Evaluation of lip print patterns, lip strain and lip thickness in skeletal class I and class II malocclusion.

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Introduction- Modern orthodontics has extensively explored the relationship between skeletal malocclusions, encompassing Class I, II, and III, and also took into account the morphology of their facial soft tissues. This ability would provide more information about the individual's identity and assist in early intervention and treatment planning. This study will help in assessment of lip prints as well as lip strain and lip thickness and their relation with skeletal malocclusion found in different individuals.

Materials and methods- Seventy-two individuals, aged 18 to 25, participated in the study. Half of the participants (36) presented with a Class I skeletal pattern, while the other half (36) exhibited a Class II skeletal pattern. The materials utilized included red lipstick, A4-sized white bond paper, cellophane tape, a cephalostat machine, pre-treatment lateral cephalograms, and tracing essentials. The study participants were chosen based on a pre-defined set of criteria for eligibility. Pre-treatment cephalograms were collected from the subjects and utilized to classify them into Skeletal Class I or Class II based on ANB angular measurements and the Wits Appraisal. Red lipstick was applied to the lips using a brush, and lip prints were collected by pressing adhesive tape onto the lips. The tape was then affixed to white paper for analysis, which was performed with the aid of a magnifying lens, following the Tsuchihashi classification method. The lateral cephalogram of the respective patient was imported to tracing sheet where cephalometric landmarks were traced.

Statistical analysis- A t-test was used to compare quantitative data between groups, while the Chi-Square test was applied for analysing qualitative data.

Result - The study results revealed that the most common lip pattern was type II (branched grooves), accounting for 28.9%, followed by type I (complete straight grooves) at 27.8%. Type III (intersected grooves) was observed in 20.9% of cases, while type IV (reticular grooves) and type I' (partial straight grooves) were each found in 8.4% of the participants and Individuals with a Skeletal Class II malocclusion tended to have thicker upper and lower lips than those with a Skeletal Class I malocclusion. However, the difference in lip strain between the two groups was not statistically significant.

Conclusion - The Type II (branched grooves) lip pattern was the most common in individuals with Skeletal Class I malocclusion, while the Type III (intersected grooves) lip pattern was more strongly associated with predicting Class II malocclusion. The study found no statistically significant difference in lip strain between individuals with Skeletal Class I and Class II malocclusions. Based on these findings, lip strain may not vary significantly between Class I and Class II cases.

Introduction

Modern orthodontics has thoroughly investigated the relationship between facial soft tissue structures and skeletal malocclusions, including Class I, II, and III. Lip prints, akin to fingerprints, are distinct to each individual and exhibit a robust hereditary pattern and also lip prints can be considered a valuable diagnostic and forensic tool in this context.[1] (Fig.1) Cheiloscopy is the term used to describe the analysis of lip prints.[2] Similar to fingerprints, each person's lip print is distinct and demonstrates a strong inherited pattern.[3] By correlating sagittal jaw alignment with lip prints, clinicians may be able to predict the type of malocclusion a person could have. It can also be used to study the genetic factors associated with malocclusion and assist in early prevention of its occurrence. Lip thickness and lip posture are very closely associated with esthetic stability and function. Orthodontic research has extensively explored the hard and soft tissues that influence smile aesthetics.[4] While dentoskeletal and soft tissue standards usually guide orthodontic treatment, it’s important to consider individual variations in lip thickness, lip posture, and dentoskeletal patterns, as these factors differ for each person.[5,6]

This study was carried out to evaluate lip prints, lip strain, and lip thickness, and to examine how they relate to skeletal malocclusion in individuals.

Figure 1. Diagrammatic representation of lip groove patterns

Materials And Methodology

A group of 72 patients was chosen according to the inclusion and exclusion criteria, and they were briefed about the study procedure before signing a consent form. Lateral cephalograms were collected as pre-treatment records and used to categorize the patients into Skeletal Class I and Class II based on ANB angular measurements and Wits Appraisal. The study included patients aged 18-25 years with skeletal Class I and Class II malocclusion, determined by the ANB angle and Wit's appraisal. Participants also had to be free from any lip lesions, congenitally missing teeth, and facial defects. Only those patients who were not missing any teeth, except for third molars, and those who had undergone extractions were included in the study. The lateral cephalogram of the respective patient was imported to tracing sheet where cephalometric landmarks were traced and the below mentioned 3 linear parameters of analysis were taken for the study: Upper lip thickness, Upper lip strain, Lower lip thickness. Following the cephalometric analysis, lip prints were collected by applying a red lipstick using a lip brush and then placing a cellophane adhesive tape over the lips. (Fig.2) Next, the cellophane adhesive tape, which held the lip patterns, was placed onto a white bond sheet. The lip prints were then

subsequently examined with the help of a magnifying lens, using the Tsuchihashi classification system.[5] (Fig.3)

Figure 2. Lip print evaluation with cellophane method

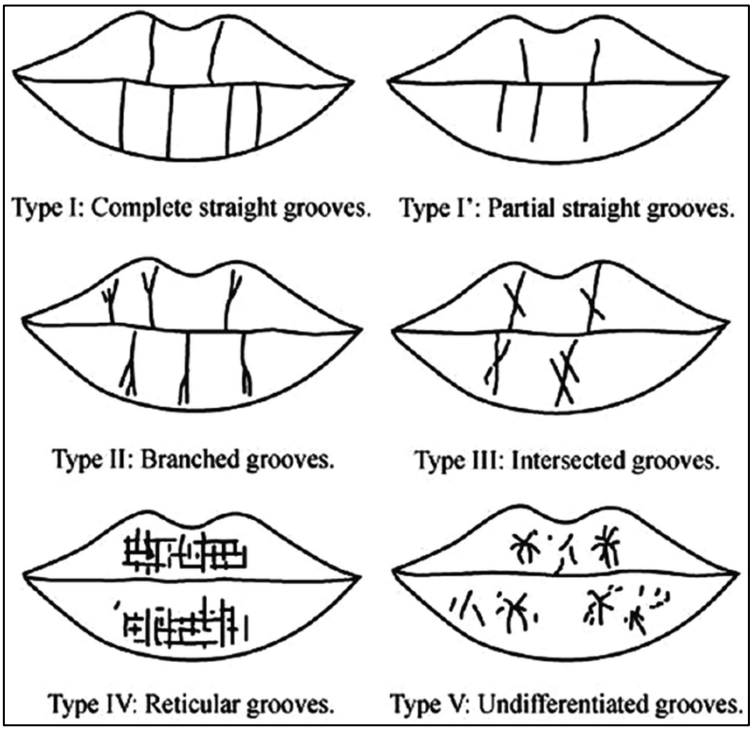


Figure 3. Tsuchihashi's classification for lip print

Statistical Analysis

The data from this study were analysed statistically, with intergroup comparisons of quantitative data performed using a t-test and qualitative data using the Chi-Square test.

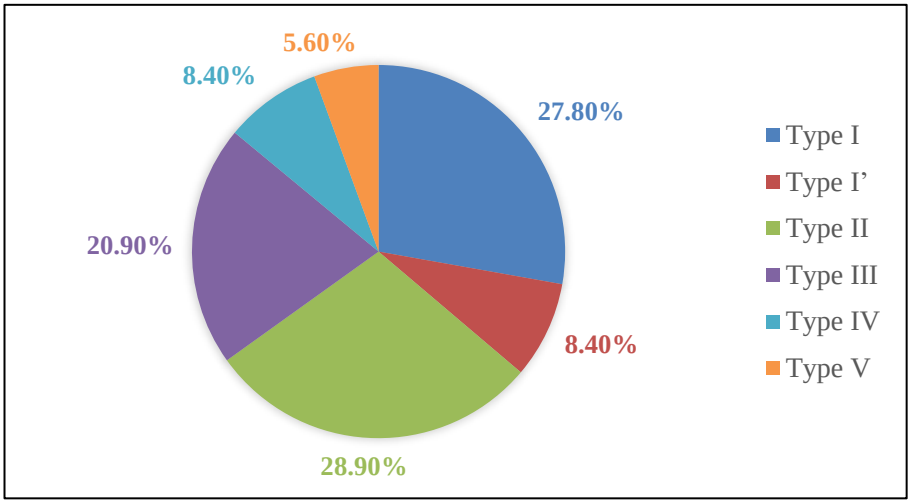
Result

The study findings indicated that the most frequent lip pattern was type II (branched grooves) at 28.9%, followed by type I (complete straight grooves) at 27.8%, type III (intersected grooves) at 20.9%, and both type IV (reticular grooves) and type I' (partial straight grooves) at 8.4% [Table 1]. These differences were found to be statistically significant (**p=0.0009**)

Table 1: Prevalence of lip print patterns in skeletal class I and II malocclusion

Type of lip print pattern	Group I (Skeletal class I)	Group II (Skeletal class II)	Total	P - Value
Type I (Complete straight grooves)	15.3%	12.5%	27.8%	
Type I' (Partial straight grooves)	4.2%	4.2%	8.4%	
Type II (Branched grooves)	19.2%	9.7%	28.9%	
Type III (Intersected grooves)	2.8%	18.1%	20.9%	**0.009**
Type IV (Reticular grooves)	2.8%	5.6%	8.4%	

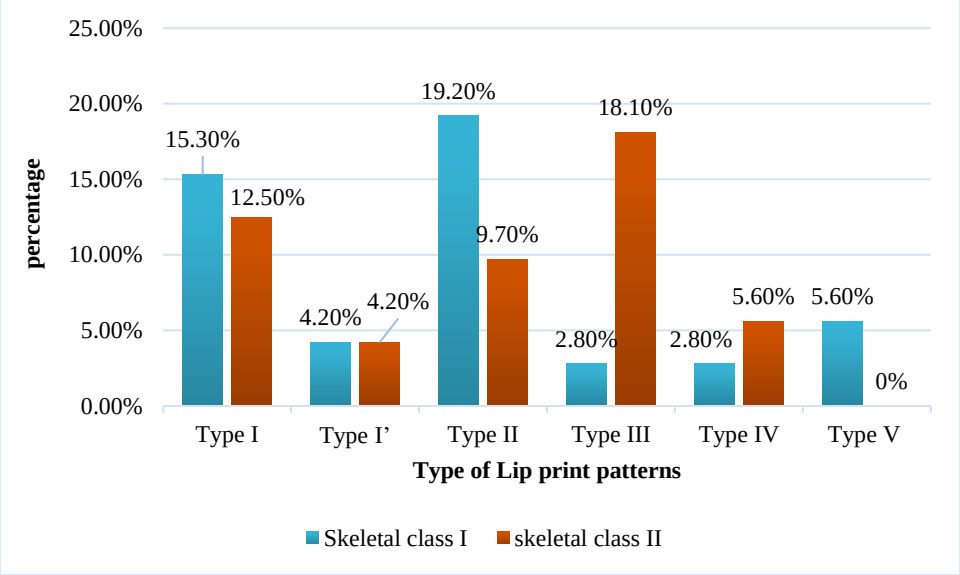
Type V (Undifferentiated grooves)	5.6%	0%	5.6%	
Total	49.9%	50.1%	100%	



Graph 1. Prevalence of different types of Lip print patterns among skeletal class I and class II malocclusion

Table-2: Lip print patterns in different skeletal malocclusions.

Lip Pattern	Skeletal type	
	Class 1	**Class II**
Type I	11 (15.3%)	9(12.5%)
Type I'	3 (4.2%)	3 (4.2%)
Type II	14 (19.4%)	7 (9.7%)
Type III	2 (2.8%)	13 (18.1%)
Type IV	2 (2.8%)	4 (5.6%)
Type V	4 (5.6%)	0 (0%)



Graph 2. Comparison of Lip print patterns between Skeletal Class I & Class II Groups

Table 2 showed the prevalence of different lip print patterns in skeletal class I and class II malocclusion and it was found that the most prevalent lip print pattern in skeletal class I malocclusion was type-II at 19.20%, followed by type-I at 15.30% and in the skeletal class II malocclusion, the most prevalent lip print pattern was type-III at 18.10%, followed by type-I at 12.50% [Table/graph 2].

Table 3: Association of lip print pattern between skeletal Class I and Class II malocclusion

Lip Pattern	Skeletal type		Chi-Square value	p-value
	Class I (n=36)	Class II (n=36)		
Type I	11 (30.55%)	9(25%)	0.277	0.599
Type I'	3 (8.33%)	3 (8.33%)	0.000	1.000
Type II	14 (38.88%)	7 (19.44%)	3.294	0.070

Type III	2 (5.12%)	13 (36.11%)	10.189	**0.001**
Type IV	2 (5.12%88)	4 (11.11 %)	1.682	0.431
Type V	4 (11.11%)	0 (0%)	4.235	**0.040**

p ≤ 0.05 – Significant, CI = 95 %

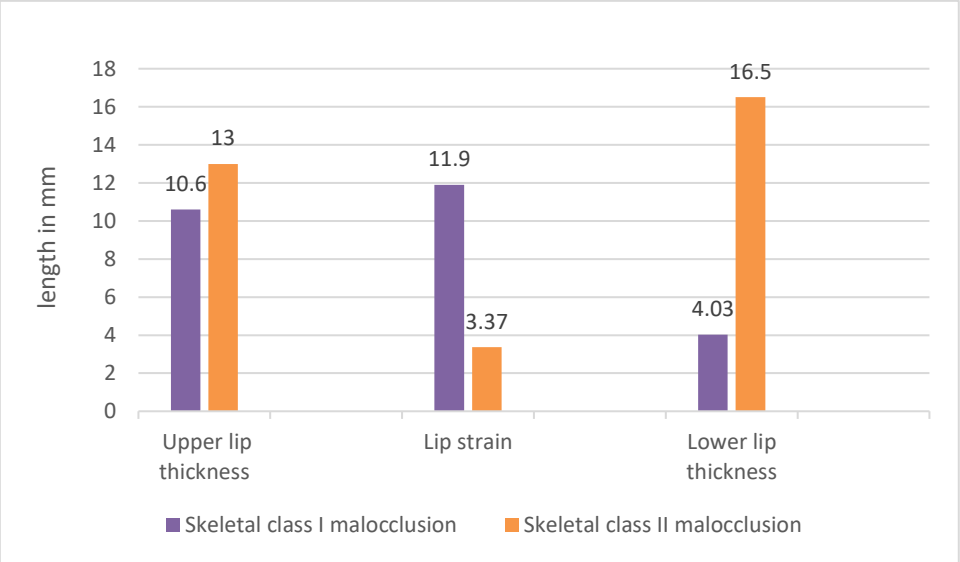
Table 3 showed relationship between lip print patterns among different skeletal malocclusions and it was found that type-III (branched grooves) and type-V (Undifferentiated grooves) had greater association with skeletal malocclusion. The results were found to be statistically significant between the two types of malocclusions i.e. skeletal class I and class II malocclusion (**p-value=0.001, p-value=0.040)** respectively. [Table-3].

Table 4: Comparison between soft tissue variables in skeletal class I and class II malocclusion

Variable	Skeletal	Mean	Std. Deviation	F-value	p-value
Upper lip thickness	Class I	10.6	2.056	24.785	**0.000**
	Class II	13.0	1.916		
Lip strain	Class I	4.03	2.351	2.134	0.149
	Class II	3.37	1.425		
Lower lip thickness	Class I	11.9	2.166	90.780	**0.000**
	Class II	16.5	1.930		

The results indicated that patients with Skeletal Class II malocclusion generally exhibited greater upper and lower lip thickness than those with skeletal Class I malocclusion and the result was found to be statistically significant between the two skeletal malocclusions (p-value=0.000). Although the lip strain was greater in skeletal class I than skeletal class II malocclusion, there was no statistical significant difference between the two skeletal malocclusion patients in this study (p-value=0.149). This implies that while there appears to

be a difference in the measured lip strain between the two skeletal malocclusions, the difference is not large enough to confidently attribute it to the skeletal classification rather than to random variation or individual differences. [Table 4, graph 3].



Graph 3. Comparison of lip thickness and lip strain in skeletal class I and class II malocclusion

Discussion

In orthodontics, the focus on soft tissues has become increasingly significant in both diagnosis and treatment planning. Orthodontics examines how jaw, facial, and body development impact tooth alignment.[6] The current study found that the branched (type II) lip pattern was the most common both among all subjects and in patients with a Class I skeletal pattern. Following type II, type III (intersected grooves) was the next most common lip pattern among the subjects, and it was also the most prevalent in patients with a Class II skeletal pattern. Comparable results were found in studies by Poudel P et al., Raghav P et al., and Kaushal B et al., involving the North Indian population.[7,8,9] In the present study, the branched lip pattern (type II) was most common in subjects with Class I malocclusion, while the intersected pattern (type III) was most prevalent in those with Class II malocclusion. However, studies by Aditi S et al.[10] and Vignesh R et al.[11] found that type I (vertical grooves) was more predominant in Class I malocclusion,

and in Vignesh R et al.'s study, subjects with Class II malocclusion exhibited type IV (reticular grooves). Ponnusamy S et al.[12] found that type I (vertical groove) lip pattern was the most common. In contrast, Raghav et al.[8] observed that individuals with Skeletal Class I and Class II malocclusions primarily exhibited Type II lip print patterns (branched grooves), while those with Skeletal Class III malocclusion most often displayed Type I patterns (complete straight grooves). However, in the present study, Type II (branched grooves) patterns were more frequently observed in individuals with skeletal Class I malocclusion. The comparison of lip strain between the two groups revealed that individuals with Skeletal Class I malocclusion had higher lip strain than those with Skeletal Class II malocclusion. However, this difference was statistically insignificant, indicating that lip strain may not be influenced by skeletal malocclusion. This result is consistent with the studies by Sharma A et al. and Rathi SS et al. [13,14] but contradicts the findings of Aggarwal I et al.[15] and Lee YJ et al.[16], who reported higher upper lip strain in individuals with skeletal Class II malocclusion compared to those with Class I.

Conclusion

- This study highlights the potential role of lip prints, lip strain and lip thickness as valuable parameters in diagnosing skeletal malocclusions.
- In individuals with Skeletal Class I malocclusion, the Type II (branched grooves) lip pattern was the most frequently observed.
- The Type III (intersected grooves) lip pattern has a greater likelihood of predicting Class II malocclusion.
- Patients with Skeletal Class II malocclusion typically had thicker upper and lower lips compared to those with Skeletal Class I malocclusion. However, lip strain was not affected by any skeletal factors.
- The present study found no statistically significant difference in lip strain between individuals with Skeletal Class I and Class II malocclusion.

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