Original Article

Comparison of soft tissue chin prominence in various mandibular divergence patterns of Tamil Nadu population

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ABSTRACT

Introduction: Chin is the prominent anatomical landmark in the lower third of the face and it plays a vital role in maintaining facial harmony. **Objective:** The aim of the present study is to evaluate the soft tissue chin (STC) prominence in various mandibular divergence patterns. **Materials and Methods:** A total of 90 lateral cephalograms (38 men and 52 women) of nongrowing individuals who had reported for orthodontic treatment with age ranging above 19 years were selected. The lateral cephalograms were divided into three groups based on their mandibular divergence patterns. Three linear measurements at three different levels (Pog-Pog', Gn-Gn' and Me-Me') were measured manually on the lateral cephalogram. ANOVA, *post hoc* test, and Mann–Whitney U-test were used for analysis and a $P < 0.05$ was considered statistically significant. **Results:** The STC thickness measurements were greater in Group A when compared to Group B and Group C. The values are highly significant with $P = 0.000$. No significant difference was found between Group B and C. The values of STC thickness between genders also showed a significant difference. **Conclusion:** The STC is thicker in hypodivergent individuals, whereas STC thickness between hyperdivergent and normodivergent showed no significant difference. Furthermore, STC prominence is greater in males when compared to females. Hence, these parameters can be used for planning an advancement genioplasty in Class II individuals.

Key words: Chin, divergence, genioplasty, soft tissue, thickness

INTRODUCTION

Facial harmony depends on the form, proportion, and position of its various anatomical units, in which chin is the prominent anatomical landmark of the lower third of the face and it plays a vital role in maintaining facial balance.[1] Successful orthodontic treatment outcome depends on the hard and soft tissue balance. However, most of the previous studies had evaluated only the position of the teeth to its corresponding skeletal bases.[2] Recently, in the field of orthodontics, there is a paradigm shift to focus more on soft tissues and the desired orthodontic treatment goal is to achieve a good soft tissue balance.

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However, the components of face exhibit a great individual variation in period, magnitude, and pattern of growth. Furthermore, the covering facial soft tissues can develop in proportion or disproportion to the underlying skeletal structures. Such variation between underlying skeletal and soft tissues can cause a disassociation between the position of the underlying structures and facial appearance that may shift the treatment into orthognathic or cosmetic surgery.[3-6] According to Holdaway, considering the hard tissue analysis alone for treatment planning is inadequate. Hence, studying of soft tissue parameters is fundamental for orthodontic treatment planning.[7]

Blanchette *et al*. observed a significant correlation between different facial pattern and soft tissue growth.[8] Brandao and Subtelny demonstrated an increase in chin prominence which is much more related to skeletal changes than the soft tissues changes. However, Foley and Duncan demonstrated an increase in 7 mm of soft tissue chin (STC) from 14 to 20 years of age. According to Hoffelder *et al*., facial profile assessment can be affected by many factors including the observer, ethnic, and racial aspect.[3]

Macari and Hanna compared STC thickness between different mandibular divergence pattern and found a significant difference between hyper- and hypo-divergent individuals. The growth pattern of an individual also had a role in amount of soft tissue growth. Sometimes, there may be a need for orthognathic surgery along with orthodontic treatment.[4]

Genioplasty is indicated to restore the adequate shape and projection of the chin in case of disproportion between soft and hard tissues and for long-term results.[9]

Thus, the aim of the study is to evaluate any gender difference and the association between mandibular divergence pattern and STC thickness at different chin levels in our population.

MATERIALS AND METHODS

Totally, 90 lateral cephalograms which were taken as a routine diagnostic procedure for the patients who reported to our department for seeking orthodontic treatment were taken, with a mean age of 25 years including 38 males and 52 females. Before the study, consent was signed by each subject to use their radiograph for study purpose. All lateral cephalometric radiographs were taken using the same digital cephalostat (ORTHOPHOS XG 3D, Sirona) in a standardized manner. The inclusion criteria were age above 19 years, lateral cephalogram should be taken at rest with no soft tissue strain and well-defined anatomical landmarks of soft tissue. Exclusion criteria were any previous orthodontic treatment or orthognathic surgery and craniofacial anomaly.

For determining the mandibular divergence, angular measurements of the maxilla and mandible in relation to the anterior cranial base were used. The angles include palatal plane and occlusal plane to mandibular plane, mandibular plane to anterior cranial base (MP/SN), mandibular plane to Frankfort plane (MP/FH), and posterior to anterior facial height ratio. The STC thickness was measured at three different levels: (1) Pog-Pog' = length between bony pogonion (Pog) and soft tissue pogonion (Pog'), (2) Gn-Gn' = distance between bony gnathion (Gn) and soft tissue gnathion (Gn'), (3) Me-Me' = length between bony menton (Me) and its corresponding soft tissue menton (Me'). All the measurements were manually done by a single operator. To determine the intraobserver reliability, all angular and linear measurements were repeated again by randomly selecting the lateral cephalograms.

All the lateral cephalograms were divided into three groups based on their mandibular divergence pattern. Group A consists of hypodivergent individuals (15 males and 15 females), Group B includes hyperdivergent individuals (11 males and 19 female), and Group C is normodivergent individuals (12 males and 18 females).

Statistical analysis

For multiple comparison among the three groups, *post hoc* test (Bonferroni) was used. Student's *t*-test and one-way analysis of variance were used to compare the studied parameters in males and females separately among the three groups. Mann–Whitney test for comparison of gender differences within each group was used. The Pearson correlation coefficient $P = 0.05$ was considered statistically significant and SPSS software (Version 21, IBM, USA) was used.

RESULTS

All the measurements of STC thickness were highly significant in hypodivergent groups when compared to hyper- and normo-divergent groups ($P = 0.000$). When hyper- and normo-divergent groups were compared, there is no significant difference existed at Pog - 0.098 and Me - 0.274 level, but a significant difference was seen at Gn- 0.004 level [Table 1]. In each group, gender differences were compared at different levels [Table 2]. There existed a significant difference between males and females in hypodivergent individuals at Pog and Me level [Table 3].

DISCUSSION

Patients seek orthodontic treatment primarily for esthetic reasons and the resulting soft tissue profile is the measure of success. Many studies have demonstrated that the movement of soft tissue landmark do not follow the movement of underlying hard tissue structures in 1:1 ratio.[4,10,11] The current emphasis on facial esthetics and orthodontic treatment outcomes has provoked increasing interest in assessment of soft tissue variables. As chin is the prominent anatomical landmark of the lower third of the face and its role

Table 1: Multiple comparisons between each group at different levels

Dependent Variable	(1) GRP	(J) GRP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
POG	1	2	-4.167*	0.537	0.000	2.86	5.48
		3	3.000*	0.537	0.000	1.69	4.31
	2	1	-4.167*	0.537	0.000	-5.48	-2.86
		3	-1.167	0.537	0.098	-2.48	0.14
	3	1	-3.000*	0.537	0.000	-4.31	-1.69
		2	1.167	0.537	0.098	0.14	2.48
GN	1	2	3.917*	0.411	0.000	2.91	4.92
		3	2.567*	0.411	0.000	1.56	3.57
	2	1	-3.917*	0.411	0.000	-4.92	-2.91
		3	-1.350*	0.411	0.004	-2.35	-0.35
	3	1	-2.567*	0.411	0.000	-3.57	-1.56
		2	1.350*	0.411	0.004	0.35	2.35
ME	1	2	2.567*	0.342	0.000	1.73	3.40
		3	1.983*	0.342	0.000	1.15	2.82
	2	1	-2.567*	0.342	0.000	-3.40	-1.73
		3	-0.583	0.342	0.274	-1.42	0.25
	3	1	-1.983*	0.342	0.000	-2.82	-1.15
		2	0.583	0.342	0.274	-0.25	1.42

Table 2: Measurements of STC thickness in between genders

Gender	Hypodivergent		Hyperdivergent		Normodivergent	
	Mean	SD	Mean	SD	Mean	SD
Male						
Pog-Pog'	13.87	1.59	9.36	4.22	9.58	1.67
Gn-Gn'	10.47	2.03	6.14	2.00	6.92	1.62
Me-Me'	8.77	1.26	5.59	1.88	5.63	1.18
Female						
Pog-Pog'	12.53	0.83	8.84	1.80	10.61	1.53
Gn-Gn'	9.53	1.68	6.05	1.09	7.78	1.11
Me-Me'	7.03	1.42	5.18	0.93	6.11	0.75

Table 3: Independent sample test

	Hypodivergent	Hyperdivergent	Normodivergent
Pog-Pog'	0.008	NS	NS
Gn-Gn'	NS	NS	NS
Me-Me'	0.001	NS	NS

in facial soft tissue balance provoked this study. According to Macari and Hanna, there exists a significant difference in STC thickness between various mandibular divergent individuals.

Subtelny found that all parts of the soft tissue profile do not directly follow the underlying skeletal structures. In some areas, soft tissue contour diverges from the underlying skeletal structures, while other areas showed a strong tendency to follow the skeletal change.[10,12] In our study also, there is a significant difference in STC thickness between various mandibular divergence pattern. Hypodivergent individuals have an increased STC thickness when compared to hyper- or normo-divergent individuals. This indicates that there exists a growth differential in the thickness of the soft tissue covering the underlying hard tissue. This was substantiated by Foley and Duncan that differential facial growth occurs from Na to Pog.[13]

The thickness of the STC was greater in men when compared to women at Pog and Me level irrespective of mandibular divergence pattern. Similar observations between the genders were seen in the study conducted by Nanda *et al*.[4,12,13] There is no significant difference in STC thickness between hyper- and normo-divergent individuals which differs from the result of Macari and Hanna.[4,14,15] This may be due to ethnic difference as described by Uysal *et al*.[16] In case of Class II individuals with hyperdivergent growth pattern, advancement genioplasty is usually indicated along with orthognathic surgery for improvement in facial profile and the long-term results are also found to be stable.[17-24] As the STC thickness in our population is similar between hyper- and normo-divergent individuals, there is no need of advancement genioplasty in all cases if there is sufficient STC thickness.

If at all chin advancement is planned a prediction ratio of 4:3 is recommended for surgical horizontal advancement of symphysis versus the net horizontal change in STC point.[25] Furthermore, there is continued growth of soft tissues till late adolescence. Further studies with three-dimensional evaluation would probably provide a more accurate measurement of facial soft tissues.

CONCLUSION

STC thickness measurements were greater in hypodivergent group when compared to hyper- or normo-divergent individuals. However, there is no significant difference between hyper- or normo-divergent individuals. All STC

measurements were greater in men than in women. The findings suggest that STC thickness varies according to the gender and growth pattern of an individual, and further research can be done using three-dimensional imaging.

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Conflicts of interest
There are no conflicts of interest.

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