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Cheiloscopy–A Diagnostic Aid In Forensic Science To Differentiate Between Smokers And Non-Smokers

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Abstract:
Background*: Forensic science finds immense contribution in crime investigation, mass disasters, age estimation and so on. Cheiloscopy is such a method which is based on the characteristic arrangement of lines and grooves on the vermilion border of lips. Cheiloscopy serves as a reliable source for identification when sufficient evidences are not found, as lip imprints are unique for every individual like fingerprints. In our study, we aimed at analysing the differences in lip patterns between smokers and non-smokers.*
Materials and Methods*: 80 males (40 smokers and 40 non-smokers), of ages within 18 and 60, were selected and their lip imprints taken. They were classified according to Suzuki-Tsuchihashi method of classification. A Student's t test (SPSS 20.0 statistical software) was used to find significant differences in the patterns, by analysing the collected data.*
Results*: Smokers and Non-smokers were found to have different lip imprint patterns. The differences were statistically significant with p<0.05.*
Conclusion: *The patterns of the vermillion border of lips may be used to distinguish between smokers and non-smokers, proving to be of potential value in the field of forensic investigation and identification.*
Key Word*: Cheiloscopy, Lip imprints, Personal identification, Forensic Science*

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I. Introduction

Biometric identification is the key to commencement of an investigation, which finds importance in personal or legal matters, and in the certification of death. Cheiloscopy is a branch of Forensic Odontology, which deals with the scientific study and examination of lip imprints. .[1,2] The word is derived from the Greek words *'Cheilos'* meaning lip and *'skopein'* meaning examine.[3]

Noted first by anthropologist R.S. Fischer in 1902,[4] Lip prints were classified into various types by different methods of classification of lip patterns. [4] These methods are- Claucos Martin Santos,[6,7,8] Raynaud,[7,8,9] Suzuki-Tsuchihashi,[2,7,8,9,10] and Afchar Bayat[6,7,8] types of classifications. Among these, the Suzuki-Tsuchihashi method is the most followed one, which classifies the lip patterns as shown in Table 1: [9,10]

Table 1: Classification of lip patterns according to Suzuki-Tsuchihashi method of classification

Type I	Clear-cut lines or grooves that run vertically across the lip
Type I'	Straight grooves that disappear halfway into the lip instead of covering the entire breadth of the lip
Type II	Grooves that fork in their course or a branched groove
Type III	An intersected groove
Type IV	A reticular groove
Type V	Grooves that do not fall into any of the other categories and cannot be differentiated morphologically

Lip patterns can be determined in stages as early as the 6th week of intrauterine life[11,12] and are usually observed to remain the same for an individual throughout his/her life unless any pathological rupture or damage occurs due to any trauma or surgical procedure. [13,14] Scarring may lead to change in the lip print pattern, size or shape.[14] The Klein's zone, which is the middle 3rd of the mucosal area of the vermillion border of lip, holds the region of most interest in the study. [2]

It has been observed that prolonged use of inhalational tobacco has the ability to fully disorient the lip pattern. Being the major constituent, nicotine from cigarettes causes dryness of mouth, changes in elastic fibres of the lips, and thus eventually sagging or elastosis of lips. [15]These may cause changes in patterns of the lip grooves. The constant heat produced from the cigarette during smoking may also affect lip patterns, textures or both.[2,10] According to a study done by Loganathan *et al.* between smokers and non-smokers in Tamil Nadu in the year 2019, it was concluded that Type III lip pattern was most commonly found in both smokers and non-smokers.[10]

The present study was done to record whether any such typical lip pattern is present, or if at all a different result is obtained among a certain population in Kolkata, from the previously done studies. No similar study had been performed in this region before, according to the acquired printed knowledge, and thus it was done to assess any differences if present, in the lip patterns of smokers and non-smokers.

Aims and Objectives: -

- To evaluate different lip patterns in a male population of Kolkata comprising of smokers and non-smokers.
- To find out the most common type of pattern in each group in the population.
- To observe any differences in the imprint patterns among the categories of smokers and non-smokers

II. Material And Methods

This comparative study was carried out on patients of Department of Oral Pathology at Kusum Devi Sunderlal Dugar Jain Dental College and Hospital, Kolkata.

A total of 80 males were included in the study out of which Group 1 comprised of 40 Non-smokers and Group 2 comprised of 40 Smokers.

Inclusion criteria:

1. Males
2. Aged ≥ 18 years,
3. For Group 2 the range of smoking habit of smokers extended from those smoking 1 to 2 cigarettes per day for at least 2 years, to those smoking 1 to 5 cigarettes per day for at least 5 years.[10].

Exclusion criteria:

1. Any lesion on the lips
2. Any scars on the lips
3. Any developmental deformity in the lip
4. Any surgical procedures performed on the lips
5. Known hypersensitivity/ allergic reaction to lipstick

Materials:

Transparent cellotape of 1-inch thickness (approx.), dark coloured lipstick, magnifying glass (2x), and white sheets of paper for the impressions.

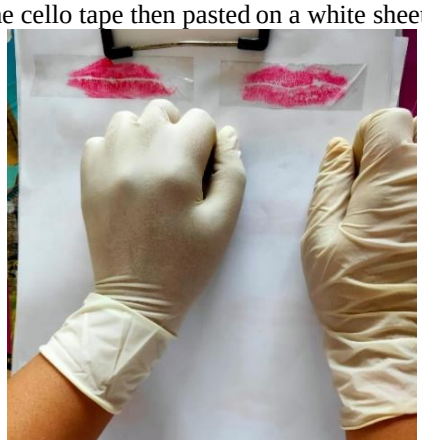
Procedure methodology

After written informed consent was obtained, [17]lipstick was applied uniformly on both the lips of the subject with a cotton swab & the subject was asked to rub the lips together to spread the lipstick uniformly. It was left like that for 30 seconds and then [18]lip impression was taken on the sticky side of a standard 1-inch width cello tape by [19]applying uniform pressure. The tape was then taken out in a single motion and stuck on a white paper [20] [Figs. 1-3]

Fig 1: Lipstick applied on Lips using cotton swab

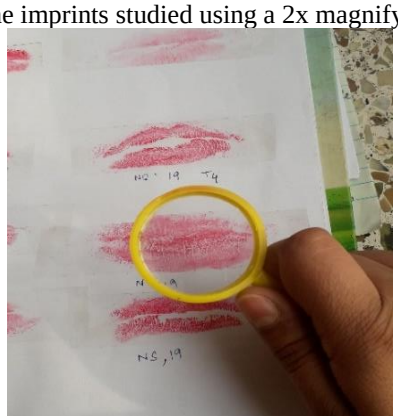
Fig 2: Impression taken on the sticky side of the cello tape

Fig 3: The cello tape then pasted on a white sheet of paper



These were then examined through a magnifying glass [Fig. 4] and [4]classified according to the Suzuki-Tsuchihashi method of classification, as shown in Table 1.

Fig 4: The imprints studied using a 2x magnifying glass



Statistical analysis

Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL) for analysis of the data, and Microsoft Word and Excel have been used to generate tables . Student's t test (two tailed, independent) was

used to find the significance of study parameters between non-smokers and smokers. The level $P < 0.05$ was considered as the cutoff value or significance. [21]

III. Result

After recording the data of patterns obtained [Figs. 5,6], a frequency table of occurrence of different patterns was formulated using Tally marks as shown in Table 2

Fig 5: Different lip patterns found in Non-Smokers

Fig 6: Different lip patterns found in Smokers

Table no. 2: Different lip patterns observed in smokers and non-smokers

	Type I	*Type I'*	*Type II*	*Type III*	*Type IV*	*Type V*	*Total*
Group 1 (Non-smokers)	**12**	1	6	10	9	2	40
Group 2 (Smokers)	8	0	7	**15**	6	4	40

After Statistical analysis of the collected data as in Tables 3 & 4, examination of the recorded lip impressions revealed the incidence of two different types of imprint patterns in smokers and non-smokers. The most prevalent pattern in smokers was Type III (37.5%), or an intersected groove pattern, whereas in non-smokers the most prevalent type was Type I (30%), or a straight groove pattern.

Table no. 3: Statistical data between the 2 groups

	N	Mean	Std. Deviation	Std. Error Mean
VAR00001 (Non-Smokers)	80	2.6000	1.296	0.05625
VAR00002 (Smokers)	80	2.825	1.2787	0.14363

Table no. 4: Student's T test

	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
VAR00001 (Non-Smokers)	26.665	79	0.000	1.50000	1.3880	1.6120
VAR00002 (Smokers)	18.885	79	0.000	2.71250	2.4266	2.9984

Comparison between Non-smokers and Smokers showed that the analysis was statistically significant with $p \leq 0.000$.

IV. Discussion

Cheiloscopy deals with the [10]identification of a person based on the characteristic arrangement of lines appearing on the vermillion border of lips. In cases of crime investigations, lip imprints can be used as an identifying tool in Forensic sciences, because each individual has a unique lip pattern. In a closed mouth, lips exhibit well defined grooves but in an open mouth they do not. It can be used in post mortem investigations, as well as to identify criminals from lip imprints left behind on cigarette butts, glasses, clothing, cups, etc. Samples can also be sent for DNA profiling to match with that of the culprit.[12,14]

This study was done to cite any difference caused by a deleterious habit such as cigarette smoking in lip imprint patterns among individuals.

Though previous studies have been done to assess the variation of lip patterns with gender of an individual, only two studies depicting variation of lip prints among smokers and non-smokers are present within our reach.[2,6]

Some drawbacks of the method of Cheiloscopy which were encountered during the proceedings of the study are smudging and spoiling of lip imprints, and variation of imprints in an open and closed mouth.

[1]In our study, Type III pattern was found to be the most prevalent among smokers, whereas Type I pattern was predominant in non-smokers. This differs from the findings observed by Loganathan[10] & Sivapathasundaram *et al*.,[6] who found the Type III pattern to predominate in both smokers and non- smokers. Also, it was seen from our study that the [22]Type I' was the least predominant lip pattern, followed by the Type V pattern, which is consistent with the findings of Suzuki *et al.*[23] and Loganathan.[10] Our results also differed from the findings reported by Verma *et al*.[24] who concluded that Type II was the most found pattern irrespective of smoking.

Our study also showed cracking of grooves in case of smokers which were not seen in non-smokers.

We opine that the heat produced by the cigarette just after smoking causes the grooves of the lips to get cracked, hence causing intersecting groove patterns more common. Nicotine from the cigarette has several effects, some of them being shrinkage of lips, sagging of lip muscles, which may be the reason for the lip patterns to vary from normal.[10]

V. Conclusion

Cheiloscopy has gained some importance in the past few decades. Since each individual has a unique lip pattern, Cheiloscopy proves to be a method of much importance in the field of identification, investigation and Forensic Sciences and Forensic Odontology most importantly.

After our study was done and the results interpreted, it may be concluded that the vermillion border of lips may be used to distinguish between smokers and non-smokers, proving to be of potential value in the field of post-mortem, ante mortem forensic investigations and also for identification purposes.

Thus, the study was successful in establishing its aim and adding to some of the aids which may help differentiate lip patterns of a smoker from a non-smoker, eventually helping in Forensic investigations. However, the study needs to be conducted on a larger sample size for further validation.

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