Original Article

Comparison of soft tissue chin thickness in adult patients with various mandibular divergence patterns in Kodava population

ABSTRACT

Background: Finally, facial contours are determined by the soft tissues, and these can be altered by growth and orthodontic treatment. The position and the relationships among the facial structures can be affected by variation in thickness, length, and tonicity of soft tissues thereby affecting facial esthetics. Such variations between skeletal and soft tissues can cause a disassociation between the position of the underlying bony structures and the facial appearance that may shift treatment into the range of orthognathic and cosmetic surgery.

Aims: This study was conducted to enumerate and compare soft tissue chin (STC) thickness in adult patients with various mandibular divergence pattern in Kodava population and to find the difference in STC thickness between men and women.

Materials and Methods: A sample including eighty patients were stratified into four groups based on the divergence pattern defined by the mandibular plane (MP) to cranial base angle (MP/sella-nasion [SN]; average = 32° ± 5). Low (L) = MP/SN ≤27°; medium-low (ML) = 27°<MP/SN ≤32°; medium-high (MH) = 32° <MP/SN <37°; and high (H), MP/SN ≥37°. The STC thickness was measured at three different levels: Pogonion (Pog)-Pog', gnathion (Gn)-Gn', menton (Me)-Me'. For statistical analysis Student's *t*-test, ANOVA were performed.

Results: The STC thickness at Pog-Pog' and Me-Me' was the highest in ML followed by MH, low and was least in high. At Me-Me', the STC thickness was the highest in ML followed by low, MH and was least in high.

Conclusions: STC thickness was greater in men than in women in all the groups except high mandibular divergence pattern.

Keywords: Hyperdivergent, Kodava, soft tissue chin thickness

INTRODUCTION

Orthodontists have already sought out ways to quantify the characteristics of the face. Different values have been assigned to the different lines, planes, and angles of the facial skeleton so that they may treat these assigned numbers to a normal value. Orthodontists will always diagnose and plan the treatment with hard tissues in mind. Skeletal and dental relationships are the underlying foundation of the soft tissue. However, a foundation that is harmonious does not suggest the overlying tissue of the face will be in harmony and esthetic. Traditional cephalometric analysis often did not even recognize soft tissue existence. When an analysis did incorporate soft tissue, it was often simply an attempt to quantify lip protrusion. In the soft tissue paradigm, orthodontists now look for more tools and ways to analyze the soft tissue profile. The muscles, fat, and skin in facial soft tissue can develop in proportion or disproportion to the corresponding skeletal structures. There can be variation in thickness, length, tonicity, of the soft tissue among the facial structure which may affect facial aesthetics. These such variations between skeletal and soft tissues can cause

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a disassociation between the position of the underlying bony structures and the facial appearance. To correct that they may undergo orthognathic and cosmetic surgery.

Thickness of the soft tissue chin (STC) has been correlated mostly with discrepancies in the sagittal plane. In a study of the association between STC thickness and vertical divergence, the focus was limited only to the correspondence of hard and soft tissue pogonion (Pog), neglecting the angle of the chin and its inferior part.

MATERIALS AND METHODS

Eighty (37 men and 43 women) subjects aged between 18 and 35 years were selected from Kodava patients who reported to the Department Orthodontics and Dentofacial Orthopaedics seeking treatment. The inclusion criteria were age above 18 years, nongrowing patients seeking orthodontic treatment, lateral cephalogram were taken at rest with no lip strain, and well defined chin structure on radiograph. Exclusion criteria were previously orthodontic or orthognathic treated patients, presence of craniofacial anomaly, any injury or trauma to chin and noncontinuous soft tissue contour at the level of chin indication a chin strain. Informed consent was obtained from patients regarding the purpose, procedures, possible complications, and risk of the study. Patients were enrolled after tracing the lateral cephalogram taken for the orthodontic treatment in Kodava population. All patients were divided into four groups based on the divergence pattern defined by the mandibular plane (MP) to cranial base angle (MP/sella-nasion [SN]; average = 32° ± 5°). Angular measurements were computed to determine the position of the mandible in relation to the anterior cranial base. The angles included were MP to SN plane to check the MP angulation. MP was constructed by line joining gonion and gnathion (Gn), SN plane was constructed by line joining sella (S) and nasion (N). Then MP was shifted to SN plane to find mandibular divergent pattern. The first group (Group A) low (L) = MP/SN ≤27° consisted of twenty patients (n = 20; nine male and 11 female). The second group (Group B) medium-low (ML) =27° <MP/SN ≤32° consisted of twenty patients (n = 20; eight male and 12 female). The third group (Group C) medium-high (MH) =32° <MP/SN <37° included twenty patients (n = 20; ten male and ten female). The forth group (Group D) with the severest hyperdivergent pattern, MP/SN ≥37° consisted of twenty patients (n = 20; ten male and ten female). The lateral cephalometric radiographs were taken using the digital cephalostat (SIRONA ORTHOPHOS XG 5 DS) in a standardized method and in a natural head position [Figure 1]. The lateral cephalograms were hand traced [Figure 2]. The STC thickness was measured at three different levels [Figure 3]: (1) Pog-Pog' = length between bony Pog and its horizontal projection (Pog') over the vertical passing through soft tissue Pog; (2) Gn-Gn' = distance between bony Gn and soft tissue Gn'; and (3) menton (Me)-Me' = distance between bony Me and its vertical projection (Me') on the horizontal passing through soft tissue Me. The three distances were measured using a metal scale.

RESULTS

Age was not statistically significantly different for men or women across all four groups [Table 1] or between men and women within each of the four groups [Table 1]. Among low mandibular divergence pattern highly significant difference was observed for Pog-Pog' given by a P = 0.000 according to gender [Table 2]. In ML while there was no significant difference in Pog-Pog', Gn-Gn', and Me-Me'[Table 3]. Among MH mandibular divergence pattern according to the gender highly significant difference was observed for Pog-Pog' given by a P = 0.000. The mean for Gn-Gn' was found significant with the value of P = 0.049 [Table 4]. According to gender among high mandibular divergence pattern, there was no significant difference in Pog-Pog', Gn-Gn', and Me-Me' [Table 5].

Table 6 shows mean STC thickness at different measurements according to mandibular divergence pattern. The STC thickness at Pog-Pog' was the highest in Group B (ML) with mean of 9.80 (±2.58) followed by Group C (MH) with 9.70 (±1.83), Group A (low) with 9.60 (±1.53) and was least in Group D (high) with 8.45 (±2.13). At Gn-Gn' the STC thickness was highest in Group B (ML) with mean of 6.80 (±1.88) followed by Group C (MH) with 6.60 (±1.75), Group A (low) with 6.40 (±2.06) and was least in Group D (high) with 5.80 (±1.321). At Me-Me', the STC thickness was highest in Group B (ML) with mean of 7.0 (±154) followed by Group A (low) with 6.55 (±2.43), then comes Group C (MH) with 6.50 (±1.46), and was least in Group D (high) with 5.85 (±1.871).

Figure 1: Cephalogram in standardized method and natural head position

Figure 2: Hand traced lateral cephalogram

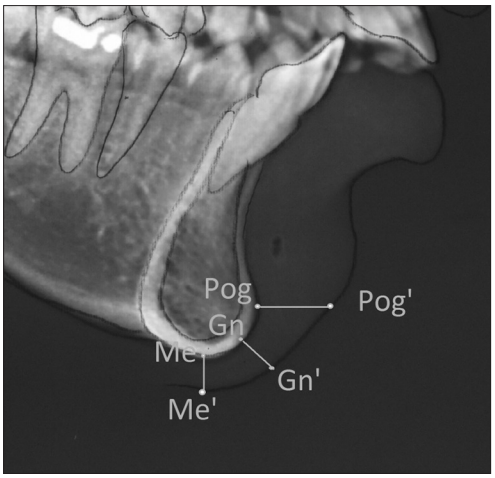

Figure 3: Soft tissue chin thickness measurement at three different levels

Table 1: Mean Mandibular plane to cranial base angle according to gender among the study population

	Gender		Mean MP/SN	Std. deviation
	Male (%)	Female (%)		
Low	9 (24.3)	11 (25.6)	24.55	2.163
Medium-low	8 (21.6)	12 (27.9)	29.90	1.618
Medium-High	10 (27.0)	10 (23.3)	34.90	1.860
High	10 (27.0)	10 (23.3)	39.15	1.725
Total	37 (100.0)	43 (100.0)	32.12	5.790

Table 2: Mean soft tissue chin thickness at different measurements according to gender among Low mandibular divergence pattern

	Gender	Mean	Std. deviation	*t*	*P*	Significance
Pog-Pog'	Male	10.7778	1.30171	4.300	0.000	HS
	Female	8.6364	0.92442			
Gn-Gn'	Male	7.3333	2.29129	1.964	0.065	NS
	Female	5.6364	1.56670			
Me-Me'	Male	7.5556	3.04594	1.758	0.096	NS
	Female	5.7273	1.48936			

Ns: Non Significant, HS; Highly Significant

Table 3: Mean soft tissue chin thickness at different measurements according to gender among Medium-Low mandibular divergence pattern

	Gender	Mean	Std. deviation	*t*	*P*	Significance
Pog-Pog'	Male	10.77	2.53	1.589	0.130	NS
	Female	9.00	2.44			
Gn-Gn'	Male	7.44	2.18	1.423	0.172	NS
	Female	6.27	1.48			
Me-Me'	Male	7.22	1.78	0.533	0.601	NS
	Female	6.81	1.60			

Ns: Non Significant

In the low (L) = MP/SN ≤27° mandibular divergence pattern, STC thickness was increased in males than females and STC was increased in Pog-Pog' and followed by Me-Me' and was thinnest at the level of Gn-Gn'. Among ML = 27° <MP/SN ≤32° mandibular divergence pattern females had thinner STC thickness compared to males and STC thickness was more in Pog-Pog' and decreased in Gn-Gn'. Among the MH = 32° <MP/SN <37° mandibular divergence pattern male has thicker STC thickness compared to females and STC thickness was increased in Pog-Pog' and least in Me-Me'. However, in high MP/SN ≥37° mandibular divergence pattern, the females had thicker STC thickness than male and STC thickness was increased in Pog-Pog' and there was no such difference in thickness in Gn-Gn' and Me-Me'.

DISCUSSION

The aim of this study was to obtain cephalometric norms from Kodava population. As the demand for facial esthetics increases, the paradigm of orthodontic treatment is shifting from hard tissue-based treatment to soft-tissue-based treatment. Facial harmony and esthetics are predominantly linked to racial preferences. The available norms derived from Caucasians Americans cannot be applied to other races unless they are modified.[1] The Kodavas are an ethnic minority living in the hilly district of Coorg in Karnataka with distinct facial features. Hence, this encouraged us to carry out the current study on Kodava population.

Table 1 shows the demographic data of the patients included in the groups. The groups were statistically well matched on gender distribution, and sagittal relationships. The samples consisted of eighty radiographs of both male and females between 18 and 35 years of age. This age group was selected because it encompasses a period of cessation of growth and development of the craniofacial complex. Lateral cephalometric radiographs are routinely taken at the start of orthodontic treatment, and no ethical issues were present. Because the subjects were prospective orthodontic patients, a wide range of craniofacial patterns in the sample was ensured. This study

was of two-dimensional data, focusing on the soft-tissue profile outline with traditional cephalometric landmarks. Extension to three-dimensional data needs computed tomography images and is planned as a subsequent project.

Orthodontic treatment is best when the facial and cephalometric characteristics of the ethnic background of patients are considered. Lateral cephalometric norms maybe specific to an ethnic group and cannot be applied to other ethnic types. Holdaway,[2] Subtelny,[3] Scheideman *et al*.[4] developed cephalometric analyses and corresponding norms. However, these norms were usually based on samples of Caucasian patients only. They have concluded that norms differ between Caucasians and other ethnic and racial groups.

Table 4: Mean soft tissue chin thickness at different measurements according to gender among Medium-High mandibular divergence pattern

	Gender	Mean	Std. deviation	*t*	*P*	Significance
Pog-Pog'	Male	11.22	0.97	5.096	0.000	HS
	Female	8.45	1.36			
Gn-Gn'	Male	7.44	1.33	2.111	0.049	S
	Female	5.90	1.81			
Me-Me'	Male	7.00	1.22	1.412	0.175	NS
	Female	6.09	1.57			

Ns: Non Significant, HS: Highly Significant, S: Significant

Table 5: Mean soft tissue chin thickness at different measurements according to gender among High mandibular divergence pattern

	Gender	Mean	Std. deviation	*t*	*P*	Significance
Pog-Pog'	Male	8.22	1.78	0.421	0.679	NS
	Female	8.63	2.46			
Gn-Gn'	Male	5.55	1.13	0.739	0.469	NS
	Female	6.00	1.48			
Me-Me'	Male	5.77	1.71	0.152	0.881	NS
	Female	5.90	1.07			

Ns: Non Significant

In general, the skin of women lacks collagen synthesis and facilitated synthesis of hyaluronic acid due to estrogen.[5] On the other hand, men tend to have thicker skin because testosterone facilitates collagen synthesis. In this study [Figure 4], according to the gender, STC thickness is increased in males than females in all three measurements in low mandibular divergence pattern. Among ML [Figure 5] mandibular divergence pattern females had decreased STC thickness compared to males. Among the MH [Figure 6] mandibular divergence pattern, male has thicker STC thickness than females. However, in high mandibular [Figure 7] divergence pattern, the females had thicker STC thickness than males in all three measurement, that is, Pog-Pog', Gn-Gn', and Me-Me'. The disagreement between our findings and those of Macari and Hanna[6] might be due to the racial differences. A review of the literature confirms differences in soft tissue thickness among different ethnic and racial groups. Growth differences between men and women on measured hard and soft tissue landmarks might also have affected those gender differences.[7]

Patients with greater MP/SN angle have thinner STC, excluding Pog [Table 6]. This finding suggests that as the vertical expansion of the skeletal tissues increases, it impinges on the thickness of a soft tissue that no longer displaces in a corresponding ratio of 1:1. This ratio has been reported in clinically normal development and after orthognathic surgery of the mandible and chin.[8]

In this study, among different divergence pattern STC thickness in male and female came up with the huge difference. STC thickness was increased in male compared to female in all the groups except in Group D where female STC thickness was increased at three levels. Several studies evaluating soft tissue cephalometric norms for different populations with different chronological ages

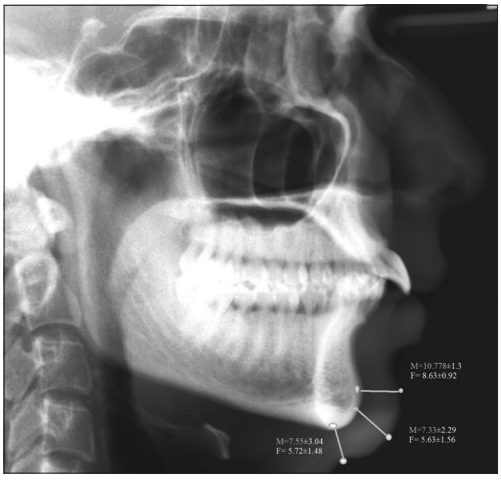

Figure 4: Low mandibular divergence pattern

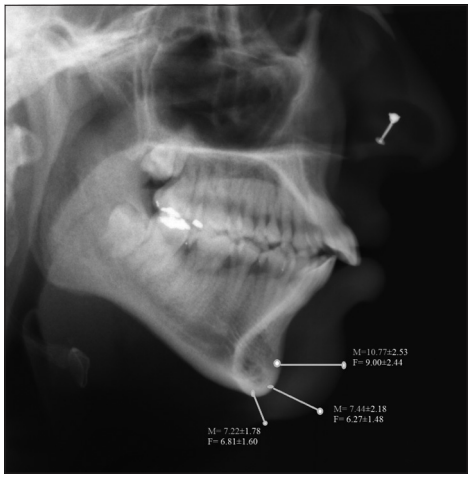

Figure 5: Medium-low mandibular divergence pattern

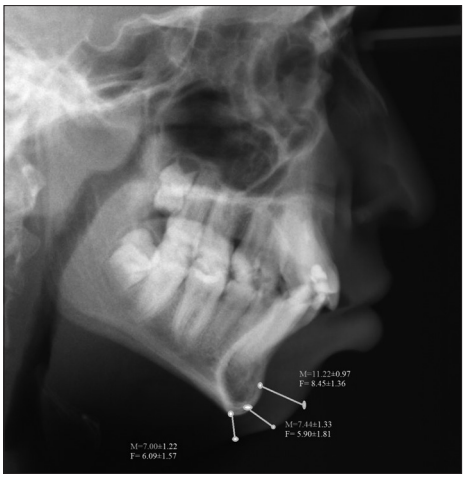

Figure 6: Medium-high mandibular divergence pattern

Figure 7: High mandibular divergence pattern

Table 6: Mean soft tissue chin thickness at different measurements according to mandibular divergence pattern

	MP/SN	Mean	Std. deviation	*F*	*P*	Significance
Pog-Pog'	Low	9.60	1.535	1.869	0.142	NS
	Medium-low	9.80	2.587			
	Medium-High	9.70	1.838			
	High	8.45	2.139			
Gn-Gn'	Low	6.40	2.062	1.182	0.322	NS
	Medium-low	6.80	1.880			
	Medium-High	6.60	1.759			
	High	5.80	1.321			
Me-Me'	Low	6.55	2.438	1.250	0.297	NS
	Medium-low	7.00	1.654			
	Medium-High	6.50	1.468			
	High	5.85	1.871			

reported that facial soft tissue thickness values were greater in men than in women.[9] Statistically, highly significant differences were present among the Group A and Group C at a level of Pog-Pog' and significant in Group C at the level of Gn-Gn'.

The relationships between the hard tissue structures and soft tissue profiles are variable. For some variables, hard and soft tissue structure are closely related, but some are independent chiefly because the characteristics of the soft tissues are influenced by their length, thickness, and functional aspects such as tissue tension.[10]

CONCLUSIONS

From this study, we concluded that the STC thickness were greater in Kodava men than in Kodava women in all the groups except high mandibular divergence pattern. STC thickness measurements were lesser in adult patients with vertical hyperdivergent pattern except at the level of Pog compared with adult patients with clinically normal and hypodivergent growth pattern in Kodava population.

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.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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