight bend at the origin or termination. Evidence of slight bend at the origin or termination.
2) WAVY -: Slight Curve at the origin or termination of a curved rugae is classified as wavy.
3) STRAIGHT -: The course of the rugae is straight from origin to termination.
4) CIRCULAR -: Rugae that formed a definite continuous ring.
5) UNDETERMINED -: If the rugae pattern didn't fall into any of the above types.

Results

The Lip prints and rugaewere studied for gender, population and their uniqueness.

The observation revealed that no two lip prints and rugae pattern were identical to each other, thus they are unique to every individuals.

The predominant lip print in males were Type IV (22.5%) followed by Type I' (12.5%), Type II (7.5%), Type I (5%) , Type III (2.5%) and for females were Type II (27.5%) followed by Type IV (22.5%) , Type I , I' (17.5%), Type III (15%). On comparison of all lip prints patterns between males and females using Chi-Square test, the data showed a highly significant difference in lip prints among males and females where P = 0.002 (P < 0.01) (Table 1, fig.6).In Indian population, Type III & IV (12.5%) pattern is predominant and Malaysian population type II (17%) pattern ispredominant but the Chi –Square test comparison of all lip print between Indian & Malaysian population revealed no significant differences (Table 2, fig.7).

Table 1: Chi Square Test for proportion to assess the sex differences in lip print pattern

Type	Sex				Total		Chi square	p
	Male		Female		N	%		
	N	%	N	%				
Type I	2	5.0	5	12.5	7	17.5	16.51	0.002**
Type I'	5	12.5	2	5.0	7	17.5		
Type II	3	7.5	8	20.0	11	27.5		
Type III	1	2.5	5	12.5	6	15.0		
Type IV	9	22.5			9	22.5		
Total	20	50.0	20	50.0	40	100.0		

P < 0.01 = Highly Significant. Here P Value = 0.002

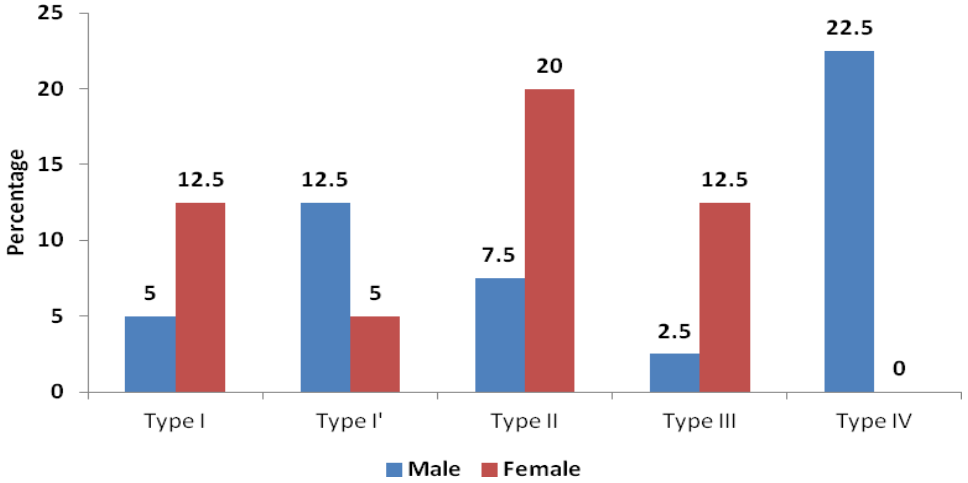

Figure 6 . Comparison Of Lip Prints Among Each Sex

Table 2 : Chi Square Test for proportion to assess the lip print pattern in different races

Type	Races				Total		Chi square	p
	Indian		Malaysian		N	%		
	N	%	N	%				
Type I	3	7.5	4	10.0	7	17.5	3.88	0.422
Type I'	3	7.5	4	10.0	7	17.5		
Type II	4	10.0	7	17.5	11	27.5		
Type III	5	12.5	1	2.5	6	15.0		
Type IV	5	12.5	4	10.0	9	22.5		
Total	20	50.0	20	50.0	40	100.0		

P >0.01 = Not Significant . Here P Value = 0.422.

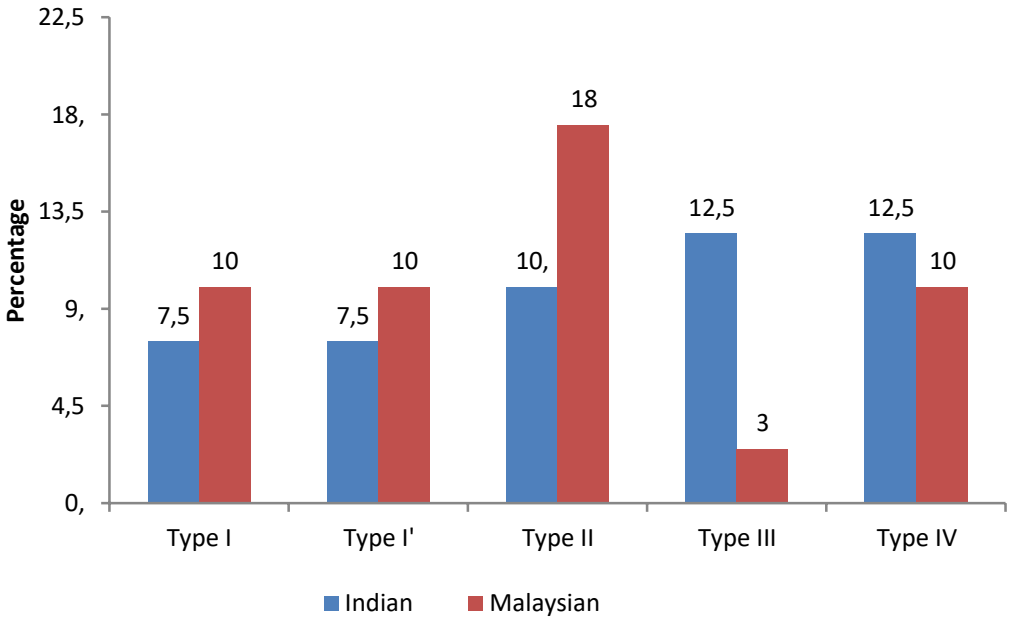

Figure 7. Comparison Of Lip Prints Among Different Races

The predominant rugae pattern in Indians was wavy pattern (27.5%) followed by curved (12.5%), straight (10%) where as in Malaysians it was Curved pattern (27.5%) followed by straight (15%) , Wavy (7.5%). No circular pattern was observed in any of the study subjects. On comparison of the rugae pattern between Indian & Malaysian Population using chi-Square test, the data showed a significant difference in rugae pattern among both the populations where P = 0.027 (P < 0.01) (Table 3, fig.8).

Table 3: Chi square test for proportion to assess rugae pattern among different races

Pattern	Races				Total		Chi square	p
	Indian		Malaysian		N	%		
	N	%	N	%				
WAVY	11	27.5	3	7.5	14	35.0	7.22	0.027*
CURVED	5	12.5	11	27.5	16	40.0		
STRAIGHT	4	10.0	6	15.0	10	25.0		
Total	20	50.0	20	50.0	40	100.0		

P < 0.01 - Significant , Here P value = 0.027

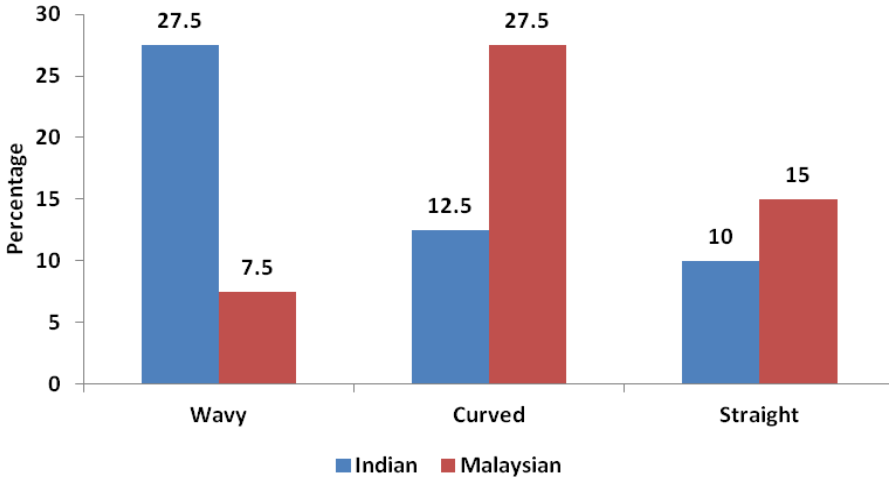

Figure 8. Comparison Of Rugae Pattern Among Different Races

Among males the Curved Pattern was predominant (25%) , followed by wavy and straight which were equal(12.5%) and females showed Wavy Pattern (22.5%) followed by curved (15%) and straight (12.5%) but Chi-Square Test comparison of rugae pattern between males and females did not show any significance. (Table 4, fig.9).

Table 4: Chi square test for proportion to assess rugae pattern among each sex

Pattern	Sex				Total		Chi square	p
	Male		Female		N	%		
	N	%	N	%				
WAVY	5	12.5	9	22.5	14	35.0	2.14	0.343
CURVED	10	25.0	6	15.0	16	40.0		
STRAIGHT	5	12.5	5	12.5	10	25.0		
Total	20	50.0	20	50.0	40	100.0		

P > 0.01 = not significant . Here P value = 0.343

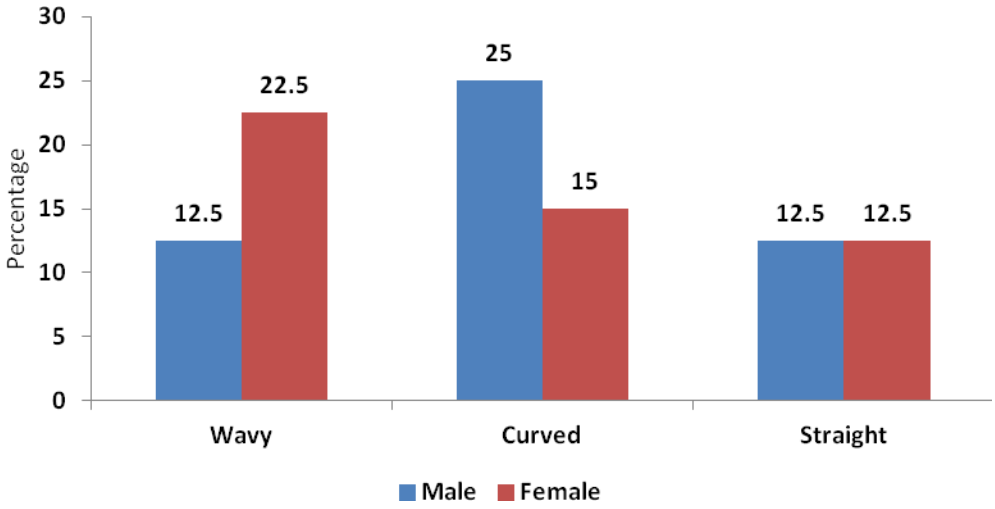

Figure 9. Comparison Of Rugae Pattern Among Each Sex

Discussion

R. Fischer (1902) was the first anthropologists to describe the furrows on the red part of human lips (7). Y. Tsuchihashi ,T. Suzuki (1950) found that arrangement of lines on the human lips is individual and unique for each human being and has classified it into various types. Locard (1932) ,Synder (1950)first used the lip prints in personal identification and criminal investigation in France (7).

Lip prints are usually left at crime scenes, and can provide a direct link to the suspect. Lip prints can be found on surfaces such as glass, clothing, cutlery or cigarette butts. The edges of the lip have sebaceous glands in between, therefore secretions enable development of latent or persistent lip prints, analogous to the finger prints . Even the invisible lip prints can be used and can be lifted using aluminium and magnetic powder (2).

According to Vahanwala et al. TYPE I and I' patterns were dominant in females and type 3 and 4 were dominant in males (2) and according to Rohit Malik et al. 2011, No two lip prints matched with each other, thus establishing the uniqueness of lip prints and stated that Type I was the most common in females, Type IV and V were seen most commonly in males (8). Contrary to these Govindkar et al. found a prevalence of type II in females . While Saraswathi et al. found a prevalence of type III and type II in females most commonly (6). Neo Xiao Xu et al. 2012, No two lip prints matched with each other. Significant differences in lip prints between males & females were found& no significant difference in lip print pattern between races (9). AnilaKoneru et al. 2013 conducted a study among two different population and stated that difference in lip print pattern exists between different populations (10). In our study we found that type II lip print pattern was more predominant in females which are reinforcing Govindkar observation and type IV in males which matches with Vahanwala studies. There was no significant difference in lip print for different race. We also observed that no two lip prints were identical to each other.

Palatoscopywas first proposed in the year 1932, by a Spanish investigator named Trobo Hermosa (11). Kuppler 1897 was the first person to study palatal anatomy to identify the racial anatomic features (2). The palatal rugae maintains its constant shape throughout the life. Palatal rugae are unique to an individual and can be protected from trauma by their internal position in the head and insulated from heat by the tongue and buccal fat pads. Palatoscopy may be useful in necroidentification, in incidents like aeronautical accidents. Palatal rugae have been studiedfor various reasons, the most important being the person identification (6).

According to Kapali et al.; English et al. 1988 ,Rugae Pattern were unique for every individuals and no two palates showed the same arrangement of palatal rugae (5). Kapali; Townsend et al.1997, stated that there was a statistically significant association between rugae forms and races (Caucasians &Aborigines)(12). Kashima et al. 1990 studied on Palatal Rugae pattern and stated that no significant difference in male and female group is present. But significant differences among the races were present (Indians & Japanese) (13). Saraf ,Bedia et al.2011, Different types of rugae shapes, were observed Significant differences in Rugae pattern between males & females were found (14). AnilaK , Surekha R et al. conducted a study on rugae patterns in two different population (kerala , Manipuri) and concluded that difference in rugae pattern occurs in two different populations (15). In our study we observed that wavy pattern was more predominant in Indians and curved pattern in Malaysians. The rugae pattern did not show any significance in discriminating the sex and also no two rugae pattern were identical to each other which states that they are unique in nature.

Conclusion

Identification of living or dead is often a difficult and challenging process. In such circumstancescheiloscopy&rugoscopy can be performed as they are unique to an individual. Cheiloscopy is useful to identify the living in a crime scene while rugoscopycan be used to identify the dead in necroidentification .Thus lip prints and palatal rugae hold a supplementary tool to establish the identity of an individual. The present study proves that both cheiloscopyandrugoscopy have the potential to identify an individual as they are unique in nature. Also in our study Type IV lip print pattern was predominant in males whereas Type II was predominant in females. Wavy Rugae pattern was predominant in Indians and curved rugae pattern in Malaysians. Differences between the lip print patterns in the two races studied were not statistically significant and difference between the rugae pattern among each sex was not observed. Further studies with a larger sample size could help

to arrive at definitive conclusions.

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