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The relationship of maxillary incisor eruption and upper lip length with the incisor stomion

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Abstract

Introduction: To determine the correlation of maxillary incisor tooth eruption and lip length with the incisor stomion of orthodontic subjects.

Material and Methods: The lateral cephalograph of 180 subjects were traced and the various parameters like SNMP, FMA, MxCH and upper lip length were recorded. The incisor stomion were recorded from patient's record files. Multivariate analysis of variance was applied to determine the difference in skeletal, dental and soft tissue variable among three vertical groups and gender of patients. Pearson's correlation was applied to assess the relationship of lip length and maxillary incisor dental height with the incisor stomion.

Results: The MxIDH (p = .001) and lip length (p = .008) showed significant difference between males and female subjects. There was significant difference in MxIDH (p = .009) and lip length (p = .031) among the vertical facial patterns. The lip length showed a statistically significant (p = .016) but weak inverse correlation (r = − .179) with incisor stomion. The MxIDH showed statistically highly significant (p = <.001) but positive weak correlation (r = .320) with incisor stomion.

Conclusions: Although, the lip length and maxillary incisor height are different in males and females, the gender has no effect of the incisor stomion. The lip length and maxillary incisor height increases with the increase in face height however, the incisor stomion remains constant. The maxillary incisor eruption is the strongest predictor in determining the incisor stomion.

Keywords: Incisor stomion, lip length, maxillary incisor height

Introduction

Esthetic smile is governed by number of factors like incisor display, gingival exposure, buccal corridors, smile arc and golden proportions of maxillary anterior teeth.[1] The upper incisor display is most important factor in the dynamics of esthetic smile. The upper incisor display up to 2-4mm on rest is considered to be ideal, while on smile, complete crown exposure along with 2mm of gingival margin is optimal in terms of best esthetics parameters.[2-5] The incisor display may vary among individuals from excessive exposure to no show at all and thereby imparting an unaesthetic smile framework. The causes of these unaesthetic exposures are lip length, incisor eruption and vertical excessive maxillary growth.[6-7] So the diagnostic requirement necessitates the disclosure of the cause to address patient concern about the aesthetic smile.

The patients concerns for seeking orthodontic treatment may be excessive tooth and gingival display while others complain of the no display of the incisors even at smile.[8]

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These patients require a thorough examination both clinical and radiographic to determine the interplay between the lips and teeth along with the skeletal profile to address the problem systematically. The treatment may include orthodontic cure alone or may involve adjunctive hard and soft tissue surgical interventions.[9] Whatsoever the treatment will be devised for the patient, the key to a successful resolution of the problem is correct diagnosis. Several studies [5,10-12] have been carried out to establish the relation incisors and upper lip which are important in determination of tooth display on rest and smile. Most of these studies [2-6,10-12] have placed their focus on the changes of the teeth display in relation to the growth of the lips or elevation of the lips during the smile. However, the incisor display may be result of various factors apart of lips elevation and growth status of the patients which include the amount of incisor eruption, lip length and vertical growth status of the maxilla.[13-15]

The role of soft tissue envelop in the smile design cannot be overlooked. The delicate complex interplay of tooth display with the lips, tooth eruption and maxillary vertical growth needs assessment and determination to plan out good esthetic outcomes for the orthodontic patients. Keeping this rationale on the forefront, this study has been designed to determine the effect and role of lip length and incisor eruption on the tooth display of the subjects in three vertical facial patterns.

Materials and Methods

This study was conducted at tertiary care hospital from September to November 2022 with an approval number DEC/PDC/2022-103. The study was carried out with 180 subjects. The sample comprised of 90 males and 90 females which were further divided into three groups of 30 subjects on the basis of vertical facial patterns. Subjects with an age range of 15 to 20 years and fully erupted maxillary incisors were the inclusion criteria. The subjects were excluded if they had incisor crown fractures or restorations, orthodontic treatment and craniofacial syndromes or anomalies.

Informed written consent of the subjects was taken prior to inclusion in the study. The various parameters were recorded on the lateral cephalographs of the patients which were traced manually over illuminator and defined as follows (Figure 1).

Skeletal Variables:

Angle SNMP: Formed by intersection of sella-nasion plane and mandibular plane.

Angle FMA: Formed by intersection of Frankfort horizontal plane and mandibular plane.

Dental Variables:

Maxillary central incisor height (MxCH): Perpendicular from the tip of maxillary central incisor to palatal plane.

Soft Tissue Variables:

Upper Lip Length: A line drawn from the subnasale to the stomion superius.

The record files of patients were retrieved and the incisor stomion were recorded. SPSS version 20.0 for windows was used to analyze the data of this study. Multivariate analysis of variance was applied to determine the difference in skeletal, dental and soft tissue variable among three vertical groups and gender of patients. Pearson's correlation was applied to assess the relationship of lip length and maxillary incisor dental height with the incisor stomion. To determine the inter examiner reliability; Cronbach's alpha test was applied to 20 randomly derived cases measured by another examiner. The p value to be statistically significant was set at ≤0.05.

Results

The difference in MxIDH, lip length and incisor stomion is shown in table 1. The MxIDH (p = .001) and lip length (p = .008) showed a significant difference between males and female subjects. The males showed significantly greater values for MxIDH and lip length as compared to female subjects. However, the incisor stomion was insignificant between males and female subjects. Table 2 shows the difference in

MxIDH, lip length and incisor stomion among the vertical facial patterns. There was significant difference in MxIDH (p = .009) and lip length (p = .031) among the vertical facial patterns. Post Hoc Bonferroni test showed the difference to be significant between hypodivergent and hyperdivergent for lip length (p = .040) and MxIDH (p = .006). The correlation of incisor stomion with lip length and MxIDH is shown in table 3. The lip length showed a statistically significant (p = .016) but weak inverse correlation (r = − .179) with incisor stomion. This shows that increase in lip length will be associated with decrease incisor stomion however it is not completely dependent on lip growth. The MxIDH showed statistically highly significant (p = <.001) but positive weak correlation (r = .320) with incisor stomion. This shows that although the increase in incisor eruption is associated with increase incisor stomion however it is not the dominant predictor. The Cronbach's alpha value for items stood at 0.893 which showed strong inter examiner reliability of scores.

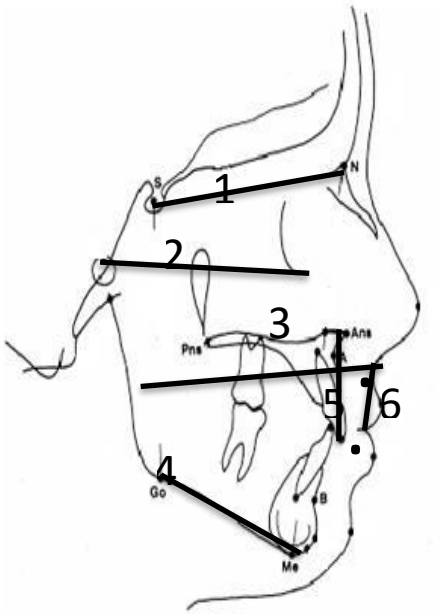

Figure 1: Cephalometric skeletal, dental and soft tissue measurements

1 = SN plane, 2 = Frankfurt horizontal plane, 3 = Palatal plane, 4 = Mandibular plane, 5 = MxCIDH, 6 = Lip Length.

Table I: The difference in lip length, MxCIDH and incisor stomion between males and females.

Variable	Gender	N	Mean	±SD	P value
lip length	male	90	21.1778	2.72557	.008*
	female	90	20.1000	2.65233	
	Total	180	20.6389	2.73558	
MxCIDH	male	90	29.7222	2.89528	.001*
	female	90	28.1444	3.24491	
	Total	180	28.9333	3.16687	
incisor stomion	male	90	4.5222	2.46425	.844
	female	90	4.4500	2.46555	
	Total	180	4.4861	2.45827	

N = 180
Independent sample t test
Level of significance ≤ 0.05*

Table II: Difference of lip length, MxCIDH, incisor stomion and Upper incisor inclination in vertical facial patterns.

Variable	Vertical Group	N	Mean	±SD	P value
lip length	Normodivergent	60	20.3833	2.34406	.031*
	hypodivergent	60	20.1500	2.91591	
	hyperdivergent	60	21.3833	2.79886	
	Total	180	20.6389	2.73558	
incisor stomion	Normodivergent	60	4.7667	2.34605	.484
	hypodivergent	60	4.2250	2.60121	
	hyperdivergent	60	4.4667	2.43190	
	Total	180	4.4861	2.45827	
MxCIDH	Normodivergent	60	29.0000	2.84039	.009*
	hypodivergent	60	28.0167	2.90815	
	hyperdivergent	60	29.7833	3.50830	
	Total	180	28.9333	3.16687	
upper incisor to SN	Normodivergent	60	108.3500	9.22933	.270
	hypodivergent	60	110.2333	9.93089	
	hyperdivergent	60	107.6167	8.04456	
	Total	180	108.7333	9.11785	

N = 180
One Way ANOVA
Level of significance ≤ 0.05*

Table III: Relationship of MxII, lip length, MxCIDH with the incisor stomion of the patients.

Variables	Incisor Stomion
MxII	-.179 .017*
Lip length	-.179 .016*
MxCIDH	.320 .000*

N = 180
Pearson's correlation coefficient
Level of significance ≤ 0.05*

Discussion

Setting an esthetic smile is an important goal to achieve in orthodontic treatment. To accomplish this goal the deep insight of the relationship of lips to incisor display is necessary prerequisite. The etiologic basis of non-esthetic smile may be primarily attributed to imbalance among teeth, lip framework and gingival scaffold.[9] This imbalance of contributing variables may leave the patients in displeasing esthetics which may range from no incisor display to excessive gingival exposure or gummy smile. The problem based approach to addressing the patient complaint requires a thorough evaluation of the etiologic basis of non-esthetic smile. Therefore, this study was design to determine the role of lip development and incisor teeth eruption to esthetic incisor stomion display.

This study determines that the lip length and incisor dental heights show a significant gender dimorphism. The males show higher values for the variables in question which is in accordance with their stature as their growth status will suggest. Other studies[5, 14] has also reported similar differences in lip length between the genders. So when planning the setting limits of these variables the gender factor must be considered separately. However, the interesting finding of the study is the incisor stomion which is insignificant between the genders. This shows that although the incisors height and lip length may vary significantly yet the resulting esthetic feature of the incisor display will remain constant for both genders. One study[12] has shown significant increase of incisor show in female subjects as compared to male subjects.

When setting the goals of orthodontic treatment, the vertical growth pattern is given due considerations to achieve stable and esthetic results. When the face grows vertically it increases the face height. The maxilla and mandible grow in downward and forward direction the associated structures like teeth and lips also show growth in vertical direction to compensate for the space created by vertical jaw growth and to maintain the occlusion of teeth and tooth to lip balance.[16-18] In most cases this balance of skeletal, dental and soft tissues growth do not keep pace with each other in harmony and results in variety of esthetic and functional problems. In this article we have found significant increase in lip length and incisor heights of subjects with hyperdivergent as compared to hypodivergent facial patterns. Taken together, the vertical growth of the jaws is well compensated by the growth in incisors and lips. For these reasons the incisor stomion of the subject in nearly the same for all the three facial patterns. Therefore, as long the jaws growth is accompanied by well harmonized growth of the lips and incisors, the vertical facial patterns do not have effect on the incisor stomion.

The relationship between the lips, incisor eruption and incisor stomion has been shown to be significant in this study. In our subjects the gender and vertical facial pattern has no effect on the incisor stomion. This fact has been also asserted in other studies[3,10-11] that gender has no significant relevance to the difference in incisor display. It is therefore, the individualized problems with the growth of the lip and incisor eruption that contribute to the increase and decrease of the incisor stomion. A study[15] found the upper lip length to be the strong predictor of the maxillary incisor display at rest. In this study we have found a significant negative correlation of upper lip length with the incisor stomion. However the correlation of the incisor eruption and incisor stomion was positive and highly significant. Therefore, in our study the strong predictor of the incisor stomion came out to be maxillary incisors height.

For treating the orthodontic patients with objectives of achieving an esthetic smile the various factors that play significant role must be considered carefully. Incisor stomion being a key factor of esthetic smile, should also be given due consideration and all factor contributing to it must be sorted out to ensure the best of outcomes.

Conclusions

- Although, the lip length and maxillary incisor height are different in males and females, the gender has no effect of the incisor stomion.
- The lip length and maxillary incisor height increases with the increase in face height however, the incisor stomion remains constant.
- The maxillary incisor eruption is the strongest predictor in determining the incisor stomion.

Limitations

The limitations of the study were that it is single center based study, the Cephalometric radiographs carry some magnification error and the parameters were static and while dynamic are not taken and compared.

Conflict of interest

No conflict of interest

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