Original Article

Correlation between lip print patterns and skeletal class I and II malocclusions – A tool to diagnose early

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Abstract

Background: Cheiloscopic analysis has been shown to have close association with skeletal malocclusion. Hence, aim of the present study was to explore any association between lip prints patterns and skeletal class I and II malocclusions. **Materials and Methods:** A study sample of 90 subjects aged between 18 and 25 years was selected from individuals opting for orthodontic therapy. Skeletal malocclusion using ANB angle was assessed using lateral cephalograms while lip print patterns were analyzed using the cellophane-adhesive method. Statistical analysis: Mean ± SD was analyzed and significance was assessed using ANOVA. **Results:** Skeletal class I group showed more branched pattern (29%). Other patterns in decreasing order were intersected (25%), reticular (24%), and vertical lip patterns (22%), while the skeletal class II group showed branched pattern as most common (32%), followed in decreasing order by reticular (29%), intersected (25%), and vertical lip patterns (14%). No statistical significance was derived between lip pattern type and skeletal malocclusion. **Conclusion:** Lip print patterns are important indicators of malocclusion and can help in predicting the same at an earlier stage.

Keywords: Angles class Imalocclusion, lip prints, malocclusion, skeletal malocclusion

Introduction

The term 'Cheiloscopy' is derived from Gr. Words; cheilos, 'lips' and ekopein, 'to see'. This term is used for studies of lip patterns. These patterns play an important role as these bear a unique identification while the only exception being the monozygotic twins. There lip print patterns are identifiable at 6th week of intrauterine life and persist unchanged throughout life, even after episodes of Herpes. Lip print patterns have been widely studied in association with various orofacial and dental conditions like early childhood caries, malocclusion, periodontal diseases, cleft lip and palate, and premalignant lesions and conditions.[1]

These patterns have been classified variously by many investigators

(I) Suzuki and Tsuchihashi classification:[1]
   a. Type I: Vertical groove across lips
   b. Type I': Partial groove pattern
   c. Type II: Branched
   d. Type III: Intersected pattern
   e. Type IV: Reticular pattern
   f. Type V: Other lip patterns

(II) Classification based on incisal class assessed as per British Standard Classification of Malocclusion:[2]

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Received: 19-01-2020 **Revised:** 12-03-2020
Accepted: 26-03-2020 **Published:** 30-07-2020

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_115_20

How to cite this article: Pandey A, Kumar N, Nabi AT, Kavita K, Choudhary P, Raj R. Correlation between lip print patterns and skeletal class I and II malocclusions – A tool to diagnose early. J Family Med Prim Care 2020;9:3539-43.

a. Class I: Incisal edges of lower anteriors occlude immediately below cingulum of maxillary central incisors.
b. Class II: Here, the incisal edges of mandibular anteriors occlude posteriorly to cingulum. They have been subdivided- (1) Division 1: Production of maxillary central incisors with increased overjet; (2) Division 2: Retroclined maxillary central incisor with reduced overjet.
c. Class III: The incisal edges of mandibular anteriors have anteriorly placed occlusion to cingulum of maxillary central incisor resulting in decreased or reversed overjet.

(III) Lip pattern classification proposed by AfcharBayat divided lip patterns into seven types: (a) A1 (straight vertical grooves covering entire lip surface); (b) A2 (vertical straight grooves not covering entire lip surface; (c) B1 (branched angulated grooves); (d) B2 (branched angulated grooves); (e) C (converging grooves); (f) D (reticular groove pattern), and (g) E (other patterns).[3]

(IV) Renaud's classification of lip patterns: According to this, there are 10 types: (i) Type a (complete vertical groove pattern); (ii) Type B (vertical incomplete); (iii) Type C (completely bifurcated); (iv) Type D (incompletely bifurcated); (v) Type E (completely intersecting); (vi) Type F (incompletely intersecting); (vii) Type G (reticular pattern); (viii) Type H (sword-shaped pattern); (ix) Type I (horizontal pattern) and (x) Type J (other lip-print patterns).[3]

(V) Santos classified lip patterns as (a) Simple and (b) Compound types. The simple type was further classified into (i) Straight lined; (ii) Curved lined; while the compound type was subclassified into (i) Bifurcated pattern; (ii) Trifurcated pattern and (iii) Anamolous pattern.[3]

The embryological development of palate, alveolus, and lips takes place at the same time. Any disturbance causing event during this period can affect all of these structures.[4] The Klein zone of vermillion border of lip is the only area concerned with identification and is covered with print patterns or grooves.[5]

Normal occlusion encompasses flush terminal plane or class I molar relation, 1–2 mm overjet and overbite, lack of crowding or tooth spacing, the absence of transverse discrepancy, the absence of decrease in arch length due to caries involvement and an early loss of primary teeth.[6]

Etiologies of malocclusion have been classified variously-

1. Moyer's classified these into six types- genetic, developmental, trauma-related, physical agent-based, habit-related, and various diseases.
2. Profit classified the etiological factors of malocclusion into three types specific or unique, environmental, and genetic reasons.[7]

ANB is the angular measurement proposed by Riedd. This angle is used to define saggital discrepancy between maxilla and mandible. ANB angle between 0 and 4° is considered as 'skeletal class I' jaw relation while an ANB angle >4° is considered as 'skeletal class II' while an ANB angle <0° degrees or in a negative value, is considered to be 'skeletal class III' sagittal jaw relation.[8]

This study aimed towards establishing a correlation between cheiloscopy and sagittal jaw relations.

Materials and Methods

A total of 90 subjectswere included in the study. Study participants fell under the age range of 18–25 years.

Inclusion criteria for subject recruitment were (1) Absence of lip lesions; (2) Absence of congenitally missing teeth; (3) No congenital facial defects; (4) Subjects with extracted teeth; (5) subjects with known allergic or hypersensitivity response towards use of lipsticks.

Exclusion criteria for the study included (1) Previous history of orthodontic therapy; (2) Subjects with grossly decayed teeth and (3) Subjects who had undergone extractions.

The ethical clearance was obtained from the Institutional ethical committee on 14/11/2019. The study was conducted from 16/11/2019 to 31/12/2019. The study was explained to each subject and informed consent was obtained from them. Lip prints were obtained by application of red-colored lipstick using a lip-brush. This was followed by application of a cellophane adhesive tape over the lips. The tape was then stuck on a white sheet and lip prints were analyzed by using a magnifying lens according to Tsuchihashi classification.

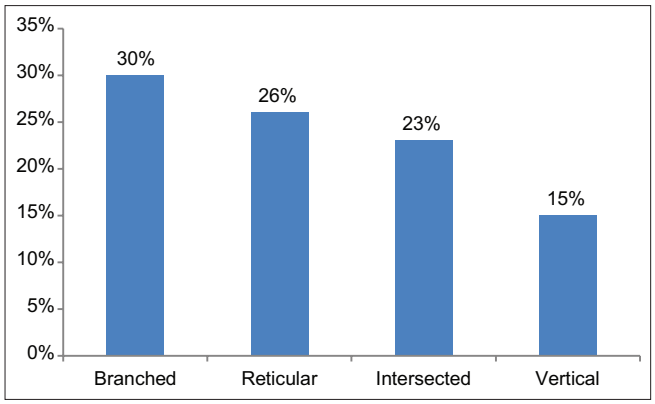
Jaw relations were assessed by using therapeutic lateral cephalograms. Study subjects were divided into two groups based on ANB angle

a. Group I (skeletal class I) and Group II (skeletal class II).

Data recorded were analyzed using SPSS, Version 17 (SPSS Inc. Chicago, Illinois, USA). Mean ± SD was calculated for each group and ANOVA was applied as a statistical tool.

Results

In this study, branched lip pattern was most prevalent (30%) followed by reticulated pattern (26%), intersected pattern (23%), and vertical lip pattern (15%) [Table 1, Graph 1]. In skeletal class I group, branched pattern was most prevalent (29%), followed by intersected (25%), reticular (24%), and vertical lip pattern (22%). In skeletal class II group, again the branched pattern was most common (32%), followed by reticular (29%), intersected (25%), and vertical lip pattern (14%) [Table 2, Graph 2]. However, no statistical significance could be derived between lip pattern type and skeletal malocclusion ($P = 0.8$) [Table 3].



Graph 1: Graph depicting lip patterns in studied population

Table 1: Table demonstrating lip patterns in decreasing order of frequency

Lip print patterns	Percentage prevalence
Branched	30%
Reticular	26%
Intersected	23%
Vertical	15%

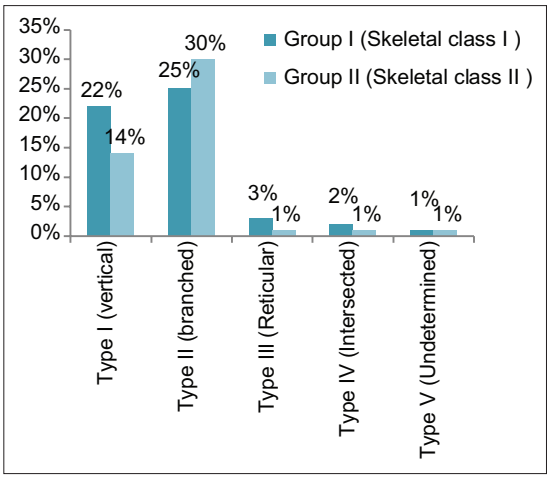
Discussion

Lip prints demonstrate significant regional variations. Cheiloscopic patterns are considered as analogous entities to dermatoglyphic patterns in correlation with various disease states and congenital conditions along with forensics.[9]

Parikh, *et al.* (2019) in their analysis showed higher prevalence of type I lip pattern and class II molar malocclusion. No statistically significant values were obtained among other lip print patterns and malocclusion.[10]

Ponnuswamy, *et al.* (2017) assessed association between lip print patterns and skeletal classes I and II malocclusionsin 25 subjects between age-groups of 18 and 35 years. Study results showed significant difference between vertical and branched lip-print patterns and both the malocclusions whereas no difference was observed among the reticular, intersected, and undetermined patterns.[11]

Kaushal, *et al.* (2018) in their study observed that the branched pattern was most prevalent (30%) while the undetermined pattern was least common (2.63%).[12] Current study found branched pattern most prevalent (Group I 29% and Group II 32%), however, no undetermined patterns were recorded in this study. Thus, it is evident that lip patterns show regional variations. For example, studies from Japanese and Indo-Dravidian populations report high incidence of intersected lip-prints whereas branched and reticular lip patterns were more common in North Indian and Malayalam populations.[13,14] Ize *et al.* (2017) reported high incidence of vertical lip pattern.[2]



Graph 2: Graph showing prevalence of lip patterns and skeletal class I and II malocclusions

The ANB angle determines the antero-posterior jaw relations. Aditi, *et al.* (2019) assessed 60 individuals (aged between 18 and 30 years) with skeletal class I, Class II Div. 1, Class II Div. 2 and Class III malocclusion which were confirmed through ANB angle. It was found that type I' was highly prevalent in skeletal class I, intersecting pattern (type III) was common in skeletal class II div. 1 and type I lip pattern was prevalent in skeletal class III malocclusion.[15]

Pal, *et al.* (2018) showed significant association between types I and IV patterns with the skeletal parameters ($P < 0.05$).[16]

Vignesh, *et al.* (2017) assessed correlation between cheiloscopic pattern with terminal planes in primary dentition of children aged between three to six years. Significant correlation were found in:[4]

a. Types IV (reticular) and V (irregular) patterns and mesial terminal step.[4]
b. Type IV (reticular) pattern with distal terminal step and type I pattern (complete vertical) with flush terminal planes. No association between cheiloscopic patterns and gender was obtained in this study.[4]

Malocclusion occurs as a third significant morbid event affecting orofacial structures by WHO, thus, forming a considerable public health problem.[17] Most importantly, malocclusions have an intricate relation with masticatory muscles.[18]

Raghav, *et al.* (2013) foundan association of skeletal class III lips patterns with vertical groove pattern (type I). The branched and reticular patterns were more common in skeletal class II subjects. However, no significant association was observed between cheiloscopic patterns and skeletal classes I and II malocclusions. This study reported the following findings:[8]

a. In skeletal Class I malocclusion, the branched pattern was most prevalent (31.58%), which was followed by reticular (26.32%), intersected (21.05%), vertical (18.42%), and undetermined lip pattern (2.63%).[8]
b. In skeletal Class II malocclusion, again branched pattern

Table 2: Table depicting prevalence of lip print patterns with skeletal class I and II malocclusion

Type of lip print pattern	Group I (Skeletal class I)	Group II (Skeletal class II)	Total	*P* (ANOVA)
Type I (vertical)	22%	14%	36%	0.8
Type II (branched)	25%	30%	55%	
Type III (Reticular)	03%	01%	04%	
Type IV (Intersected)	02%	01%	03%	
Type V (Undetermined)	01%	01%	02%	
Total	53%	47%	100%	

Table 3: Table depicting statistical correlation between lip print patterns and skeletal malocclusion using ANOVA

Lip patterns	Mean±SD		Std. error	Df	*P*
	Group I	Group II			
Branched Intersected Reticular Vertical	10.6	9.4	11.844	12.818	0.89

was more commonly found (36.84%), followed by intersected (23.68%), reticular (18.42%), vertical (15.79%), and undetermined lip pattern (5.3%).[8]

c. In skeletal class III malocclusion, the vertical pattern was most frequently found (42.11%), then were branched (28,9%), intersected (21.05%), and reticular pattern (7.89%).[8]

Kulkarni (2011) in their analysis demonstrated a strong negative correlation of ANB angle (0.9060) with sagittal jaw relation. Sagittal jaw relations are determined by studying Steiner's, McNamara and Down's analysis. If all parameters are within normal range, then a subject is classified as having skeletal class I jaw relationship, however, sagittal jaw relation is considered to be effective, if any of the parameters vary and the subject is placed under skeletal class II or III jaw relations.[19]

Other malocclusions studies involve molar-to-molar, canine, and incisal relations. Vignesh (2018) reported association between different cheiloscopic patterns with inter-canine relationships. Type IV (reticular) pattern was most frequently seen in class I canine relation. Both types A and IV lip patterns were more frequently seen in class II canine relation, while the type V cheiloscopic pattern was more frequently noted in class III inter-canine relation. All canine relationships showed significance ($P = 0.005$) with cheiloscopic patterns. Association studies with cheiloscopic patterns and different types of malocclusion have been reported in primary dentitions as it acts as predictor of malocclusion in permanent dentition.[20]

Cheiloscopy can be incorporated in the routine practice and many of the malocclusion both dental and skeletal can be predicted and appropriate preventive programs can be initiated at the early age so that full blown malocclusions can be prevented. Patient's psychological problems develop because full blown malocclusions can also be prevented by early diagnosis.

Cheiloscopy is study of the genetic factors only, which gives the results its limitations, the influence of local factors and the most important the environmental factors also plays significant role in causing malocclusion. The larger sample size would be desirable to explore the real nature of association between cheiloscopy and malocclusion.

Conclusion

Cheiloscopy is a predictor of many oro-facial and dental diseases. Its association has been proven with numerous developmental patterns such as malocclusions in both primary and permanent dentitions. This study provides and supports its close relation with development of skeletal malocclusion.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

The present study did not receive funds or grants from any of the agencies in India or Abroad.

Conflicts of interest

There are no conflicts of interest.

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