

Determination of Relationship between Lip Prints and Skeletal Malocclusion in Children of Age 9–14 Years

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ABSTRACT

Aim: To determine the relationship between lip prints and sagittal skeletal jaw relation in children of age 9–14 years.

Materials and methods: The lateral cephalograms of a total of 90 children were analyzed cephalometrically to categorize as skeletal class I, II, or III jaw relation groups. Each group had 30 patients. Lip prints of each sample were recorded and analyzed.

Statistical analysis: The data obtained were statistically analyzed (Z test) to compare lip print patterns among patients of different sagittal skeletal jaw relations.

Results: (1) Type IV lip print pattern was significantly higher ($p < 0.05$) in occurrence on lower lip of class III group males when compared to males of class I group; (2) The proportion of type I lip print pattern on lower lip was significantly higher ($p < 0.05$) in overall subjects having class II jaw relation; (3) Type II lip print pattern on upper lip and type I lip print pattern on lower lip were significantly higher ($p < 0.05$) in females of class II group as compared to class III group; (4) Type III upper lip print pattern was significantly higher ($p < 0.05$) in females of class III group as compared to class II group.

Conclusion: In the present study, type I lip print pattern on lower lip was significantly higher ($p < 0.05$) in overall subjects having class II jaw relation; some interrelations between lip print patterns and malocclusions were found especially in skeletal class II and III jaw relation groups. No definite lip print pattern could be associated with any particular sagittal skeletal jaw relation.

Clinical significance: Lips prints and craniofacial skeleton develop at the same embryonic period. Developmental factors that cause malocclusions might also reflect in the lip print patterns.

Keywords: Cheiloscopy, Lip print, Sagittal skeletal jaw relation.

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INTRODUCTION

The positive identification of living or deceased using the unique traits and characteristics of the person forms a cornerstone of forensic science. Identity of a person from a forensic point of view does not end at his finger, palm, or foot prints but also includes his distinct lip prints. Lip prints consist of normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of human lip between the inner labial mucosa and outer skin. Every person has his unique lip print which does not change over time.¹ The study of lip prints is called cheiloscopy.²

The mixed dentition is the time of greatest opportunity for occlusal guidance, especially in cases of malocclusion. As uninterrupted growth might further complicate the condition in the permanent dentition, an appropriate diagnosis at an early stage becomes necessary. Any relation between lip prints and skeletal jaw relation might aid in the early diagnosis and interception of the condition and also might be helpful in future forensic research.

There exists a deficiency in studies carried on samples of pediatric age group. Therefore, the present study was undertaken with the aim to find out whether there exists a relationship between lip prints and sagittal skeletal jaw relation in children of age 9–14 years. Objectives of the study were to record and study the lip prints and lateral cephalograms of each sample in the study group, to correlate the recorded lip print patterns with the respective sagittal skeletal jaw relation and to determine if there exists any association between them.

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MATERIALS AND METHODS

It was an observational, hospital-based study. The samples were selected from patients visiting the Department of Pediatric and Preventive Dentistry and Department of Orthodontics and Dentofacial Orthopedics based on inclusion and exclusion criteria. Based on previous hospital records, a convenience sample of total 90 children in the age group of 9–14 years, with 30 in each of skeletal class I, II, and III groups, were included.

Inclusion Criteria

(1) Normal lip mucosa and (2) patients with skeletal class I, II, or III sagittal jaw relation.

Exclusion Criteria

(1) Patients with developmental anomalies of lips, (2) patients with pathologies of lips, (3) chapped or dry lips, (4) patients who are unable to open mouth, (5) patients who do not give informed consent, (6) those with trauma in the region of lips and jaws, (7) individuals with known hypersensitivity to lipsticks, (8) patients with previous history of orthodontic treatment or any maxillofacial surgeries, congenital facial defects, (9) congenitally missing teeth, (10) extracted teeth (except 3rd molars), and (11) scarring of lips previously or presently.

The study was initiated after having obtained institutional ethical clearance. A prior written informed consent was taken from the parents before the start of the study. Lateral cephalograms of all the selected subjects were taken in natural head position (NHP) and were analyzed cephalometrically. ANB angle, WITS appraisal, and Beta angle were calculated for each cephalogram to assess the anteroposterior jaw position (Table 1).³ Keeping the norms into consideration, the cephalograms were categorized into class I (Fig. 1), class II (Fig. 2), and class III (Fig. 3) skeletal jaw relation groups when at least two norms coincided. The lateral cephalograms of each patient were further subjected to cephalometric archial analysis to reconfirm their skeletal jaw relation and assess their treatment needs.⁴ All cephalometric analyses were performed by a single investigator to prevent any interobserver bias.

The lip impressions of all individuals (Fig. 3) in each groups were recorded using lipstick-cellophane tape method.¹ Magnifying glass

lens was used for the analysis of lip prints.¹ The field of observation was restricted to middle thirds of both upper and lower lips. All lip print analyses were done by an observer who was blinded in relation to clinical examination and cephalometric analysis of the patient. The lip print patterns were classified according to Suzuki and Tsuchihashi's classification system (Table 2).⁵ The lip print pattern was determined by counting the highest number of lines in the study area having similarity to the Suzuki Tsuchihashi classification.

The study data were analyzed using SPSS software version 22, IBM, Corp. Z test (standard normal variant test) for proportion was used for comparing different lip print patterns in subjects having skeletal class I and class II malocclusion, skeletal class I and class III malocclusion, and skeletal class II and class III malocclusions. The frequency distribution for various lip print patterns with respect to different malocclusions was expressed in terms of number and percentage. The level of significance (*p* value) was set at *p* < 0.05.

RESULTS

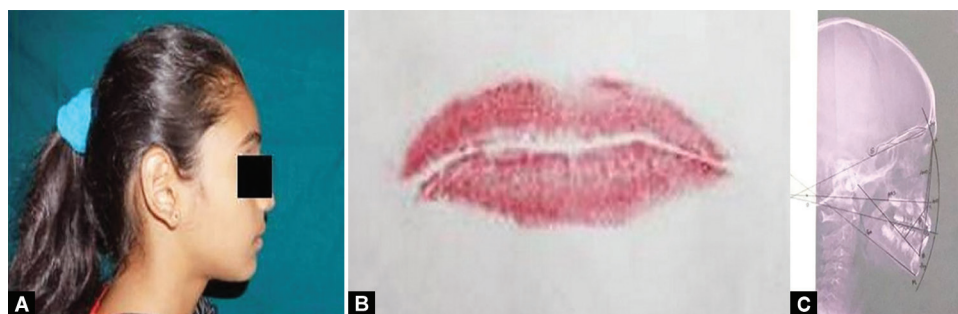
Comparison of different lip print patterns in subjects of class I, class II; class I, class III; and class II, class III sagittal skeletal jaw relations are given in Tables 3 to 5, respectively.

The results of our study are given as:

- Type IV lip print pattern was significantly higher (*p* < 0.05) in class III group when lower lip patterns were compared between males of class I and class III.

Table 1: Norms for ANB angle, WITS, appraisal, and beta angle⁹

Cephalometric analyses	Parameters	Skeletal class I jaw relation	Skeletal class II jaw relation	Skeletal class III jaw relation
ANB angle	Inside inferior angle between line N (nasion) to point A and N to point B	2°	>2°	<-1°
WITS appraisal	It is the distance between points AO and BO on occlusal plane. It gives the anteroposterior relation between the two jaws	Males: -2 to +4 mm Females: -4.5 to +1.5 mm	Males: >+4 mm Females: >+1.5 mm	Males: >-2 mm Females: >-4.5 mm
Beta angle	Internal angle measured at point A between A and B lines and a perpendicular line drawn on CB line (condyion—point B line) from point A	27° and 35°	<27°	>35°



Figs 1A to C: Class I group patient. (A) Profile photograph; (B) Lip print; (C) Cephalometric tracing



Figs 2A to C: Class II group patient. (A) Profile photograph; (B) Lip print; (C) Cephalometric analyses



Figs 3A to C: Class III group patient. (A) Profile photograph; (B) Lip print; (C) Cephalometric analyses

Table 2: Suzuki and Tsuchihashi classification

Type I	Clear-cut vertical grooves that run across the entire lips
Type I'	Similar to type I, but does not cover the entire lip
Type II	Branched grooves (branching Y-shaped pattern)
Type III	Intersected grooves (crisscross pattern, transverse grooves)
Type IV	Reticular grooves
Type V	Undetermined (grooves do not fall into any of the types I–IV and cannot be differentiated morphologically)

As type I, i.e., full vertical grooves and type I', i.e., partial vertical grooves (Tsuchihashi classification) were very difficult to differentiate; they were considered as a single group in this study

- Comparison of lip patterns between skeletal class II and class III showed:

The proportion of type I lower lip print pattern was significantly higher ($p < 0.05$) in overall subjects having class II jaw relation.

Type II upper and type I lower lip print patterns were significantly higher ($p < 0.05$) in females of skeletal class II group.

Type III upper lip print pattern was significantly higher ($p < 0.05$) in females of skeletal class III group.

DISCUSSION

Lip prints are unique to each individual, and the uniqueness of patterns depends on the way the lip muscles relax to produce a

particular pattern.¹ Thus, they play a very important role in forensic identification.

Hirth et al. observed that the lip grooves might be influenced by hereditary factors.⁶ King et al., found that there is a fundamental genetic control of craniofacial form.⁷ The lip, alveolus, and palate develop completely during the first 6–12 weeks of gestation.³ It is known that any factor active during the time period of genetic expression is bound to affect all structures developing at that time. Therefore, extraneous factors that cause malocclusions at the time of development should also affect the lip print patterns. This might suggest a relationship between lip print patterns and skeletal malocclusions. A similar hypothesis has been tested earlier in relation to dermatoglyphics and malocclusion.⁸

As the present study samples were mostly in the mixed dentition stage, diagnostic analyses based on a single baseline cannot be consistently valid; therefore, Sassouni's archial analysis which is based on the composite of four planes instead of single line or point of reference was also used in this study. The essence of this analysis is that there is no one plane which is considered fixed.⁴ This analysis also helps in the treatment planning of the patients.

The Sassouni archial method (Figs 1 to 3):

Four planes (supraorbital, palatal, occlusal, and mandibular) are drawn. These four planes converge towards a focal area called "O". From O as a center and ON ("N"—nasion) as radius an arc is drawn. This arc becomes the reference plane. The distance between it and pogonion is measured in millimeters. The more pogonion is anterior to the arc, the more protrusive is the chin. The point of convergence of these planes (O) varies in each particular

Table 3: Comparison of different lip print patterns in subjects of class I and class II sagittal skeletal jaw relations

Lip	Lip print pattern	Total sample (n)			Class I (n)			Class II (n)			p value	
		Total	Males	Females	Total	Males	Females	Total	Males	Females	Males	Females
Upper lip	Type I	25	17	8	7	n	3	12	n	3	0.16	0.07
	Type II	16	5	11	6	4	4	7	9	6	0.78	0.50
	Type III	24	15	9	10	2	3	5	1	1	0.15	0.26
	Type IV	19	9	10	5	7	3	4	4	2	0.67	1.00
	Type V	6	3	3	2	2	1	2	2	2	1.00	0.32
	Total	90	49	41	30	1	14	30	0	14		
Lower lip	Type I	40	22	18	12	16	6	18	16	9	0.12	0.30
	Type II	16	10	6	4	6	0	5	9	3	0.67	0.38
	Type III	16	10	6	7	4	3	4	2	0	0.31	1.00
	Type IV	11	5	6	2	4	2	2	4	1	1.00	0.32*
	Type V	7	2	5	5	0	3	1	1	1	0.07	0.14
	Total	90	49	41	30	2	14	30	0	14		

*Statistical significance

Table 4: Comparison of different lip print patterns in subjects of class I and class III sagittal skeletal jaw relations

Lip	Lip print pattern	Total sample (n)			Skeletal class I (n)			Skeletal class II (n)			p value	
		Total	Males	Females	Total	Males	Females	Total	Males	Females	Males	Females
Upper lip	Type I	25	17	8	7	4	3	6	4	2	0.78	0.94
	Type II	16	5	11	6	2	4	3	2	1	0.28	0.93
	Type III	24	15	9	10	7	3	9	4	5	0.8	0.23
	Type IV	19	9	10	5	2	3	10	5	5	0.15	0.26
	Type V	6	3	3	2	1	1	2	2	0	1.00	0.55
	Total	90	49	41	30	16	14	30	17	13		
Lower lip	Type I	40	22	18	12	6	6	10	7	3	0.58	0.86
	Type II	16	10	6	4	4	0	7	4	3	0.31	0.94
	Type III	16	10	6	7	4	3	5	2	3	0.56	0.33
	Type IV	11	5	6	2	0	2	7	4	3	0.08	0.03*
	Type V	7	2	5	5	2	3	1	1	1	0.07	0.12
	Total	90	49	41	30	16	14	30	17	13		

*Statistical significance

Table 5: Comparison of different lip print patterns in subjects of class II and class III sagittal skeletal jaw relations

Lip	Lip print pattern	Total sample (n)			Skeletal class II (n)			Skeletal class III (n)			p value	
		Total	Males	Females	Total	Males	Females	Total	Males	Females	Males	Females
Upper lip	Type I	25	17	8	12	9	3	6	4	2	0.06	0.69
	Type II	16	5	11	7	1	6	3	2	1	0.55	0.04*
	Type III	24	15	9	5	4	1	9	4	5	0.94	0.04*
	Type IV	19	9	10	4	2	2	10	5	5	0.26	0.14
	Type V	6	3	3	2	0	2	2	2	0	0.15	0.16
	Total	90	49	41	30	16	14	30	17	13		
Lower lip	Type I	40	22	18	18	9	9	10	7	3	0.39	0.03*
	Type II	16	10	6	5	2	3	7	4	3	0.42	0.90
	Type III	16	10	6	4	4	0	5	2	3	0.33	0.06
	Type IV	11	5	6	2	1	1	7	4	3	0.15	0.24
	Type V	7	2	5	1	0	1	1	0	1		0.92
	Total	90	49	41	30	16	14	30	17	13		

*Statistical significance

face both vertically and horizontally.⁴ This assessment of vertical or horizontal growth defects helps in the treatment planning of each patient.

In the course of the present study, it was observed that the full thickness of the lips could not always be recorded in patients with various malocclusions due to the skeletal prognathism or retrognathism. Therefore, both upper and lower lips were studied for each patient. This is in contrast with the study conducted by Sivapathasundharam et al., in which they suggested to study the lip print pattern in the middle part of lower lip up to 10 mm wide.¹ Mamandras et al. observed the lips reach their maturity in late adolescence.⁹ Therefore; in the present study the field of observation was restricted to middle thirds of both upper and lower lips.

Comparing the lip print patterns in males of class I and III, type IV (reticular grooves) lip print pattern was significantly high ($p < 0.05$) in lower lip of class III group. In a study conducted by Raghav et al., they have found in both males and females a significantly high proportion of vertical lip print pattern in skeletal class III as compared to skeletal class I, while the proportion of reticular lip pattern was significantly high in subjects having skeletal class I as compared to skeletal class III.¹⁰

As per the present study, the proportion of type I (vertical grooves lip print pattern in lower lip was significantly high ($p < 0.05$) in subjects having skeletal class II as compared to skeletal class III. Type II (branched grooves) lip print pattern was significantly high ($p < 0.05$) in upper lip, and type I (vertical grooves) lip print pattern was significantly high in lower lip of skeletal class II group females, whereas type III (intersected grooves) lip print pattern was significantly high ($p < 0.05$) in upper lip of skeletal class III group females. Different results were seen in a study conducted by Raghav et al., where vertical lip pattern was significantly high in subjects having skeletal class III as compared to skeletal class II.¹⁰

Kulkarni et al. concluded that it is easier to relate lip print patterns to class I and class III sagittal malocclusion subjects as compared to class II subjects, but they could not find a conclusive association of lip patterns with different skeletal malocclusion.³ As the methodology was different, the results could not be compared with that of the present study.

Raghav et al. associated vertical lip patterns with skeletal class III malocclusion.¹⁰ In this study, the proportion of type I lower lip print pattern (vertical grooves) was significantly higher ($p < 0.05$) in overall subjects having class II jaw relation; relationship between lip print patterns and malocclusions was found especially between skeletal class II and class III jaw relation groups.

CONCLUSION

- In the present study, the proportion of type I lip print pattern was significantly higher ($p < 0.05$) on lower lip in overall subjects having class II jaw relation.
- Some interrelations between lip print patterns and malocclusions were found especially between skeletal class II and III jaw relation groups.
- No definite lip print pattern could be associated with any particular sagittal skeletal jaw relationship
- Further research with a larger sample size and varied ethnic background is required for conclusive results regarding association of lip print patterns with different skeletal malocclusions.



REFERENCES

1. Sivapathasundharam B, Ajay Prakash P, Sivakumar G. Lip prints (Cheiloscopy). *Indian J Dent Res* 2001;12:234–237.
2. Acharya AB, Sivapasundaram B. *Shafer's textbook of oral pathology*, 5th ed. New Delhi: Elsevier; 2006. pp. 1119–1227.
3. Kulkarni N, Vasudevan SD, Shah R, et al. Cheiloscopy: a new role as a marker of sagittal jaw relation. *J Forensic Dent Sci* 2012;4:6–12. DOI: 10.4103/0975-1475.99152.
4. Nanda SK, Sassouni V. Planes of reference in roentgenographic cephalometry. *Angle Orthod* 1965;35(4):311–319.
5. Suzuki K, Tsuchihashi Y. New attempt of personal identification by means of lip prints. *J Indian Dent Assoc* 1970;42:8–9.
6. Hirth L, Gottsche H, Goedde HW. Lip prints—variability and genetics (author's transl). *Humangenetik* 1975;30(4):47–62.
7. King L, Harris EF, Tolley EA. Heritability of cephalometric and occlusal variables as assessed from siblings with overt malocclusions. *Am J Orthod Dentofacial Orthop* 1993;104(2):121–131. DOI: 10.1016/S0889-5406(05)81001-7.
8. Reddy BR, Sankar SG, Roy ET, et al. A comparative study of dermatoglyphics in individuals with normal occlusions and malocclusions. *J Clin Diagn Res* 2013;7(12):3060–3065. DOI: 10.7860/JCDR/2013/7663.3853.
9. Mamandras AH. Linear changes of the maxillary and mandibular lips. *Am J Orthod Dentofacial Orthop* 1988;94(5):405–410. DOI: 10.1016/0889-5406(88)90129-1.
10. Raghav P, Kumar N, Shingh S, et al. Lip prints: the barcode of skeletal malocclusion. *J Forensic Dent Sci* 2013;5:110–117. DOI: 10.4103/0975-1475.119777.