Effects of Sagittal and Vertical Skeletal Variations on Overlying Facial Soft Tissue Profile in Adults

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INTRODUCTION

Background: Soft tissue profile differs in its morphology and appearance based on the underlying three-dimensional skeletal structure. Hence, it can be affected by underlying bone morphology in the sagittal or vertical facial dimensions.[1,2]

Objectives: This study aimed to compare soft tissue profile variations between Class I and Class II adult patients in the three vertical skeletal facial patterns (normodivergent, hypodivergent and hyperdivergent). The primary purpose of the study was to determine which skeletal variation had the most significant impact on the soft tissue profile.

MATERIAL & METHODS

Retrospective soft tissue profile analysis was performed in Lateral Cephalograms for 131 adult patients (47 males, 84 females).
Soft tissue analysis was divided into three categories, subnasal profile, general profile, and soft tissue thickness. Sample was then divided based on two sagittal skeletal patterns (Class I and Class II), and three vertical skeletal groups.
Viewbox cephalometric tracing software was utilized for the assessment. **D**escriptive, comparative and correlation statistics were obtained using SPSS software.

RESULTS

Intergender: Males presented significantly thicker soft tissue compared to females at the level of the upper lip, lower lip and chin.

Sagittal: Class I individuals displayed significantly thicker upper lip especially in females, however, no significant differences were found at the level of the subnasal profile. Class II patients presented a significantly decreased Z-angle, facial angle, lower lip and chin prominence.

Vertical: Hyperdivergent patients had generally thinner soft tissue when compared to the normodivergent and hypodivergent groups. Hyperdivergent patterns also presented significant differences at the level of subnasal and general profiles compared to the other vertical groups.

DISCUSSION

Intergender:
Soft tissue thickness: Similar to other studies, males presented thicker soft tissue compared to females in all aspects of the face.[2,3,4] This interesting finding could be used for gender identification. Patients' gender must be considered when planning orthodontic treatment where the outcome of extraction therapy on the facial profile would be more noticeable in females compared to males.[5]
Subnasal profile: Females have more protruded lips.
General profile: There was no gender dimorphism.

Sagittal
Soft tissue thickness: In a study conducted on an adult Pakistani population, Jeelani et al. concluded that soft tissues have a tendency to camouflage underlying skeletal discrepancies i,e, Class III individuals presented thicker upper lip and thinner lower lip and chin, whereas Class II pattern had thinner upper lip and thicker lower lip. We found this to be true between Class I and Class II patients only at the level of the upper lip.[6]
Subnasal profile: Since the H-line measures the harmony of the subnasal profile specifically at the level of the lips, we can imply that Class I and Class II profiles in our sample were equally harmonious.[7]
General profile: Significant differences at the level of Z-angle, 0-degree meridian, facial angle, lower lip prominence and chin prominence, where the Class II group presented increased facial convexity due to mandibular retrognathism, similar to Buschang et al.[1]

Vertical
Soft tissue thickness: Similar to our results, a study conducted on CBCT found that the soft tissue was considerably thinner in hyperdivergent patterns at the level of the upper lip, lower lip and chin.[2]
Subnasal profile: Hyperdivergent patients display a more convex subnasal profile. This could be related to the fact that the backward positioned chin in high angle cases give the impression of protruded lips at the subnasal level. This is not attributed to thicker lips as seen above.
General profile: As FMA increased, the profile presented a more convex trend especially at the level of Z-angle, 0-degree meridian, facial angle and chin prominence. Chin was more retruded in hyperdivergent group as opposed to the hypodivergent group.

CONCLUSIONS

1. The vertical dimension had a more overall impact on the soft tissue compared to the sagittal. Soft tissue thickness, subnasal profile and general profile were all influenced by the vertical dimension
2. Males present thicker soft tissue compared to females, whereas females have a more convex profile
3. Vertical dimension must be given special consideration when planning orthodontic treatment and mechanics

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*Soft Tissue Comparison between **Males and Females** using Mann-Whitney test*

	Soft tissue variables	Males (N=47)	Females (N=84)	p-value (0.05)
Subnasal Profile	Upper lip to E-plane	-5.43	-4.43	**0.043**
	Lower lip to E-plane	-2.85	-1.70	**0.029**
	Nose	9.41	7.64	**0.024**
	Soft A to Holdaway	-3.64	-4.19	**0.027**
	Lower lip to H-plane	0.15	0.71	0.082
	Soft B to Holdaway	-6.53	-4.64	**0.000**
Soft tissue Thickness	Upper lip at subnasale	17.79	11.99	**0.000**
	Upper lip at vermilion	15.06	13.83	**0.003**
	Lower lip 1	15.94	10.60	**0.000**
	Lower lip 2	11.64	13.54	**0.000**
	Chin at pog	13.13	10.57	**0.000**
	Chin at Gn	8.77	6.94	**0.000**
General Profile	Nasolabial angle	99.62	100.57	0.633
	Z-angle	76.98	76.64	0.859
	0-degree meridian	2.38	3.64	0.316
	Facial angle	91.70	90.05	0.465
	Upper lip prominence	0.96	1.51	0.164
	Lower lip prominence	-2.28	-1.26	0.201
	Chin prominence	-8.32	-7.15	0.195

*Soft Tissue Comparison between **Class I and Class II regardless of gender***

	Soft tissue variables	Class I (N=61)	Class II (N=70)	p-value (0.05)
Subnasal Profile	Upper lip to E-plane	-5.25	-4.39	**0.046***
	Lower lip to E-plane	-2.23	-2.01	0.463*
	Nose	9.02	7.62	**0.034***
	Soft A to Holdaway	-4.05	-3.94	0.792*
	Lower lip to H-plane	0.66	0.39	0.453
	Soft B to Holdaway	-5.21	-5.41	0.587*
Soft tissue Thickness	Upper lip at subnasale	14.79	13.44	**0.008***
	Upper lip at vermilion	14.85	13.77	**0.001***
	Lower lip 1	12.72	12.33	0.404*
	Lower lip 2	12.77	12.93	0.54*
	Chin at pog	11.59	11.40	0.689*
	Chin at Gn	7.72	7.49	0.502*
General Profile	Nasolabial angle	96.61	103.39	**0.001**
	Z-angle	78.75	75.03	**0.000**
	0-degree meridian	3.97	2.51	0.059*
	Facial angle	92.59	88.94	**0.035***
	Upper lip prominence	1.69	0.99	0.246*
	Lower lip prominence	-0.44	-2.66	**0.001***
	Chin prominence	-5.87	-9.06	**0.000**

Kruskall Wallis test** comparing soft tissue between **vertical groups regardless of gender (1: Normodivergent, 2: Hypodivergent, 3: Hyperdivergent)

Soft tissue variables	Vertical groups		p-value (0.05)
Upper lip to E-plane	1	2	0.549
		3	0.291
	2	1	0.549
		3	**0.043**
	3	1	0.291
		2	**0.043**
Lower lip to E-plane	1	2	**0.025**
		3	**0.010**
	2	1	**0.025**
		3	**0.000**
	3	1	**0.010**
		2	**0.000**
Nose	1	2	0.230
		3	0.281
	2	1	0.230
		3	**0.010**
	3	1	0.281
		2	**0.010**
Soft A to Holdaway	1	2	0.206
		3	0.298
	2	1	0.206
		3	**0.010**
	3	1	0.298
		2	**0.010**

Soft tissue variables	Vertical groups		p-value (0.05)
Lower lip to H-plane	1	2	**0.010**
		3	**0.006**
	2	1	**0.010**
		3	**0.000**
	3	1	**0.006**
		2	**0.000**
Soft B to Holdaway	1	2	**0.029**
		3	**0.017**
	2	1	**0.029**
		3	**0.000**
	3	1	**0.017**
		2	**0.000**
Upper lip at subnasale	1	2	0.585
		3	0.449
	2	1	0.585
		3	0.099
	3	1	0.449
		2	0.099
Upper lip at vermilion	1	2	0.308
		3	0.866
	2	1	0.308
		3	0.189
	3	1	0.866
		2	0.189

Soft tissue variables	Vertical groups		p-value (0.05)
Lower lip 1	1	2	0.370
		3	0.884
	2	1	0.370
		3	0.243
	3	1	0.884
		2	0.243
Lower lip 2	1	2	**0.030**
		3	0.934
	2	1	**0.030**
		3	0.180
	3	1	0.934
		2	0.180
Chin at pog	1	2	0.959
		3	0.111
	2	1	0.959
		3	0.153
	3	1	0.111
		2	0.153
Chin at Gn	1	2	0.314
		3	0.091
	2	1	0.314
		3	**0.003**
	3	1	0.091
		2	**0.003**

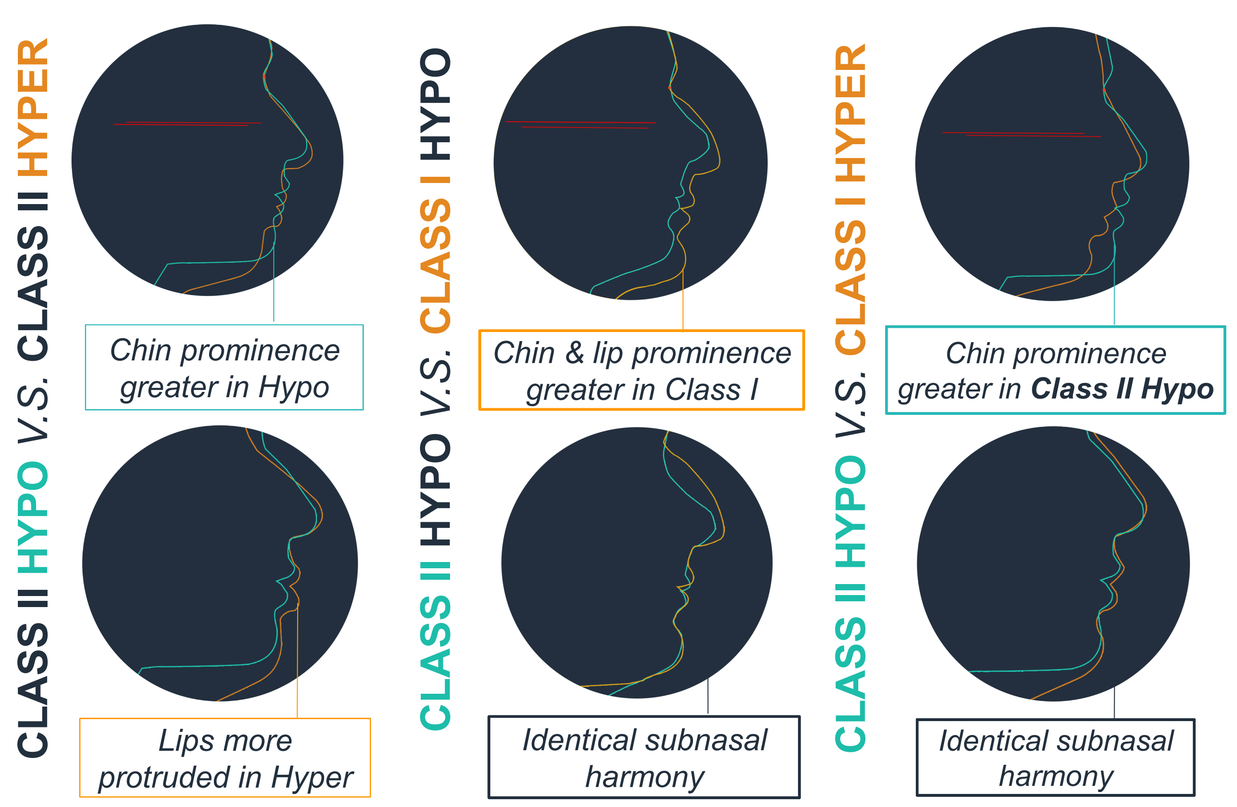
Soft tissue variables	Vertical groups		p-value (0.05)
Nasolabial angle	1	2	0.954
		3	0.947
	2	1	0.954
		3	0.837
	3	1	0.947
		2	0.837
Z-angle	1	2	**0.011**
		3	0.062
	2	1	**0.011**
		3	**0.000**
	3	1	0.062
		2	**0.000**
0-degree meridian	1	2	0.077
		3	0.072
	2	1	0.077
		3	**0.000**
	3	1	0.072
		2	**0.000**
Facial angle	1	2	0.892
		3	**0.050**
	2	1	0.892
		3	**0.015**
	3	1	**0.050**
		2	**0.015**

Soft tissue variables	Vertical groups		p-value (0.05)
Upper lip prominence	1	2	0.815
		3	0.931
	2	1	0.815
		3	0.990
	3	1	0.931
		2	0.990
Lower lip prominence	1	2	0.983
		3	0.969
	2	1	0.983
		3	0.918
	3	1	0.969
		2	0.918
Chin prominence	1	2	**0.010**
		3	**0.041**
	2	1	**0.010**
		3	**0.000**
	3	1	**0.041**
		2	**0.000**

***Correlation** between soft tissue variables and skeletal patterns*

	Soft tissue variables	ANB Males	ANB Females	FMA Males	FMA Females
Subnasal Profile	Upper lip to E-plane	0.307	0.385	-0.053	0.282
	Lower lip to E-plane	0.176	0.090	0.041	0.229
	Soft A to Holdaway	-0.029	-0.204	-0.212	-0.256
	Lower lip to H-plane	-0.025	0.130	0.155	0.169
	Soft B to Holdaway	0.018	-0.054	**0.555**	0.262
Soft tissue Thickness	Upper lip at subnasale	-0.074	-0.293	0.005	-0.186
	Upper lip at vermilion	-0.186	-0.243	-0.038	-0.096
	Lower lip 1	0.107	0.018	-0.159	-0.033
	Lower lip 2	0.255	0.162	0.283	0.103
	Chin at pog	0.034	-0.022	-0.126	-0.075
	Chin at Gn	-0.090	-0.084	**-0.417**	-0.164
General Profile	Nasolabial angle	0.266	0.228	-0.214	0.052
	Z-angle	**-0.313**	**-0.571**	**-0.312**	**-0.490**
	0-degree meridian	0.112	-0.154	**-0.379**	**-0.463**
	Facial angle	-0.087	-0.293	**-0.420**	-0.221
	Upper lip prominence	-0.032	-0.021	0.044	0.025
	Lower lip prominence	-0.150	-0.202	-0.018	-0.123
	Chin prominence	**-0.337**	**-0.526**	**-0.432**	**-0.509**

General profile (top) & subnasal profile (bottom) superimpositions of two randomly selected patients



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