

# Evaluation of the Association of Lips Competency with Different Skeletal, Dental, and Soft Tissue Components of the Face in the Raichur Population

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## Abstract:-

### ➤ Introduction

Facial attractiveness may be attributed to lips competency. Identifying the lip's position in repose and the etiological agents behind lips incompetency have a significant role in orthodontic diagnosis and treatment planning. The contributing factors include discrepancies in lips morphology and dimensions, vertical and sagittal skeletal and dental discrepancies.

### ➤ Objective of the study

This study evaluates the skeletal, dental, and soft tissue cephalometric features of patients with incompetent lips to find the most discriminant features to the etiology of lip incompetence in the Raichur population.

### ➤ Materials and methods

A total of 40 lateral cephalograms collected from the Raichur population were grouped into control groups (n=20) and incompetent groups (n=20) and analysis was performed including 16 linear and angular measurements to investigate the skeletal, dental, and soft tissue characteristics of subjects with lip incompetence.

### ➤ Results

In Raichur population along with dental protrusion both upper and lower lip length is also significantly shorter and upper anterior dental height is significantly larger in incompetent subjects compared to subjects with competent lip.

**Keywords:-** Competent Lips, Incompetent Lips, Skeletal, Dental, and Soft Tissue.

## I. INTRODUCTION

Orthodontic treatment aims in improving function and dentofacial esthetics with the balance of the surrounding structures. Angle's paradigm of achieving the optimum occlusion is replaced by a more esthetic soft tissue paradigm in modern orthodontic therapy.

Although ideal occlusion certainly remains the primary functional goal, the esthetic outcome is also critical and therefore essential to the overall treatment objectives.

There are numerous studies on the factors related to facial attractiveness and the difference in perception between laypersons and orthodontists. The majority of research have highlighted the significance of competent lips as one of the aspects in facial attractiveness. Therefore, identifying the lips' position in repose and the etiological agents behind lip incompetency have a significant role in

orthodontic patient's management.

According to clinical definitions competent lips are those that are closed in the resting posture with minimal muscular exertion. For all ethnic groups, 4mm is the maximum distance between the lips when they are relaxed; anything more is considered to have incompetent lips.

Incompetence of lips is a common chief complaint among patients, and excessive incisor protrusion is typically the cause. The incompetent lips are usually treated by an extraction line of treatment which may not always be accurate. Earlier research assessed the cephalometric characteristics of patients with bimaxillary dentoalveolar protrusion (BDAP) concluded incompetency of lips is a result of BDAP and did not consider sagittal and vertical skeletal discrepancy, dental anomalies, lip morphology and dimensions which may contribute in the etiology of this problem. Their assessment stands critical for better outcome of treatment. Unfortunately, very few studies were conducted to evaluate the etiological background of lip incompetence. This study investigated the skeletal, dental, and soft tissue characteristics of subjects with lip incompetence in the Raichur population. The objective of this study was to assess the cephalometric characteristics of patients with incompetent lips and to determine the most distinctive characteristics to the etiology of incompetent lips in the Raichur population.

## II. MATERIAL AND METHODS

The Institutional Ethical Committee of the Navodaya Dental College in Raichur, Karnataka, accepted this study. Pre-treatment lateral cephalograms of 40 patients who visited the Department of Orthodontics and Dentofacial Orthopaedics, Navodaya Dental College, Raichur for treatment were chosen for the study,

All of the cephalograms were recorded with the same exposure parameters with the same magnification and the same machine. The x-rays were printed using standard Fujifilm Medical Dry Imaging film (8\*10 inches in size) and the Fujifilm Dry pix plus printer.

Cephalometric radiographs of 40 adult patients (13 males and 27 females, aged 18-30 years) were collected from the records of the Department of Orthodontics in Navodaya dental college between 2021 and 2023 as control group (CG) and incompetent group (IG). The CG was in good facial proportions, with a minimal overbite and overjet, Class I skeletal and dental relationships, competent lips, and no history of orthodontic treatment.

Adult healthy volunteers with fairly symmetrical faces who had not previously experienced trauma or orthodontic treatment and whose lips were not less than 3mm apart at repose matched the inclusion criteria for the incompetent group. Patients with syndromes, medical illnesses, severe sagittal, vertical malocclusions and a history of orthodontic treatment were excluded. Single operator performed the analysis to minimize potential bias. The analysis included 16 linear and angular measurements which are described in

Table 1. Using independent samples t-tests, the mean values and standard deviations for each variable were calculated and compared between the two groups.

To identify the most important differentiating factors, lip separation stepwise discriminant analysis was carried out between the 2 groups. Statistical Package Software System, version 16 (SPSS Inc., Chicago, Illinois, USA) was used in performing the analyses.

Table 1 - Cephalometric angular and linear measurements used in the present study.

Variable	Definition
NPg-SN	Facial plane angle
ANB (°)	Angle between nasion-point A and nasion-point B
Co-Go (mm)	Mandibular ramal height
SN-MP (°)	Mandibular plane angle
N-FC-A(°)	Maxillary height
J angle (°)	Angle of inclination
ANS-Gn (mm)	Lower face height
LI-NB (°)	Angle between the long axis of lower incisors and NB line
UI-NA (mm)	Distance between the labial surface of upper incisors and NA line
UI-SN (°)	Angle between long axis of upper incisors and SN line
U-lip thick (mm)	Distance between the vermilion border of upper lip to labial surface of upper central incisors
U-lip length (mm)	Distance from base of the nose to the inferior border of the upper lip
L-lip length(mm)	Distance from Menton to the superior border of the lower lip
U. Lip-E line (mm)	Distance between upper lip and esthetic (nose-chin) line.
Inter-labial gap	The vertical distance between upper and lower lips
NLA (°)	The angle between a line tangent to the base of the nose and a line tangent to upper lip.

## III. RESULTS

The patients' demographic information revealed that age and gender were compatible (Table 2). Compared to the control group, subjects in the incompetent group had thinner upper lips, shorter upper and lower lips, more retrognathic facial types, a greater angle between nasion-point A and nasion-point B, shorter Ramal length, steeper mandibular plane, increased maxillary height and lower anterior facial height, bimaxillary dental protrusion, and smaller interincisal angle. The significant discriminant variables, in order, protrusion of upper incisors ( $p=0.001$ ), upper anterior dental height ( $p=0.001$ ), upper ( $p=0.0239$ ), and then lower lip length ( $p=0.0469$ ).

#### IV. DISCUSSION

The most common reason for seeking orthodontic treatment is function as well as dentofacial esthetics. Orthodontic diagnosis and treatment planning greatly benefit from considering the competency of the lips. A subject is classified as having incompetent lips when his/her lips are apart at clinical rest or when his lips are in contact but present higher activity of the mentalis muscle, clinically verified by shrinkage of the chin skin (Yamaguchi *et al.*, 2000).

Lip incompetence is considered as a pathological condition that, if left untreated, can lead to a number of oral issues due to an insufficient lip seal. Unfortunately, there is not much written on the general skeletal and dental characteristics connected to lip incompetence. Regardless of the relationship between their upper and lower incisors in sagittal space, the cephalometric characteristics of participants with incompetent lips were investigated in the current investigation in order to determine the etiological cause of this clinically significant distinction.

It is possible to postulate that dentofacial anatomy, rather than occlusal circumstances, is the cause of the lip incompetence in people with normal occlusion. The link between dentofacial morphology and lip incompetence hasn't been clearly explained in an experimental investigation yet as malocclusion subjects were used and malocclusion and the dentofacial morphology were not clearly separated in these studies. As a result, it is not well understood how the dentofacial morphology and occlusal condition influence lip competence.

Apart from this, varied samples including different racial groups could change the outcome.

In the current study evaluating skeletal and dental characteristics of subjects with incompetent lips on lateral cephalogram in the Raichur population showed significantly larger inter-labial gap, shorter and thinner upper lips, shorter lower lips, larger upper anterior protrusion, and larger upper anterior dental height.

Bimaxillary protrusion may cause short upper and lower lip due to labially directed forces and vice versa due to reduced palatally or lingually directed force from the lips, thereby causing lips incompetency.

Previously conducted study stated that incompetency of lips was observed even in normal occlusion cases and

they hypothesized that dentofacial morphology may be the contributing factor. Hassan *et al.*, stated that thinner lips have decreased flaccidity producing reduced forces on the teeth surface and contribute to the lips incompetency.

The displacement of maxilla evaluated by maxillary height showed downward displacement of maxilla may have contributed for incompetent lips. Reduced ramal height leading to steepening of mandibular plane may contribute for the reduced lower lip length leading to incompetency, which is in accordance with study conducted by Sheikh *et al.*, that stated steeper mandibular plane and shorter total mandibular length lead to incompetent lips

On evaluation of upper incisors to palatal plane showed that downward displacement of upper incisors showed lips incompetency even with normal lip length. Hassan *et al.*, stated that shorter palatal plane, shorter mandibular body, shorter posterior cranial base, and more retrognathic facial type .

It is vital to realize that both the soft tissue draping and the underlying skeletal malocclusion can occasionally go unnoticed, which can lead to inaccurate diagnosis and treatment planning. Therefore, accurate clinical examination together with strong knowledge of underlying malocclusion and CTP (cephalometric treatment planning) can help in improved diagnosis and treatment planning.

Even if an individual's normal occlusion was achieved by orthodontic treatment, some people might not become lip competent if dentofacial morphology alone were the only factor contributing to this condition. Even if an individual's normal occlusion was achieved by orthodontic treatment, some people might not become lip competent if dentofacial morphology alone were the only factor contributing to this condition. If treatment goals include achieving lip competence, a treatment approach based also on the dentofacial morphology must be considered. To better understand how occlusal circumstances affect lip incompetency, more study will be required using malocclusion participants with normal dentofacial morphology and analyzing changes in lip incompetency before and after orthodontic therapy.

In light of these findings, a better treatment plan can be created for malocclusion patients who lack lip competency .Unfortunately, there is very little information in the literature about the general skeletal and dental features associated with lip incompetence.

Table 2: Demographic Data of the Study Sample.

Demographic data	Control group(n=20)	Incompetent group(n=20)	P-value*
Gender			
Male	8(40)	5(25)	0.3112
Female	12(60)	15(75)	
Age(years)			
<20	10(50)	10(50)	1.00
20-24	8(40)	8(40)	
25-30	2(10)	2(10)	
Mean(SD)	19.7±3.36	20.2±4.2	0.6799

Table 3: Skeletal Linear and Angular Measurements.

Skeletal	Control group(n=20)		Incompetent group(n=20)		P-value*
	Mean	SD	Mean	SD	
SN –MP	25.00	5.59	27.15	4.16	0.1757
Lower antr facial height	60.00	5.38	61.65	4.67	0.3069
N-FC-A	52.60	3.90	53.25	5.40	0.6649
J ANGLE	91.05	5.22	89.40	4.16	0.2757
Facial angle	83.85	4.92	84.40	3.91	0.6979
Co-Go	55.60	4.30	55.35	5.79	0.8776

Table 4: Dental Linear and Angular Measurements

Dental	Control group(n=20)		Incompetent group(n=20)		P-value*
	Mean	SD	Mean	SD	
Interincisal angle	114.45	10.95	117.6	11	0.3697
U1-SN	114.95	8.02	116.11	8.91	0.4984
U1 to NA (mm)	4.79	2.99	11.33	1.12	0.0001*
PP to incisal edge U1	24.89	4.16	25.53	2.20	0.0001*
L1 to NB(angle)	27.95	6.87	31.47	6.24	0.0842

Table 5: Soft Tissue Characteristics.

Dental	Control group(n=20)		Incompetent group(n=20)		P-value*
	Mean	SD	Mean	SD	
Upper lip length	19.10	2.49	17.6	2.11	0.0231*
Upper lip thickness	14.28	2.14	13.80	2.38	0.5101
Nasolabial angle	80.60	27.95	88.50	8.49	0.234
Upper lip-E line	-1.85	2.06	-0.60	1.90	0.0534
Lower lip length	43.75	2.04	40.13	1.40	0.0469*

\*is p&lt;0.001 highly significant

## V. CONCLUSION

Multiple factors, other than just bimaxillary protrusion, can be implicated in the development of incompetent lips. This needs to be taken into account when treating such a problem.

In the Raichur population lips incompetency may be contributed to skeletal, dental or soft tissue parameters like short upper lip due to dental protrusion or anatomic, thinner lips, downward displacement of maxilla and maxillary teeth and shorter ramal length leading to steeper mandibular plane.

The shortcomings of the study is that, subject selection was not done separately based on dentofacial morphology and malocclusion. This maybe be considered in conducting further studies.

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