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Assessment of the soft tissue chins thickness with different skeletal vertical patterns in Pakistani adults

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The aim of the study is to evaluate and compare the soft tissue chin thickness values among adult patients with different vertical growth patterns. A sample size of 180 adults patients (32 males and 148 females), with an average age of 21.42 years (range 17- 32 years), was selected. The sample was divided into three groups according to the vertical growth pattern using SNMP angle (hypodivergent <27°, normodivergent 27-37° and hyperdivergent >37°). The soft tissue chin thicknesses in each group were measured at pogonion (Pog), gnathion (Gn), and menton (Me) and analyzed using the one-way analysis of variance and post-hoc Tukey test. The soft tissue chin thickness values were greater in hypodivergent group at Pog (12.71±2.10 mm), Gn (9.72 ± 2.55 mm) and Me (9.13 ± 2.88 mm) and smallest in hyperdivergent group (Pog 8.05 ±1.20 mm, Gn 6.07±1.47 mm, Me 5.91±1.21 mm). The soft tissue chin thicknesses were greater in men than women. Soft tissue chin thickness was greater in hypodivergent adults than those of normodivergent and hyperdivergent adults. In all the three groups, soft tissue thickness values were greater in men than women.

Key words: Vertical pattern, soft tissue, thickness, adult, chin.

INTRODUCTION

The vertical pattern plays a crucial role in diagnosis and treatment planning in both orthodontic growing and adult patients (Opdebeeck and Bell, 1978; Schendel et al., 1976). The development of vertical pattern has been related to several factors, like the growth of jaws, dentoalveolar development, eruption of the teeth, and function of the tongue and lips (Nielsen, 1991). Three basic types of vertical growth pattern are said to exist: Hypo-divergent (low angle), normo-divergent (average), and hyper-divergent (high angle) (Fields et al., 1984). Those with a hypo-divergent growth pattern have reduced vertical growth which is typically associated with short face, deep anterior overbite, increased posterior to anterior facial height ratio, decreased lower facial height and reduced sella-nasion (SN)/mandibular plane (MP) angle (SN-MP) angle (Opdebeeck and Bell, 1978). The hyper-divergent growth pattern have increased vertical growth with long face, anterior open bite, decreased posterior to anterior facial height ratio, increased lower facial height and increased SN-MP angle (Schendel et al., 1976). Normo-divergent growth pattern lies between these two types.

Bony and soft tissue structures help in the determination of facial harmony and esthetics (Stephan

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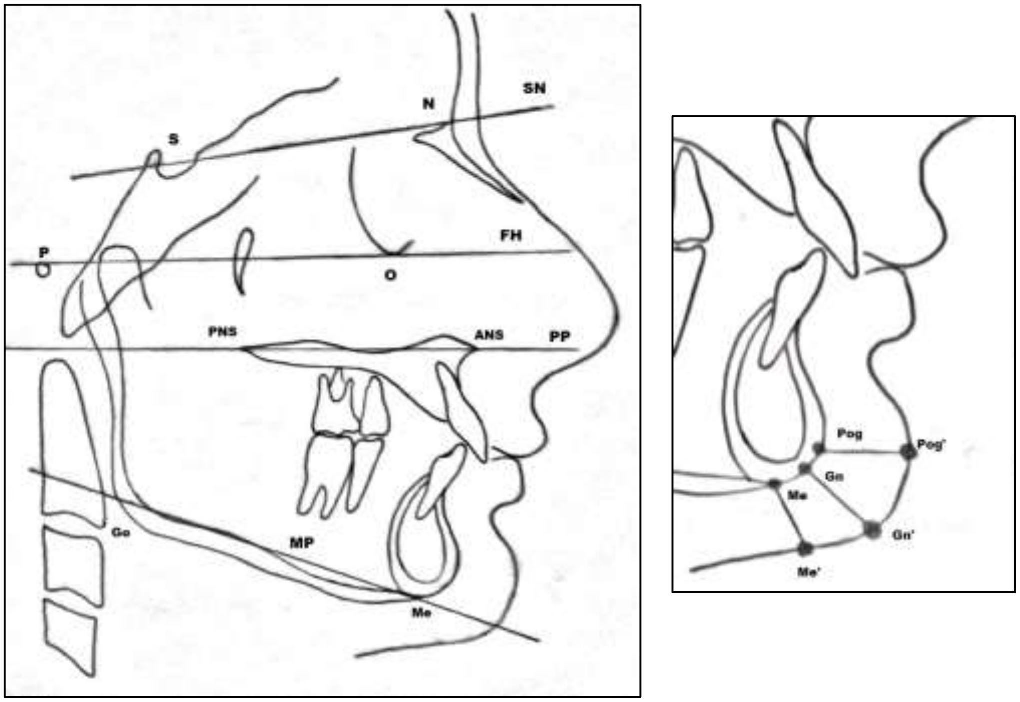

Figure 1. Lateral cephalometric tracing showing angular (left) and linear measurements (right). Left: SN (sella to nasion representing anterior cranial base), FH (Frankfurt horizontal plane; porion to orbitale), PP (palatal plane; ANS to PNS), MP (mandibular plane; gonion to menton. Right: Pog-Pog'= length between bony pogonion (Pog) and its horizontal projection (Pog') over the vertical passing through soft tissue pogonion; Gn-Gn'= distance between bony gnathion (Gn) and soft tissue gnathion (Gn'); and Me-Me'= distance between bony menton (Me) and its vertical projection (Me') on the horizontal passing through soft tissue menton.

and Simpson, 2008); with the soft tissue structures has a major visual influence on facial esthetics (Dumont, 1986). Variation between the bony structures and its overlying soft tissue position may affect the treatment outcomes ranging from camouflage to orthognathic surgery (Kamak and Celikoglu, 2012; Ramos et al., 2005; Ramos et al., 2005).

Genioplasty is a method of recontouring the chin by changing its shape, or size, or both, in the horizontal direction, for esthetic purpose (Sarver et al., 2003; Rosen, 2007) therefore, precise soft tissue measurement is necessary for surgical outcomes (Cha, 2013). Different studies showed soft tissue thickness changes after orthognathic surgery in patients with thick and thin soft tissues (Shaughnessy et al., 2006; Reddy et al., 2011; Abeltins and Jakobsone, 2011).

The aims and objectives of this study were to: (1) Evaluate and compare the soft tissue thickness values at different chin levels with different vertical growth patterns among the adult patients in a sample from Pakistani population and; (2) The difference in soft tissue chin thickness between men and women.

MATERIALS AND METHODS

The study was cross-sectional comparative, carried out on 180 pretreatment lateral cephalograms (32 male and 148 female) of adult Pakistani subjects. Mean age of subjects was 21.42 ± 3.178 years. Data was collected from patients coming to Orthodontics Department at Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, DUHS for orthodontic treatment. Signed consent to use the radiographs was obtained from the patients, before the study was conducted.

The following inclusion and exclusion criteria were used for the selection of the subjects for this study: Inclusion criteria were Pakistani adults of age above 18 years, the lateral cephalometric radiograph of each subject was taken by the same operator using a single Cephalometer, Rotograph Plus at 80 kvp, 10 mA and 0.8 s exposure time using 8 × 10 inch Kodak green film. For exact calculation of mid-sagittal enlargement a scale of known dimensions was attached to the Cephalostat. All subjects were positioned in the cephalostat with the sagittal plane at a right angle to the path of the X-rays, the Frankfort plane parallel to the horizontal, the teeth in centric occlusion, and the lips slightly closed with no lip strain, and well defined chin structures on the radiograph. Previous orthodontic and/ or orthognathic surgery treatment, presence of craniofacial anomaly like cleft lip and palate, TMJ abnormality, syndromes or presence of a noncontinuous soft tissue contour at the level of the chin indicating a chin strain were not included.

Tracing and measurement on cephalometric radiograph was done by a single investigator. Three linear and four angular measurements were measured on each radiograph. The landmarks were located and the following measurements were used (Figure 1), the angular measurements are:

Figure 2. Lateral cephalometric radiographs with different vertical skeletal pattern using SN-MP angle. Normodivergent group 27-37; hypodivergent group < 27; and hyperdivergent group >37.

Table 1. Description of the sample.

Parameter	Groups				
	Total	**Hypodivergent group MP/SN =<27**	**Normodivergent group 27<MP/SN <37**	**Hyperdivergent group MP/SN >37**	**P- value**
Total sample					
N	180	60	60	60	
Age, years (range)	21.42 (17-32)	21.02 (18-27)	21.97 (17-32)	21.27 (18-32)	NS
Men					
N	32	13	10	9	
Age, years (range)	20.91 (18-29)	19.85 (18-24)	22.70 (18-29)	20.44 (18-22)	NS
Women					
N	148	47	50	51	
Age, years (range)	21.53 (17-32)	21.34 (18-27)	21.82 (17-32)	21.41 (18-32)	NS

MP/SN, Mandibular plane to anterior cranial base. NS, not significant.

1. Mandibular plane to anterior cranial base (SN-MP).
2. Palatal plane to mandibular plane (MMA)
3. Mandibular plane to horizontal (FHMP), and
4. The ANB angle for the assessment of the sagittal relationship between the jaws.

The linear measurements for soft tissue thickness at chin were measured at three different levels:

1. Pog-Pog'= length between bony pogonion (Pog) and its horizontal projection (Pog') over the vertical passing through soft tissue pogonion;
2. Gn-Gn'= distance between bony gnathion (Gn) and soft tissue gnathion (Gn'); and
3. Me-Me'=distance between bony menton (Me) and its vertical projection (Me') on the horizontal passing through soft tissue menton.

Patients were divided into three groups based on vertical growth pattern using the SN-MP angle (Figure 2).

The sample included 60 patients in each group: Hyperdivergent group (9 men and 51 women; mean age, 21.27 ±-3.34 years), hypodivergent group (13 men and 47 women; mean age, 21.02±2.37 years), and normodivergent group (10 men and 50 women; mean age, 21.97±3.64 years).

Statistical analysis

All statistical analyses were done using the SPSS software package (SPSS for Windows 98, version 16.0, SPSS Inc., Chicago, IL). Arithmetic mean and standard deviation were calculated for each variable. Shapiro-Wilk statistics showed that all data were normally distributed; thus, parametric tests were used for further comparisons. One-way analysis of variance (ANOVA) was used to compare soft tissue chin thickness and different cephalometric skeletal measurements among three facial divergence groups and post-hoc test (Tukey honestly significant difference) was used for multiple comparisons. Statistical significance level was set at P=0.05.

RESULTS

Table 1 shows the mean age and range of the age of the

Table 2. Comparison of the skeletal and soft tissue chin variables measurements among different vertical pattern.

Parameter	Groups						
	Hypodivergent group MP/SN =<27		Normodivergent group 27<MP/SN <37		Hyperdivergent group MP/SN >37		ANOVA (P)
	Mean	SD	Mean	SD	Mean	SD	
Age, years	21.02	2.37	21.97	3.64	21.27	3.34	NS
Skeletal measurements							
SNMP	23.03	2.44	32.15	3.14	40.73	2.20	<0.001
FHMP	16.38	2.99	24.57	4.39	31.26	2.30	<0.001
MMA	18.02	3.93	25.04	4.71	30.75	4.58	<0.001
ANB	3.67	2.41	4.73	5.63	5.05	2.85	NS
Soft tissue measurements							
Pog-Pog’	12.71	2.10	9.70	1.62	8.05	1.20	<0.001
Gn-Gn’	9.72	2.55	7.03	1.46	6.07	1.47	<0.001
Me-Me’	9.13	2.88	7.13	1.66	5.91	1.21	<0.001

	Comparison among groups		
Groups	Hypodivergent-normodivergent	Hypodivergent-hyperdivergent	normodivergent-hyperdivergent
Age	NS	NS	NS
Skeletal measurements			
SNMP	<.001	<.001	<.001
FHMP	<.001	<.001	<.001
MMA	<.001	<.001	<.001
ANB	NS	NS	NS
Soft tissue measurements			
Pog-Pog’	<.001	<.001	<.001
Gn-Gn’	<.001	<.001	.017
Me-Me’	<.001	<.001	.004

MP/SN, Mandibular plane to anterior cranial base; SD, standard deviation; ANOVA, analysis of variance; NS, not significant; MMA, palatal plane to mandibular plane; FHMP, mandibular plane to horizontal; Pog-Pog’, length between bony pogonion (Pog) and its horizontal projection (Pog’) over the vertical passing through soft tissue pogonion; Gn-Gn’, distance between bony gnathion (Gn) and soft tissue gnathion (Gn’); Me-Me’, distance between bony menton (Me) and its vertical projection (Me’) on the horizontal passing through soft tissue menton. NS, not significant.

patients in each group and the mean age of men and women within each of the three groups. Age was not statistically significantly different between men and women within each group and across the three groups.

Table 2 shows the comparison of the skeletal and soft tissue chin variables measurements among different vertical patterns. All skeletal and soft tissue chin thickness measurements except nasion-B point (ANB) shows statistically significant differences among the three groups.

Patients in hypodivergent group has thickest soft tissue thickness at Pogonion, Gnathion and Menton ($p<0.001$), while the hyperdivergent group’s patients has the thinnest soft tissue chin thickness at all the three points ($p<0.001$).

The soft tissue chin thickness measurement of hypodivergent, normodivergent and hyperdivergent group of men and women are presented in Table 3 which shows men have thicker soft tissue chin thickness values as compared to the women.

DISCUSSION

The main purpose of this study is to determine the association between vertical skeletal pattern and soft tissue chin thickness in adults and to compare these values between men and women and also among different vertical skeletal groups. A previous study which evaluated the soft chin thickness in adult patients with various mandibular divergence pattern, showed that the values of soft tissue chin thickness was statistically significant only at point gnation for both men and women (Macari and Hanna, 2013).

According to Celikoglu et al. (2015) the thickness values was statistically significant in women of high angle group at pogonion only.

In our study, we found that the soft tissue chin thickness values were the thickest in the hypodivergent group and thinnest in the hyperdivergent group for both men and women While in normodivergent group the

Table 3. Comparison of soft tissue thickness at chin between men and women among different vertical pattern

Sex	Soft tissue chin measurements	Groups						
		Hypodivergent group MP/SN =<27		Normodivergent group 27<MP/SN <37		Hyperdivergent group MP/SN >37		ANOVA (P)
		Mean	SD	Mean	SD	Mean	SD	
Men	Pog-Pog’	12.92	1.42	9.65	0.62	7.83	0.66	<0.001
	Gn-Gn’	10.07	2.83	7.05	1.25	6.33	0.66	<0.001
	Me-Me’	10.57	4.82	8.60	1.34	5.83	0.66	0.008
Women	Pog-Pog’	12.66	2.26	9.72	1.76	8.09	1.28	<0.001
	Gn-Gn’	9.62	2.49	7.03	1.51	6.02	1.57	<0.001
	Me-Me’	8.73	1.95	6.84	1.57	5.93	1.29	<0.001

MP/SN, Mandibular plane to anterior cranial base; SD, standard deviation; ANOVA, analysis of variance; NS, not significant; Pog-Pog’, length between bony pogonion (Pog) and its horizontal projection (Pog’) over the vertical passing through soft tissue pogonion; Gn-Gn’, distance between bony gnathion (Gn) and soft tissue gnathion (Gn’); Me-Me’, distance between bony menton (Me) and its vertical projection (Me’) on the horizontal passing through soft tissue menton.

thickness values lies between these two groups. The statistically significant differences were found at pogonion (P <0.001), gnathion (P<0.001) for both men and women and at Menton (P=0.005) and (P<0.001) for men and women respectively. The difference between this study with previous studies (Macari and Hanna, 2013; Celikoglu et al., 2015) might be due to racial and ethnic groups. Hyperdivergent patients have deficient chin which required advancement genioplasty in comparison with the hypodivergent patients which do not require advancement genioplasty.

However, hypodivergent patients may require reduction genioplasty, or vertical augmentation genioplasty, or even sliding genioplasty for correction of any possible facial asymmetry. Soft tissue chin thickness is also correlated with sagittal plane discrepancies (Hoffelder et al., 2007). Soft tissue pogonion was influenced by the skeletal pogonion (Tanaka et al., 2011).

According to the soft tissue paradigm, more importance has been given to the soft tissue during diagnosis and treatment planning (Uysal et al., 2012). Soft tissue varies significantly with the difference in mandibular divergence pattern (Scheideman et al., 1980). Soft tissue should be considered before planning orthognathic surgery due to difference in soft tissue responses after surgery between the patients having thick and thin soft tissue (Abeltins and Jakobsone, 2011; Jakobsone et al., 2013 ; Wen-Ching et al., 2000)

Conclusions

The following conclusions were drawn:

1. Soft tissue chin thickness were greater in adults at pogonion, gnathion and menton in hypodivergent group.
2. These values are smallest in hyperdivergent adults.
3. In all the three groups, soft tissue thickness values were greater in men than women.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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