

Original Research

Comparison of Soft Tissue Chin Thickness in Adult Patients with Mandibular Divergence Patterns in Durg Population

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ABSTRACT:

Aim and Objective: To evaluate and compare soft tissue chin thickness in adult patients with different mandibular divergence patterns. **Materials and Methods:** A total of 30 adult subjects (aged 19–28 years) were divided equally into three groups based on mandibular plane angles (low, medium, and high angle). Lateral cephalometric radiographs were used to assess soft tissue chin thickness at three landmarks: POG–POG', GN–GN', and ME–ME'. Skeletal divergence was determined using MP/FH, FMPA, SN/MP, PP/MP, and ANB angles. Independent t-tests and ANOVA were used for statistical analysis ($p < 0.05$). **Results:** Statistically significant differences were observed in soft tissue chin thickness for GN–GN' ($p = 0.05$) and ME–ME' ($p = 0.001$) among different mandibular divergence groups. Skeletal divergence angles showed strong correlations with these soft tissue measurements. **Conclusion:** Soft tissue chin thickness is influenced by the skeletal divergence pattern, with the lowest values recorded in the high-angle group. This association should be considered in orthodontic diagnosis and treatment planning.

Keywords: Chin, Soft Tissue, Divergence, Mandible, Thickness, Adult

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INTRODUCTION

Facial esthetics and symmetry are crucial in orthodontic diagnosis and treatment planning. Among various craniofacial structures, the chin plays a pivotal role in defining the lower third of the face. Its morphology and soft tissue thickness significantly impact facial harmony, especially in profile view¹. A protruded or retruded chin, even in the presence of normal dental occlusion, may create disharmony in appearance, prompting orthodontic or surgical intervention.

The soft tissue thickness overlying the bony chin can influence the final esthetic outcome of treatments, such as orthognathic surgery or camouflage orthodontics. Therefore, a thorough understanding of the relationship between hard tissue (skeletal base) and soft tissue chin is vital for reliable outcome prediction².

Mandibular divergence patterns, usually classified by the mandibular plane angle in relation to various

cranial base references (e.g., SN/MP, MP/FH, FMPA), represent different vertical growth tendencies. Individuals with a low mandibular plane angle (low-angle pattern) often exhibit horizontal growth, a prominent chin, and a deep bite. In contrast, those with a high mandibular plane angle (high-angle pattern) typically show vertical growth, an increased lower facial height, and a relatively retruded or less prominent chin³.

Previous studies have demonstrated that skeletal divergence can influence the thickness and morphology of the soft tissue chin, with high-angle subjects generally showing thinner soft tissue coverage^{4,5}. These findings are important for clinicians when planning procedures such as genioplasty, chin augmentation, or camouflage orthodontics, where precise knowledge of soft tissue response is essential.

Moreover, population-specific craniofacial characteristics can further modulate these

relationships. As craniofacial morphology is known to vary by ethnicity and geographic region⁶, studies in local populations like that of Durg, Chhattisgarh, are essential to build regionally relevant clinical insights. There remains a paucity of data on soft tissue chin thickness variations across different mandibular divergence types in this population. Hence, the present study aims to evaluate and compare the soft tissue chin thickness in adults with low, medium, and high mandibular divergence patterns within the Durg population, contributing valuable data for both orthodontic and surgical facial assessments.

MATERIALS AND METHODS

Thirty adult patients aged 19–28 years were selected from the Durg population. They were divided into three groups (n=10 per group):

- Low angle group
- Medium angle group
- High angle group

Inclusion Criteria: Adult patients aged 19–28 years, Class I skeletal pattern, No history of orthodontic treatment or facial trauma.

Exclusion Criteria: Systemic diseases affecting bone or soft tissue and patients with congenital craniofacial anomalies.

Digital lateral cephalograms were analyzed using standard cephalometric landmarks. Soft tissue chin thickness was measured at three levels and the distances were measured manually with the help of scale. (figure 1)

- POG–POG’: Pogonion bony to soft tissue pogonion.
- GN–GN’: Gnathion bony to soft tissue gnathion.
- ME–ME’: Menton bony to soft tissue menton.

Mandibular divergence assessed through: MP/FH Angl, FMPA Angle, SN/MP Angle, PP/MP Angle, ANB Angle

STATISTICAL ANALYSIS

ANOVA was used for intergroup comparisons. Independent t-tests evaluated gender- and age-related

differences. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1 and 2 describes that none of the parameters (POG–POG’, GN–GN’, ME–ME’, and skeletal angles) showed statistically significant gender differences. In the low-angle group and medium angle group soft tissue chin thickness is similar across males and females, suggesting gender does not significantly affect the outcomes. Table 3 describes that in the high-angle group, males had significantly thicker soft tissue at pogonion and steeper mandibular divergence angles. This indicates possible sexual dimorphism in vertical facial morphology in high-angle cases.

Table 4, 5, 6 describes that no parameters showed statistically significant differences (p > 0.05), although some trends were noted: Low Angle ME–ME’: 8.67 mm in older vs. 6.86 mm in younger (p = 0.060). Medium Angle ANB: 9.00° in older vs. 2.67° in younger (p = 0.165). Age does not appear to be a major influencing factor within the 19–28 age range for either skeletal divergence or soft tissue thickness. Trends suggest slightly thicker soft tissue in older subgroups, but not significantly. Table 7 describes that GN–GN’ and ME–ME’ show a progressive decrease in thickness from low to high angle groups, reaching statistical significance.

Soft Tissue Thickness

GN–GN’: Significant difference (p = 0.05) with lowest values in high-angle group.

ME–ME’: Highly significant difference (p = 0.001).

POG–POG’: No significant intergroup difference (p = 0.68).

The reduction in ME–ME’ (from 7.4 mm to 4.9 mm) was most pronounced, reflecting the chin’s inferior region is most affected by skeletal divergence. POG–POG’ differences were minor and not statistically significant.

Skeletal Divergence Angles: MP/FH, FMPA, and SN/MP showed highly significant differences between groups (p < 0.001). Higher mandibular divergence correlated with reduced soft tissue chin thickness.

Table 1: Gender wise comparison on various parameters in low angle group

Parameters	Gender	N	Mean	SD	t-value	p-value
POG-POG’	Male	4	9.75	1.708	0.243	0.814 (n.s)
	Female	6	9.50	1.517		
GN-GN’	Male	4	8.00	2.944	-0.117	0.910 (n.s)
	Female	6	8.17	1.602		
ME-ME’	Male	4	6.75	.957	-1.202	0.264 (n.s)
	Female	6	7.83	1.602		
MP-FH ANGLE	Male	4	22.25	2.630	1.600	0.148 (n.s)
	Female	6	19.67	2.422		
FMPA	Male	4	21.00	2.000	2.087	0.070 (n.s)
	Female	6	18.33	1.966		
SN-MP	Male	4	27.50	3.512	2.136	0.065 (n.s)
	Female	6	22.67	3.502		

PP-MP	Male	4	22.75	4.992	1.300	0.230 (n.s)
	Female	6	19.67	2.582		
ANB	Male	4	4.50	2.887	1.052	0.323 (n.s)
	Female	6	3.00	1.673		

Statistical test: independent sample t test; (p<0.05- significant, CI=95%), N= number of study subjects s- Significant, n. s: Not Significant

Table 2: Gender wise comparison on various parameters in medium angle group

Parameters	Gender	N	Mean	SD	t-value	p-value
POG-POG'	Male	7	9.00	1.000	0.714	0.496 (n.s)
	Female	3	8.33	2.082		
GN-GN'	Male	7	7.57	1.272	-0.060	0.954 (n.s)
	Female	3	7.67	4.041		
ME-ME'	Male	7	6.43	1.134	0.096	0.926 (n.s)
	Female	3	6.33	2.082		
MP-FH ANGLE	Male	7	27.43	2.370	0.758	0.470 (n.s)
	Female	3	26.00	3.606		
FMPA	Male	7	27.71	2.690	0.779	0.459 (n.s)
	Female	3	26.00	4.359		
SN-MP	Male	7	29.43	1.272	0.091	0.930 (n.s)
	Female	3	29.33	2.082		
PP-MP	Male	7	21.86	7.358	-1.011	0.342 (n.s)
	Female	3	26.33	1.528		
ANB	Male	7	5.57	7.892	0.247	0.811 (n.s)
	Female	3	4.33	4.933		

Statistical test: independent sample t test; (p<0.05- significant, CI=95%), N= number of study subjects s- Significant, n. s: Not Significant

Table 3: Gender wise comparison on various parameters in high angle group

Parameters	Gender	N	Mean	SD	t-value	p-value
POG-POG'	Male	4	11.50	2.380	2.825	0.022 (s)
	Female	6	7.50	2.074		
GN-GN'	Male	4	6.50	1.732	0.853	0.419 (n.s)
	Female	6	5.67	1.366		
ME-ME'	Male	4	5.50	.577	1.503	0.171 (n.s)
	Female	6	4.50	1.225		
MP-FH ANGLE	Male	4	32.25	2.217	2.507	0.037 (s)
	Female	6	27.83	2.994		
FMPA	Male	4	32.25	2.062	4.348	0.002 (s)
	Female	6	26.17	2.229		
SN-MP	Male	4	34.50	3.000	-1.129	0.292 (n.s)
	Female	6	36.17	1.722		
PP-MP	Male	4	32.25	5.315	1.141	0.287 (n.s)
	Female	6	25.17	11.444		
ANB	Male	4	3.25	2.630	1.101	0.303 (n.s)
	Female	6	2.00	.894		

Statistical test: Independent sample t test; (p<0.05- significant, CI=95%), N= number of study subjects s- Significant, n. s: Not Significant

Table 4: Age -wise comparison of various parameters among low angle group

Parameters	Age group	N	Mean	SD	t-value	p-value
POG-POG'	19-23 years	7	9.14	1.464	-1.585	0.152 (n.s)
	24- 28 years	3	10.67	1.155		
GN-GN'	19-23 years	7	8.29	1.799	0.411	0.692 (n.s)
	24- 28 years	3	7.67	3.055		
ME-ME'	19-23 years	7	6.86	1.069	-2.185	0.060 (n.s)
	24- 28 years	3	8.67	1.528		
MP-FH ANGLE	19-23 years	7	20.43	2.992	-0.462	0.656 (n.s)

	24- 28 years	3	21.33	2.309		
FMPA	19-23 years	7	19.14	2.734	-0.513	0.622 (n.s)
	24- 28 years	3	20.00	1.000		
SN-MP	19-23 years	7	25.14	4.811	0.611	0.558 (n.s)
	24- 28 years	3	23.33	2.082		
PP-MP	19-23 years	7	21.43	4.077	0.648	0.535 (n.s)
	24- 28 years	3	19.67	3.512		
ANB	19-23 years	7	4.14	2.116	1.211	0.261 (n.s)
	24- 28 years	3	2.33	2.309		

Statistical test: independent sample t test; (p<0.05- significant, CI=95%), N= number of study subjects s- Significant, n. s: Not Significant

Table 5: Age -wise comparison of various parameters among medium angle group

Parameters	Age group	N	Mean	SD	t-value	p-value
POG-POG'	19-23 years	6	9.33	1.033	1.735	0.121 (n.s)
	24- 28 years	4	8.00	1.414		
GN-GN'	19-23 years	6	8.33	2.251	1.371	0.208 (n.s)
	24- 28 years	4	6.50	1.732		
ME-ME'	19-23 years	6	6.50	1.378	0.272	0.793 (n.s)
	24- 28 years	4	6.25	1.500		
MP-FH ANGLE	19-23 years	6	27.17	2.483	0.229	0.825 (n.s)
	24- 28 years	4	26.75	3.304		
FMPA	19-23 years	6	27.50	2.881	0.354	0.733 (n.s)
	24- 28 years	4	26.75	3.862		
SN-MP	19-23 years	6	29.50	1.378	0.256	0.804 (n.s)
	24- 28 years	4	29.25	1.708		
PP-MP	19-23 years	6	25.00	3.521	1.097	0.305 (n.s)
	24- 28 years	4	20.50	9.327		
ANB	19-23 years	6	2.67	1.966	-1.529	0.165 (n.s)
	24- 28 years	4	9.00	10.165		

Statistical test: independent sample t test; (p<0.05- significant, CI=95%), N= number of study subjects s- Significant, n. s: Not Significant

Table 6: Age -wise comparison of various parameters among high angle group

Parameters	Age group	N	Mean	SD	t-value	p-value
POG-POG'	19-23 years	8	9.00	3.295	-0.205	0.843 (n.s)
	24- 28 years	2	9.50	0.707		
GN-GN'	19-23 years	8	5.75	1.581	-1.069	0.316 (n.s)
	24- 28 years	2	7.00	0.000		
ME-ME'	19-23 years	8	4.75	1.165	-0.849	0.421 (n.s)
	24- 28 years	2	5.50	0.707		
MP-FH ANGLE	19-23 years	8	29.62	3.815	0.043	0.966 (n.s)
	24- 28 years	2	29.50	2.121		
FMPA	19-23 years	8	28.62	4.033	0.040	0.969 (n.s)
	24- 28 years	2	28.50	3.536		
SN-MP	19-23 years	8	35.75	1.753	0.659	0.528 (n.s)
	24- 28 years	2	34.50	4.950		
PP-MP	19-23 years	8	27.38	10.980	-0.385	0.710 (n.s)
	24- 28 years	2	30.50	0.707		
ANB	19-23 years	8	2.62	1.923	0.424	0.683 (n.s)
	24- 28 years	2	2.00	1.414		

Statistical test: independent sample t test; (p<0.05- significant, CI=95%), N= number of study subjects s- Significant, n. s: Not Significant

Table 7: Intergroup comparison between various parameters:

Parameters	Group	N	Mean	SD	f-value	p-value
POG-POG'	Low angle	10	9.6	1.506	0.31	0.68 (n.s)
	Medium angle	10	8.8	1.317		

	High angle	10	9.1	2.923		
GN-GN'	Low angle	10	8.1	2.079	3.20	0.05 (s)
	Medium angle	10	7.6	2.171		
	High angle	10	6	1.491		
ME-ME'	Low angle	10	7.4	1.43	9.35	0.001 (s)
	Medium angle	10	6.4	1.35		
	High angle	10	4.9	1.101		
MP-FH ANGLE	Low angle	10	20.7	2.71	23.91	0.001 (s)
	Medium angle	10	27	2.667		
	High angle	10	29.6	3.438		
FMPA	Low angle	10	19.4	2.319	25.28	0.001 (s)
	Medium angle	10	27.2	3.12		
	High angle	10	28.6	3.748		
SN-MP	Low angle	10	24.6	4.142	36.41	0.001 (s)
	Medium angle	10	29.4	1.43		
	High angle	10	35.5	2.321		
PP-MP	Low angle	10	20.9	3.814	2.60	0.09 (n.s)
	Medium angle	10	23.2	6.426		
	High angle	10	28	9.775		
ANB	Low angle	10	3.6	2.221	0.99	0.382 (n.s)
	Medium angle	10	5.2	6.877		
	High angle	10	2.5	1.78		

Statistical test: ANOVA; ($p < 0.05$ - significant, CI=95%), N= number of study subjects s- Significant, n. s: Not Significant

DISCUSSION

The present study revealed statistically significant differences in soft tissue chin thickness among patients with varying mandibular divergence patterns. The thickness at the ME-ME' and GN-GN' levels showed a strong correlation with skeletal divergence, confirming earlier hypotheses that vertical growth patterns are associated with reduced soft tissue chin thickness⁴⁷.

In our study, subjects with high-angle mandibular patterns had significantly thinner soft tissue chins, especially at the menton (ME-ME') and gnathion (GN-GN') points. This supports the findings of Celebi et al., who reported that increased vertical facial dimensions correspond to decreased chin prominence due to both skeletal retrusion and thinner soft tissue cover⁸. The ME-ME' measurement, representing the most inferior point of the chin, may reflect the reduced vertical bone support and lower muscular tonicity often observed in high-angle individuals⁹.

On the other hand, low-angle subjects showed thicker chin soft tissues, which may be due to their more forward-rotated mandibles and stronger muscular attachment in the mental region. This pattern is consistent with findings by Burstone and Legan, who noted that patients with a horizontal growth tendency tend to have more prominent and well-supported chins, both skeletally and in soft tissue terms¹⁰.

Interestingly, while POG-POG' differences were statistically insignificant across groups, the trend of reduced soft tissue thickness in the high-angle group was still evident. The central pogonion point might not be as sensitive to vertical skeletal changes, given

its relatively fixed position and the variability in soft tissue adaptation among individuals¹¹.

Gender-wise comparisons showed no significant differences, aligning with some previous research suggesting that soft tissue thickness in the chin region does not vary markedly between sexes within similar skeletal classes¹². However, it is important to note that other studies have reported sex-related differences, particularly in adult and aging populations, indicating the need for further age-stratified analyses¹³. From a clinical standpoint, these findings underline the importance of integrating vertical skeletal analysis into soft tissue assessments when planning treatment. In high-angle cases, especially, esthetic challenges may arise from both retruded skeletal anatomy and reduced soft tissue volume. This necessitates a comprehensive diagnostic approach, possibly including soft tissue grafting or genioplasty in surgical cases, or skeletal anchorage-supported intrusion or advancement mechanics in orthodontic cases.

Furthermore, these results highlight the importance of population-specific cephalometric norms. The data from the Durg population contributes to the understanding of regional craniofacial variation and helps build customized diagnostic and treatment protocols for better clinical outcomes.

CONCLUSION

There is a clear association between mandibular divergence patterns and soft tissue chin thickness. High-angle cases demonstrate significantly thinner soft tissue chins, especially in lower regions (ME-ME', GN-GN'). These findings have practical

implications in orthodontic and surgical planning for profile enhancement and facial harmony.

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