

Assessment of Lip Phenotype and its Association with Anterior Tooth Alignment in Children

Anusha Balavanthapu, Suzan Sahana, Aron Arun Kumar Vasa

Department of Pedodontics and Preventive Dentistry, St. Joseph Dental College, Eluru, Andhra Pradesh, India

Abstract

Background: Lip types are typical for every person, and there are three basic lip phenotypes in humans. Uncertainty exists as to whether a general trend follows in the classification of lip according to the dental alignment. **Aim:** The purpose of this study was to assess the correlation between lip phenotype and the type of anterior tooth alignment. **Materials and Methods:** The study sample comprised schoolchildren aged between 10 and 14 years screened before the study and equally divided ($n = 50$) based on lip phenotypes given by Cutbirth classification on the basis of lip form as high, moderate, and straight lip. Parameters assessed included anterior well-aligned teeth, anterior malaligned teeth, crowding, spacing, midline diastema, increased anterior maxillary overjet, anterior deep bite, and retroclined anterior teeth. Scores for each of these morphologic characteristics were determined by direct measurement. Descriptive and analytical statistics were done. **Results:** The Chi-square test was used to check differences in proportions. The statistical significance was set at $P < 0.05$. Statistical significant correlations were observed between anterior tooth alignment and the lip phenotype. **Conclusion:** The malaligned anterior teeth were significantly higher in children with high and moderate lip phenotypes, whereas the well-aligned anterior teeth were a general trend that existed in children with straight lip phenotype.

Keywords: Anterior tooth alignment, lip phenotype, malaligned teeth

INTRODUCTION

Esthetics is one of the important reasons why people seek dental treatment.^[1] Increased concern over dental appearance has been observed during childhood and adolescence to early adulthood.^[2,3] Malocclusions are the third in the ranking of priorities among the problems of dental public health worldwide, surpassed only by dental cavity and periodontal diseases.^[4] Good anterior tooth alignment is more favorable in terms of sociability, social class, attractiveness, and intelligence.^[5] Normal occlusion is considered anatomically and functionally essential for the development and maintenance of a healthy dentition.^[6]

The mouth plays a pivotal role in characterizing facial beauty. Burcal *et al.* illustrated that people have a greater substantive interest in changing aspects of their lips than of other facial structures.^[7] Lips are the structures that surround the oral aperture. Craniofacial morphology has been reported to be highly heritable,

but before the research, little was known as to which genetic variants influence normal lip phenotypes. Anatomically, the philtrum and its pillars are a part of the upper lip.^[8]

Historically, it has been taught that the incisal edge of maxillary central incisors should extend approximately 2 mm coronal to the upper lip, when the lip is in repose. This statement is true only if the patient has a horizontally straight lip in repose. According to Cutbirth, there are three basic lip phenotypes in humans when the maxillary lip is in repose. This includes straight lip, moderately arched lip, and maximally or highly arched lip. A basic rule of maxillary incisal plane determination is that there should be some tooth display when the maxillary lip is in repose. This position guides as an essential tool in definitive restorative procedures.^[9]

The concern for facial esthetics is not a new concept to the orthodontic specialty. The majority of orthodontic diagnosis

Address for correspondence: Dr. Suzan Sahana,
Department of Pedodontics and Preventive Dentistry,
St. Joseph Dental College, Eluru, Andhra Pradesh, India.
E-mail: drsuzansahana@gmail.com

Received: 07-Feb-2019 Revised: 04-Sep-2019
Accepted: 12-Oct-2019 Published: 29-Nov-2019

Access this article online

Quick Response Code:



Website:
www.ijpedor.org

DOI:
10.4103/ijpr.ijpr_2_19

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How to cite this article: Balavanthapu A, Sahana S, Vasa AA. Assessment of lip phenotype and its association with anterior tooth alignment in children. *Int J Pedod Rehabil* 2019;4:55-9.

is based on patients' profile and lips at rest while analyzing a static photograph and/or lateral cephalogram. Although several studies have previously investigated the association between malocclusion and lip competence, lip length, and lip thickness, very little has been documented regarding the various lip phenotypes and its clinical significance.^[10,11] Hence, the purpose of this research was to investigate whether lip phenotypes in children influence the anterior tooth alignment. The assessment and a positive correlation suggest that lip form classification may aid as a simple guide in clinical practice to predict occurrence of anterior tooth irregularities in young children.

MATERIALS AND METHODS

The study comprised children aged between 10 and 14 years of both genders from schools of West Godavari district, Andhra Pradesh, South India. Before the commencement of the study, ethical clearance was obtained from the institutional ethical committee. Consent to carry out the screening procedure was obtained from the school authorities as well.

Exclusion criteria

Children with partially erupted anterior teeth and missing anterior teeth and those who underwent previous orthodontic treatment were excluded.

Children with mental or physical impairment, congenital anomalies, or syndromes were also not included in the study.

An analytical tool based on Cutbirth classification of lip phenotypes was used to categorize the children according to the lip type. A total of 860 children were screened until the desired sample size ($n = 150$) was obtained for equal inclusion in each category.

Screening procedure

For the assessment of lip phenotype, each child was examined while seated in a relaxed position with adequate backrest. The lips-in-repose position was produced by having the children who lick their lips and facial surfaces of their upper teeth and then instructing them to part their lips. Alternatively, they were instructed to say "hi" with a relaxed upper lip without smiling. These two methods relax the upper lip, allowing it to fall passively.^[12] Following this, the measurement was carried out using a calibrated ruler and Williams probe. The measurement parameter for the lip form classification was based on the distance from the highest aspect of the lower vermilion border of the upper lip to the line drawn between commissures at rest. According to the classification system, straight type is 0–3 mm in height, moderately arched lip is between 3 and 6 mm, and a highly or maximally arched lip form is >6 mm in height^[1] [Figures 1-3]. Accordingly, the screened children were categorized until the desired sample size in each lip phenotype was obtained. Of a total of 860 children screened, 150 were selected for the study.

The study participants were equally divided based on lip phenotype classification on the basis of lip forms as follows:

- Highly arched lip ($n = 50$)



Figure 1: Straight type of lip form.

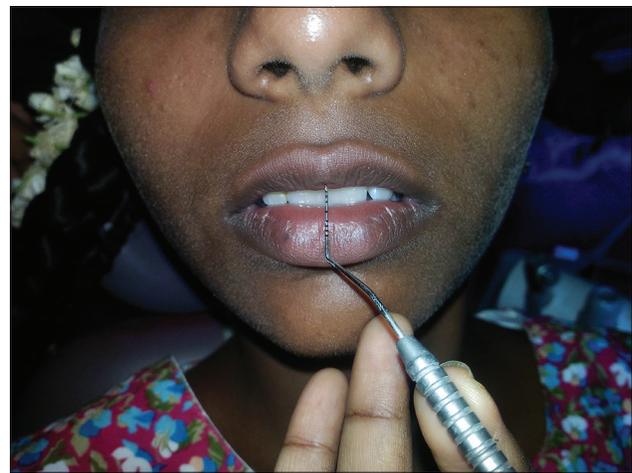


Figure 2: Moderately arched type of lip form.



Figure 3: Highly arched type of lip form.

- Moderately arched lip ($n = 50$)
- Straight lip ($n = 50$).

All the study participants were assessed for anterior tooth alignment. Examination of the children was done under

normal illumination with the help of a mouth mirror, explorer, and William's probe. The presence of any of the following characteristics was noted and documented [Figures 4-6].

- Anterior well-aligned teeth
- Anterior malaligned teeth
- Missing teeth
- Crowding
- Spacing



Figure 4: Well-aligned anterior teeth in straight lip type.



Figure 5: Increased overjet of anterior teeth in moderately arched lip type.



Figure 6: Malaligned anterior teeth in highly arched lip type.

- Midline diastema
- Increased anterior maxillary overjet
- Anterior deep bite
- Retroclined anterior teeth.

Scores for each of these morphologic characteristics were determined by direct measurement. The association between type of anterior tooth alignment and lip phenotypes was analyzed.

Statistical analysis

Descriptive and analytical statistics were done. The Statistical Package for the Social Sciences software version 22.0 (IBM Corporation, Chicago, USA) was used to analyze the data. The Chi-square test was used to check differences in proportions. The statistical significance was set at $P < 0.05$.

RESULTS

The association between anterior tooth alignment and lip phenotype (moderate and high type) was statistically significant. Table 1 represents the demographic data of the study sample that comprises 88 boys and 62 girls with a mean age of 10.9 years.

The anterior tooth alignment of the study population as illustrated in Table 2 showed the following characteristics:

- In straight type of lip form, mostly well-aligned (74.0%) teeth were evident than highly (60.0%) and moderately arched types (58.0%)
- Deep bite was mostly seen in highly (22%) and moderately arched types (18.0%) and very few in straight type (10.0%)
- Anterior spacing was not a common finding and was seen among 16% of moderately arched type, 12% of straight type, and 10% of highly arched type
- Midline diastema was not significantly seen in any of the lip types
- Crowding/malaligned teeth were high in moderately arched type followed by highly arched and very few in straight type
- Increased overjet was mostly seen in highly arched (50%) followed by moderately arched type (24%) and negligible among straight type (1%)
- Few cases of retroclined anterior teeth were evident in highly arched and moderately arched lip types but none among straight type.

Table 1: Demographic details of the study population (n=150)

Variables	Value
Age	
Mean (SD)	10.901 (1.07)
Range	10-13
Sex, n (%)	
Male	62 (41.30)
Female	88 (58.60)

SD: Standard deviation

Table 2: Comparison of type of lip and features of anterior tooth alignment

Variables	Types of lip			χ^2	P [†]
	High, n (%)	Moderate, n (%)	Straight, n (%)		
Anterior tooth alignment					
Crowding	20 (40)	21 (42)	13 (26)	3.2986	0.192
Well aligned	30 (60)	29 (58)	37 (74)		
Deep bite					
Deep bite	11 (22)	9 (18)	5 (10)	2.688	0.2608
Normal	39 (78)	41 (82)	45 (90)		
Anterior spacing					
Anterior spacing	5 (10)	8 (16)	6 (12)	0.8437	0.655
Normal	45 (90)	42 (84)	44 (82)		
Midline diastema					
Midline diastema	2 (4)	3 (6)	5 (10)	1.5	0.472
Normal	48 (96)	47 (94)	45 (90)		
Crowding					
Crowding	17 (34)	24 (48)	13 (26)	5.381	0.067
Normal	33 (66)	26 (48)	37 (74)		
Malalignment					
Malalignment	17 (34)	24 (48)	13 (26)	5.381	0.067
Normal	33 (66)	26 (52)	37 (74)		
Overjet					
Overjet	25 (50)	12 (24)	1 (1)	30.5216	<0.001
Normal	25 (50)	38 (76)	49 (99)		
Retroclined					
Retroclined	3 (6)	1 (1)	0	3.595	0.1656
Normal	47 (94)	49 (99)	50 (100)		

[†]P value derived from paired Chi-square test, significant at $P < 0.05$

DISCUSSION

The hypothesis that the anterior tooth alignment is influenced by the type of lip form in children was found to be partially supported in this study. There was likewise a trend noted, wherein well-aligned anterior teeth were a common feature in children with straight type of lip form.

Selection of sample population in this study was done in different locations throughout the city, and a maximum number of schoolchildren were screened for probable inclusion in the study. Children in the age group of 10–14 years were selected as they tend to have fully erupted permanent anterior teeth, and if needed, motivation for treatment can be done at this age as they can possibly express judgments on type of dental alignment.

The lip classification system proposed by Cutbirth was used as an analytical tool to categorize the lip forms. He suggested three lip phenotypes but did not define how to obtain specific measurements. Hence, in addition to that, the measurement parameters as suggested by Kim *et al.* have been employed to specifically classify the lip forms.^[12] Screening of the sample population revealed that the most common form of lip phenotype encountered was the straight type of lip form, followed by moderately arched type. Highly arched lip was the type least encountered. Hence, a higher number of children had to be screened to comply with the inclusion criteria of the sample population.

Lip analysis in orthodontics is a part of soft-tissue analysis, and evaluation of each lip type and incisal class may play a role in accumulating database for diagnosis. Clinicians have hypothesized that lip competence is related to dental inclination, overjet, and overbite. With lip incompetence, teeth and dental arches lack adequate guidance from the occlusion, tongue position, and orofacial muscle function. This leads to narrow arches, crowded teeth, and an open bite.^[13]

The present study revealed that children with straight lip phenotype mostly have well-aligned teeth. Malaligned anterior teeth including crowding and increased overjet were significantly higher in children with highly or moderately arched lips.

There are no studies documented in the literature for lip phenotypes and malocclusion, but the authors have used craniofacial features to assess malocclusion. The influence of incompetent lip seal on craniofacial morphology was studied by Drevensek *et al.* Observations from their cephalometric analysis showed a higher anterior facial height in children with open mouth posture. They stated that lip incompetence plays an important role in the growth and development of craniofacial complex.^[14] Concomitant with the findings of the present study, Iida *et al.* reported that anterior teeth are positioned forward in individuals with lip incompetence.^[15] Evaluation of upper lip length in vertical dimensions has shown shorter

lips in participants with Class II, Division 1 malocclusion compared to Class I participants as reported by Alkhalaf and Al-Sabbagh.^[11] This indicates that changes even in length of the upper lip have an effect on malocclusion. However, a weaker correlation was found between malocclusion and lip competence as reported by Kolawole *et al.* who determined the relationship between malocclusion, lip competence, and gingival health in schoolchildren.^[10]

Observations in the present study, however, revealed no significant difference with respect to anterior teeth spacing including midline diastema. Midline diastema is a space between the maxillary central incisors. Liu *et al.* reported that the prevalence of maxillary midline diastema decreases with age. By the age of 12 years, the size of diastema decreases with the eruption of lateral incisor and canine.^[16] Since the space is a characteristic feature seen in mixed dentition and the children examined were over 10 years of age with full complement of anterior teeth present, midline diastema was not a significant finding among any of the groups in the present study.

CONCLUSION

- A significant correlation was found between the type of lip form and the alignment of anterior teeth
- Malaligned anterior teeth were significantly higher in children with high and moderate lip phenotypes, whereas well-aligned anterior teeth were a general trend that existed in children with straight lip phenotype.

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

Nil.

Conflicts of interest

There are no conflicts of interest.

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