A Comparative Analysis of Lip Print Pattern, Lip Competency, and Incisal Class in Indian Population

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ABSTRACT

Introduction: The pattern of lip print varies in various types of incisor relationships. It is useful in building up a database for diagnosis and is a crucial tool in forensic analysis.

Objective: To compare lip print patterns, lip classification, and incisal relationship in the Indian population and to highlight the need to establish lip prints as an adjunctive tool for diagnostic and forensic analysis.

Material and Methods: Lip print patterns, lip classification, and the incisal classification were determined on a sample of 152 participants who were randomly selected from a group of patients and students from the Department of Orthodontics and Dentofacial Orthopaedics of different hospitals all over India were screened. The lip print of the participants was screened with the aid of transparent tape over the lips, which had red lipstick evenly spread with a brush over the upper and lower lips. Lip competencies (Jackson's classification) and incisal class (British Standard Classification of Malocclusion) were assessed by photographs, manually checking and casts.

Results: In the collected sample, vertical pattern of lip print and Class I incisal relationship was more prevalent. The collected obtained was tabulated and subjected to statistical analysis. Differences in lip print patterns among different incisor classes was significant ($p \leq 0.05$) with vertical lip print patterns seen more in Class I and Class II div 2 subjects, Class II div 1 subjects had more of a reticular pattern and Class III subjects had a branched pattern. There was no statistically significant difference in the association between lip pattern and lip competency as well as an association between incisor classification and lip competency.

Conclusion: Lip print pattern is a significant predictor of malocclusion at a younger age and can help in stopping the progression of malocclusion. The vertical lip print pattern was the most prevalent one among the subjects. A significant relationship exists between lip print patterns and the incisal classification. These lip print patterns can be used for forensic database useful in crime solving, war, and terrorist activities.

Keywords: Incisal classification, Lip competency, Lip print pattern.

Introduction

Lip analysis is a type of soft tissue examination in orthodontics that comprises lip thickness, lip seal, lip competence, lip prominence, and lip length.[1]Diversified lip characteristics are found in different parts of the world.[2] These characteristics varies with respect to ethnicity and race.[3] Though there are researches that have been done to find a correlation between skeletal malocclusion with lip prints[4], there are no studies done to find a correlation with the incisal malocclusions in Indian population. Hence it is

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important to rule out a relation between variation in lip print pattern for different ethnic groups and no such studies have been done in Indian population, hence there is a need for this present study.

Many individuals seek orthodontic therapy as they become more concerned about the aesthetics.[1] With the latest paradigm shift of orthodontic treatment more towards soft tissue importance lips competencies, nasolabial angle, facial profile etc., prior prediction of the malocclusion can help in early treatment thereby improving the aesthetics.

Studies have focussed on using patient data not only for diagnosis and treatment but also as a ground for forensic evaluation.[1,5]

Lip print is a recent method of forensic evaluation with numerous studies.[6–9] There are various methods for recording lip prints and determining patterns in different ethnic groups.[10,11] There exists normal lines, fissures, grooves and furrows located within the lips and have distinct characteristics in the same way as in fingerprints for identification as in forensic investigations.[7,8] These studies have used the lip prints obtained from crime scenes as trace evidence and as an aid for personal identification[11,12]

Cheiloscopy is branch of forensic odontology which has been used in conjunction with the lip morphology in certain type of malocclusion.[6-10,12] Other studies have shown that lip prints are unique to each individual and can be used as a tool for personal identification[9–12] with different populations determining the predominant lip patterns.[11,13–15]

The purpose of this study was to examine lip print pattern, lip classification, and incisal relationship in Indian population and to emphasise the necessity to establish lip prints as an auxiliary tool for diagnostic and forensic investigation.

Objective

to compare the lip print pattern, lip classification, and incisal relationship in the Indian population and to emphasise the need of developing lip prints as an additional tool for forensic and diagnostic investigation.

Material and Methods

Sample size:

The sample size was calculated using G power software version 3.2.9. Considering the population size of 250 with the average new cases in Dept of Orthodontics in a month with a margin of error (MOE) of 5%, Confidence level: 95% and response distribution/Sample proportion: 50%, the final sample size came out to be 152. The study was approved by the Institutional Ethics Committee (IEC) (reference number SDCRI/IEC/22/09).

Methodology:

Lip print patterns, lip classification and the incisal classification were determined on a sample of 152 participants who were randomly selected from a group of patients and students from the Department of Orthodontics and Dentofacial Orthopaedics of different hospitals all over India were screened. Ethical clearance was obtained from the Hospital's ethical committee. The lip print of the participants was screened with the aid of transparent tape over the lips, which had red lipstick evenly spread with a brush over the upper and lower lips. Lip competencies (Jackson's classification) and incisal class (British Standard Classification of Malocclusion) were assessed by photographs, manually checking and casts.

Incisal classification:

Class I – The lower incisor edges occlude with or lie immediately below the cingulum plateau of upper central incisors

Class II - The lower incisor edges occlude posterior to the cingulum plateau of upper central incisors. There are two subdivisions:

Division 1: The upper central incisors are proclined and there is an increased overjet

Division 2: The upper central incisors are retroclined and the overjet is reduced

Class III - The lower incisor edges occlude anterior to the cingulum plateau of upper central incisors. The overjet is reduced or reversed.

Lip competency determination

Lip competency was done using Jackson's classification and with the patient seated in a relaxed position on the dental chair, the upper and lower lips were examined with upper incisors as the reference tooth and classified as follows:

Upper Lip:

- Position 0 – no coverage of the maxillary incisors
- Position 1 – coverage of cervical third of maxillary incisors
- Position 2 – coverage of middle third of maxillary incisors
- Position 3 – coverage of incisal third of maxillary incisors

Lower Lip:

- Position 0 – no coverage of the maxillary incisors
- Position 1 – coverage of incisal third of maxillary incisors

- Position 2 – coverage of middle third of maxillary incisors
- Position 3 – coverage of cervical third of maxillary incisors

A negative classification of -1 was recorded if the lower lip was trapped behind the upper incisor. Competent upper and lower lip position is recorded when the combination of scores is 3/1 or 2/2.

Lip print analysis

The lips were analysed for completeness and lips with congenital or acquired deformities, which included patients with cleft lip and palate or with syndromes affecting the lips, pathologies, swellings, or abnormalities were excluded from the study. The Lip prints were recorded using the lipstick-cellophane method with the patient seated on the dental chair in a semi-reclined position. The lips were cleaned to remove any previous lipstick or salve and with the aid of a soft make-up brush, red lipstick applied evenly over the surface of the upper and lower lips. The subject was asked to close the lips together gently to allow an even spread of the lipstick over the surfaces of both lips.

The lip print pattern was obtained by placing a wide piece of cellophane from one end of the lip to the other. The cellophane with the lip print pattern was placed in a drawing book with plain white pages and the biodata, incisal class and lip competency recorded. Only lip print patterns with clear details were included in the study. A magnifying glass was then used by 2 examiners to identify the lip type for clarity and agreement. The paired t-test was used to determine the inter examiner agreement with $p>0.05$ considered to be statistically non-significant indicating consistency of interpretation.

Lip pattern description using the method described by Tsuchihashi16

- Type I and Type I': -Clear cut vertical grooves that run across the entire lips or do not cover the entire lip.
- Type II: - Branched grooves (branching Y–shaped pattern).
- Type III: - Intersected grooves (criss–cross pattern, transverse grooves).
- Type IV: - Reticular grooves.
- Type V: - Undetermined (grooves do not fall into any type and cannot be differentiated morphologically).

Vertical grooves are either long or full in Type I or partial/short vertical grooves in Type I but studies have found no significant differences between the two types.

RESULTS:

Table 1 shows the distribution of cases according to lip print patterns. Most common pattern seen was vertical (43.1%) followed by reticular pattern (34.9%). (Table 1)

Table 2 shows the distribution of cases according to incisor classification. 62.5% of the subjects belonged to Class I, 21.7% belonged to class II div 1, 11.8% belonged to class II div 2 and 3.9% belonged to class III. (Table 2)

Table 3 shows the distribution of cases according to lip competency. 75.2% of the subjects had competent lips and 24.8% had incompetent lips. (Table 3)

Table 4 shows the distribution of association between lip pattern and incisor classification. Vertical pattern was most seen in Class I subjects and Class II div 2 subjects. In Class II div1 subjects, most seen pattern was reticular whereas branched pattern was seen most in Class III subjects. This difference in lip print patterns among different incisor classes was significant. (Table 4)

Table 5 shows the distribution of association between lip pattern and lip competency. Most seen pattern among subjects of both groups was vertical pattern followed by reticular pattern and there was no significant difference. (Table 5)

Table 6 shows the distribution of association between incisor classification and lip competency. There was no significant difference reported. (Table 6)

Table 1:- Distribution of cases according to lip patterns

Pattern	n	%
Vertical	66	43.4
Branched	23	15.1
Intersected	10	6.6
Reticular	53	34.9

Table 2:- Distribution of cases according to incisor classification

Incisor class	n	%
Class I	95	62.5
Class II div 1	33	21.7
Class II div 2	18	11.8
Class III	6	3.9

Table 3:-Distribution of cases according to lip competency

Lip competency	n	%
Competent	114	75
Incompetent	38	25

Table 4:- Association between lip pattern and incisor classification

Incisor classv		Lip Print Pattern				Total	p value
		Vertical	Branched	Intersected	Reticular		
Class I	n	45	14	6	30	95	0.006*
	%	47.40%	14.70%	6.30%	31.60%	100.00 %	
Class II div 1	n	15	1	0	17	33	
	%	45.50%	3.00%	0.00%	51.50%	100.00 %	
Class II div 2	n	6	5	3	4	18	
	%	33.30%	27.80%	16.70%	22.20%	100.00 %	
Class III	n	0	3	1	2	6	
	%	0.00%	50.00%	16.70%	33.30%	100.00 %	

Chi-square test; * indicates significant difference at p≤0.05

Table 5:- Association between lip pattern and lip competency

Competency		Lip Print Pattern				Total	p value
		Vertical	Branched	Intersected	Reticular		
Competent	n	47	16	8	43	114	0.559
	%	41.20%	14.00%	7.00%	37.70%	100.00 %	
Incompetent	n	19	7	2	10	38	
	%	50.00%	18.40%	5.30%	26.30%	100.00 %	

Chi-square test; p≤0.05 indicates significant difference

Table 6:- Association between lip competency and incisor classification

Competency		Incisor classification				Total	p value
		Class I	Class II div 1	Class II div 2	Class III		
Competent	n	74	23	13	4	115	0.749
	%	64.90%	20.20%	11.40%	3.50%	100.00%	
Incompetent	n	21	10	5	2	38	
	%	55.30%	26.30%	13.20%	5.30%	100.00%	

Chi-square test; p≤0.05 indicates significant difference

Discussion

Lip print pattern shows diversity with respect to various regions and populations [6,9,11,12,15,17]. Higher amount of intersected lip print pattern was seen more in Japanese[16] and Indo Dravidian[18] population and branched pattern was more seen in Kerala[19] and North Indian population[13]. In African population there was more prevalence of vertical pattern[1] and in Egyptian and Malaysian population intersected pattern was more common[20] This is at variance with the current study where the vertical pattern was most prevalent. This variation could be because of different lip positions and malocclusions prevalent amongst different ethnicities.[7,8]

Lip competency in this study was high with majority of participants demonstrating positions 2/2 and 3/1 according to Jackson's classification. In a study done by Ize etal1 there was a significant relation with the lip print pattern. This agrees with another study where competent lips were more prevalent[21]. This also is in variance with the current study since there is no much significance between lip competencies and the lip print pattern.

The lip print and incisal classification had a strong

correlation. In a study done by Iyamu1 on an African population he found out a significant corelation between incisal classification and lip prints. In his study he concluded that class I incisor relation had more prevalent lip pattern of branched pattern and a vertical pattern was more prevalent in Class III incisor relation.

In a study done by Maheshwari etal[22], more prevalent vertical lip print was seen in all 3 molar relationships whereas no significant relationship was seen between lip print and molar relationship.

Incisal class may be valuable in obtaining data of lip print patterns for a possible forensic data base useful in solving crime, war, and terrorist activities. This agrees with previous studies where orthodontic evaluation was associated with lip prints and skeletal malocclusion.[6,13,23,24]

The results from the previous studies have shown a correlation between skeletal malocclusion and lip prints which can be used for identification of suspects and matching data obtained from crime scene.[9,10,12]

Conclusion

The prevalent lip type is vertical type. A significant relation exists between lip print pattern and incisor classification. The correlation between lip pattern and incisor classification reveals that Class I and Class II div 2 participants were more likely to have a vertical pattern. Reticular patterns were more frequently observed in Class II div 1 participant and Branching patterns were seen in Class III subjects. The patterns of lip prints among the various incisor classes varied significantly. The corelation between lip competencies with either lip pattern or incisor classification revealed statistical insignificance. Lip print pattern is a significant predictor of malocclusion at a younger age and can help in stopping the progression of malocclusion. Lip prints are unique to each individual and differ depending on a person's ethnicity and cultural heritage.

Limitation

The study's main weakness was the need for a bigger sample size to evaluate the correlation between the lip print and incisal categorization. It should have also been considered because sexual dimorphism might vary substantially depending on incisal classification, competencies, and lip print pattern.

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