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Cheiloscopy: Lip prints as a marker for sagittal jaw relation

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Abstract

Introduction: Lip prints can be used as evidence in personal identification and criminal investigation in forensic dentistry. Establishing a correlation between sagittal jaw relation and lip prints would benefit the clinician by predicting the type of malocclusion and can also provide additional information on individual personal identity.

Aim: This study was designed to explore the possible association of lip prints with skeletal Class I, Class II and Class III malocclusions.

Materials and Method: A sample of 210 subjects in the age group of 18-25 years were selected. Subjects were divided into four groups group I (Class I) group II (Class II Div1), group III (Class II Div 2) and group III (Class III). Lip prints of all the individuals were recorded and compared.

Results: It was found that Branched lip pattern was most common in total sample population with no sexual dimorphism. The most predominant pattern in Class I and Class II subjects is Branched type and in Class III subjects is reticular.

Conclusion: No statistically significant association of lip prints with Skeletal Class I, Class II and Class III malocclusion was revealed.

Keywords: Lip prints, Orthodontic diagnosis, Sagittal jaw relation

Introduction

Human identification is of paramount importance and it is challenging considering the fact that every individual is

distinct and exhibits his own patterns of characteristics. With tremendous demand placed upon law enforcement to provide justice, it is logical to use any type of physical characteristic to identify an individual. Finger prints, DNA fingerprinting play a behemoth role in forensic science. In forensic identification, the mouth allows for a myriad of possibilities. Apart from teeth, some of the relevant data can also be derived from soft oral and perioral tissue prints. Lips, as well as the hard palate, are known to play a supplemental role in personal identification (1).

External surface of lips have many elevations and depressions forming a characteristic pattern called lip prints, examination of which is known as cheiloscopy. It can be defined "as a science dealing with lines appearing on red part of the lips or as a method of identification of a person based on characteristic arrangements of wrinkles and grooves appearing on the lips". Suzuki and Tsuchihashi (2) in 1970 were among first to give classification of various patterns present on human lips. In 1999, the Federal Bureau of Investigation (FBI) and the Illinois State Police stated that "lip prints are unique like fingerprints and are a positive means of identification" (3). Lip prints are unique to a person and they show strong hereditary pattern just like fingerprints and their pattern varies both in males and females. They are established during 6th month of intrauterine life and do not change throughout life. It has been verified that they recover after undergoing alterations like trauma, inflammation and diseases like herpes. Their configuration and form of the furrows cannot be altered by environmental factors (4). It is one of the most interesting and emerging methods of individual identification, and aids in criminal and forensic investigations.

Lip prints may vary in different kinds of malocclusion. Since lip prints develop earlier than jaw relation, establishing a correlation between sagittal jaw relation and lip prints would benefit the clinician by predicting the developing malocclusion and can help in intercepting it from developing into a severe one. Thus, the present study is conducted to find an association of lip print patterns with sagittal jaw relation.

Material and Method

The present study was carried out in the Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College & Hospital, Ahmedabad. It was approved by the Institutional Ethical Committee (IEC). For this study 210 subjects equally divided between males and females, with age ranging from 18-25 years visiting the department and dental students who have not undergone orthodontic treatment previously were selected and divided according to skeletal sagittal jaw relation. Lateral cephalograms were taken for each patient. Criteria for sample selection included subjects having no lesions on the lips, no congenital facial defects, no congenitally missing teeth or extracted teeth (except third molars), individuals with known hypersensitivity to lipsticks and individuals with no history of previous orthodontic treatment or maxillofacial surgery. A written informed consent was obtained from all the subjects as prescribed and approved by ethical committee.

The subjects were divided into 4 groups on the basis of their ANB angle, WITS appraisal and Beta angle as follow.

Lip print recording: The subjects are asked to sit at relaxed position on a dental chair, and the lips of the subjects are cleaned with the help of wet cotton. The lipstick is applied with a single stroke evenly on the vermillion border. Over the lipstick, the glued portion of the cellophane tape strip is placed and a lip impression is made by dabbing it first in the center and then pressing it uniformly towards the corners of the lips. The cellophane strip is then stuck to the white bond paper for permanent record. The subject is

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provided with tissue paper to clean the lips. A vertical line is drawn with a pencil at the center of the print. At a distance of 5 mm on either side of this line, parallel lines are drawn to the first line. These lines demarcate the middle 10 mm of the lower lip, which is the area to be studied and the lip impressions are subsequently visualized with the use of a magnifying lens. This is chosen because the center portion of the lower lip is the area that represents the lip print pattern and diagnostically significant in forensic investigation. Tsuchihashi's classification of lip print was used to analyze the lip prints.

Tsuchihashi's classification for lip print identification:

Type 1: Clear-cut grooves running vertically across the lips

Type 2: Fork grooves in their course

Type 3: Intersecting grooves

Type 4: Reticulate grooves

Type 5: Undetermined

Statistical analysis

The data values were tabulated and subjected to statistical analysis. For comparison of proportions between all the groups and also between genders, Chi-Square test was applied. The sample Z test to compare the sample proportion was done using using SPSS version 23. A p-value of <0.05 is considered as statistically significant.

Result

The most predominant lip pattern in the total study sample is branched type (Type II) (35.2%). This is followed, in order, by vertical type (Type I) (26.7%), reticular type (Type IV) (21.9%), intersected type (Type III) (13.8%), and undetermined type (Type V) (2.4%) (Table I). No sexual dimorphism occurs in lip print patterns is observed (P=0.726). The most predominant pattern in Class I (Table II), Class II Div1 (Table III) and Class II Div 2 (Table IV) subjects is branched type lip print pattern and reticular pattern in Class III subjects (36.7%) (Table V). Comparing lip print pattern of skeletal Class I subjects with skeletal Class II Division 1 and Division 2 subjects, shows branched pattern predominant in both and reticular pattern in Class III subjects.

Fig 1: Different types of lip print pattern

Table I: Prevalence of different lip patterns in study population

Type of lip prints	Female		Male		Overall		Z cal	Z critical	P value	Sig
	N	%	N	%	N	%				
Vertical	28	26.7	28	26.7	56	26.7	0	3.84	1	NS
Branched	39	37.1	35	33.3	74	35.2	0.36	3.84	0.548	NS
Intersected	14	13.3	15	14.3	29	13.8	0.04	3.84	0.841	NS

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Reticular	23	21.9	23	21.9	46	21.9	0	3.84	1	NS
Undetermined	1	1.0	4	3.8	5	2.4	1.96	3.84	0.161	NS
Total	105	100.0	105	100.0	210	100.0				
Chi sq	2.019		Df	4.0	P value	0.726 NS				

Table II: Prevalence of different lip patterns in Class I malocclusion

	Female		Male		Overall					
Type of lip prints	N	%	N	%	N	%	Z cal	Z critical	P value	Sig
Vertical	8	26.7	8	26.7	16	26.7	0	3.84	1	NS
Branched	11	36.7	10	33.3	21	35.0	0.09	3.84	0.764	NS
Intersected	5	16.7	4	13.3	9	15.0	0.16	3.84	0.689	NS
Reticular	6	20.0	7	23.3	13	21.7	0.09	3.84	0.764	NS
Undetermined	0	0.0	1	3.3	1	1.7	1	3.84	0.317	NS
Total	30	100.0	30	100.0	60	100.0				
Chi sq		1.2	Df	4.0	P value	0.872 NS				

Table III: Prevalence of different lip patterns in Class II Div1 malocclusion

	Female		Male		Overall					
Type of lip prints	N	%	N	%	N	%	Z cal	Z critical	P value	Sig
Vertical	6	20.0	9	30.0	15	25.0	0.81	3.84	0.368	NS
Branched	14	46.7	11	36.7	25	41.7	0.64	3.84	0.423	NS
Intersected	3	10.0	5	16.7	8	13.3	0.64	3.84	0.423	NS
Reticular	6	20.0	4	13.3	10	16.7	0.49	3.84	0.483	NS
Undetermined	1	3.3	1	3.3	2	3.3	0	3.84	1	NS
Total	30	100.0	30	100.0	60	100.0				
Chi sq		1.9	Df	4.0	P value	0.761 NS				

Table IV: Prevalence of different lip patterns in Class II Div 2 malocclusion

Class II 2	Female		Male		Overall					
Type of lip prints	N	%	N	%	N	%	Z cal	Z critical	P value	Sig
Vertical	9	30.0	7	23.3	16	26.7	0.36	3.84	0.548	NS
Branched	10	33.3	12	40.0	22	36.7	0.25	3.84	0.617	NS
Intersected	4	13.3	5	16.7	9	15.0	0.16	3.84	0.619	NS
Reticular	7	23.3	5	16.7	12	20.0	0.36	3.84	0.548	NS

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Undetermined	0	0.0	1	3.3	1	1.7	1	3.84	0.317	NS
Total	30	100.0	30	100.0	60	100.0				
Chi sq		1.9	Df	4.0	P value	0.759 NS				

Table V: Prevalence of different lip patterns in Class III malocclusion

Class III	Female		Male		Overall					
Type of lip prints	N	%	N	%	N	%	Z cal	Z critical	P value	Sig
Vertical	5	33.3	4	26.7	9	30.0	0.16	3.84	0.689	NS
Branched	4	26.7	2	13.3	6	20.0	0.81	3.84	0.368	NS
Intersected	2	13.3	1	6.7	3	10.0	0.36	3.84	0.548	NS
Reticular	4	26.7	7	46.7	11	36.7	1.21	3.84	0.271	NS
Undetermined	0	0.0	1	6.7	1	3.3	1	3.84	0.317	NS
Total	15	100.0	15	100.0	30	100.0				
Chi sq		2.9	Df	4.0	P value	0.540 NS				

Table VI: Comparison of lip print patterns in Class II and Class III

Overall	Class II		Class III		Overall			
Type of lip prints	N	%	N	%	Z cal	Z critical	P value	Sig
Vertical	31	25.8	9	30.0	0.25	3.84	0.617	NS
Branched	47	39.2	6	20.0	4	3.84	0.045	S
Intersected	17	14.2	3	10.0	0.36	3.84	0.547	NS
Reticular	22	18.3	11	36.7	4.84	3.84	0.027	S
Undetermined	3	2.5	1	3.3	0.09	3.84	0.764	NS
Total	120	100.0	30	100.0				
Chi sq		6.693	Df	4.0	P value	0.153 NS		

On comparison of different lip print patterns between Class II and Class III subjects reticular type (Type IV) is found to be more predominant in Class III subjects (36.7%) as compared to Class II subjects (18.3%). This difference is found to be statistically significant. (P=0.027). Branched type (Type II) is found to be more predominant in Class II subjects (39.2%) as compared to Class III subjects (20%) difference of which is found to be statistically significant (Table VI).

Discussion

The development of sagittal relation is a result of the interaction and synergistic effects of genetic and environmental factors. The effect of a particular environmental factor on phenotype varies depending on genetic background, which ultimately determines facial and dental morphology. Although the existence of lip prints was noted as early as 1902, its importance did not reach the forensic specialists until it was found in a murder scene. They develop much earlier in life (6th

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month of intrauterine life) and do not change with time which makes it special to be used as an analytical tool in the forensic dentistry. Any factor that influences the development of a particular structure will ultimately affect all the other structures that develops along with it. So there is a possibility for the developmental changes that occur in relation to jaws might be reflected in the cheiloscopic patterns [5]. This study is an attempt to find a link between lip prints and maxillary and mandibular teeth, which could be helpful in predicting the developing malocclusion at an earlier age.and be helpful in providing preventive and interceptive orthodontic treatment when necessary.

The most predominant lip pattern in the total study sample is Branched type (35.2%) followed by vertical type (26.7%), reticular type (21.9%), intersected type (13.8%), and undetermined type (2.4%).

The most predominant pattern in Class I and Class II subjects is branched type lip. This is in accordance to the study done by Pradeep R et al [6] (36.84%), Babita Kaushal et al [7] in which branched pattern (Type II) was most predominantly seen in Class II and Class I group. No sexual dimorphism is seen in our study (P= 0.759) which is also signified by 'Z' value (<3.84). This is in accordance with the study conducted by Pradeep R et al [6], Babita Kaushal et al [7], Sujatha Ponnusamy et al [3] and Vignesh R et al [8] which showed no significant difference in lip pattern between males and females with Class I and Class II malocclusion.

The most predominant pattern in Class III subjects is reticular (Type IV) (36.7%). This is in accordance to the study done by Shivani et al [9] in which most predominant lip pattern in individuals with Class III malocclusion was assessed and Type I and IV, Type III and IV were found to be more predominant.

On comparing subjects having skeletal Class I and Class II no significant difference in the lip patterns is found, as indicated by P value (0.883). This is in accordance with the study by Pradeep R et al [6] in which no significant difference was found when Class I group was compared to Class II.

On comparing lip prints on Class I with Class III subjects no significant difference between the two was found (P= 0.421) and Z cal (<3.84). This is in accordance to the study by Vignesh R et al [8] in which no significant lip print patterns was found between Class I and Class III subjects. This is in contrast to the study of Pradeep R et al [6] who observed branched (Type II) lip print pattern to be significantly predominant in subjects with Class I than Class III jaw relation.

On comparison of different lip print patterns between Class II and Class III subjects Reticular type is found to be more predominant in Class III subjects (36.7%) as compared to Class II subjects (18.3%) and branched type is found to be more predominant in Class II subjects (39.2%) as compared to Class III subjects difference of which is found to be statistically significant. (P=0.045). This is in accordance with the study by Kulkarni et al [10] in which significant difference was observed among skeletal Class I, Class II and Class III groups. This is in contrast to the study by Pradeep R et al [6] in which significant difference was found in vertical type (Type I) which was predominant in Class III group.

Conclusion

It is found that branched type (Type II) cheiloscopic pattern is prevalent in the total sample. Skeletal Class I and Class II Div1 and Class II Div2 subjects also shows branched (Type II) to be predominant cheiloscopic pattern. Skeletal Class III subjects show reticular (Type IV) pattern predominant. No statistically significant difference is observed between lip prints of skeletal Class

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I, skeletal Class II and skeletal Class III subjects. No sexual dimorphism is observed. Further research with larger sample size with different ethnic groups may be necessary.

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