SHORT COMMUNICATION

Comparison of upper and lower lip position, length and thickness in sagittal and vertical malocclusion

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Abstract

This study aimed to compare the upper and lower lips position, length, and thickness in different malocclusions, in randomly selected 180 patients' pre-treatment lateral cephalograms. The subjects were grouped sagittally by using Steiner's analysis and Wits appraisal and vertically based on Frankfort horizontal and mandibular plane (FHMP) angle and lower facial height. One-way ANOVA was applied to compare the upper and lower lip positions, thickness, and length in sagittal and vertical malocclusion and independent sample T test was applied for comparison between genders among soft tissue variables. Post-hoc Dunnett T3 was performed for comparison of lip variables in adjacent malocclusion groups. The level of significance was not less than or equal to 0.05. The anteroposterior position of the upper and lower lips with respect to E and S planes and upper and lower lip thickness varied significantly ($p < 0.05$) in all classes of sagittal malocclusion, whereas the anteroposterior (AP) position of the LL with respect to both planes and UL length between vertical malocclusion groups was statistically significant ($p < 0.05$). AP position and fullness of both lips have a significant association with sagittal malocclusion, whereas the AP position of the lower lip's and the length of upper lip is significantly associated with vertical malocclusion.

Keywords: Lip positions, thickness, length, malocclusion.

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Introduction

Patients seek orthodontic treatment to improvise dentofacial aesthetics and affect personality development and social interactions.[1] In recent times, there has been a paradigm shift from Angle's ideal occlusion of skeletal and dental relationships towards soft tissue paradigm. Orthodontists play a major part in determining the soft tissue profile due to the marked effect on incisor position by orthodontic treatment and hence on profile.[2,3]

Recently, lip position, length, and thickness have been observed to change in accordance with various skeletal facial types.[4,5] Although many investigations on the favoured anteroposterior (AP) lip positions for various facial types have been reported, few have assessed the connection between the favoured anteroposterior and vertical lip positions and its thickness in totally different facial disproportion.[6-8]

On cephalometric analysis, we can analyse the sagittal position of lips through various reference lines which are: Sushner's S2 line, Steiner's S1 line, Burrstone's B line, Ricketts E line, and Holdway's H line. Most commonly, the Rickett's and Steiner's analysis is performed for AP position of the lips (Figure 1).

In this context, many authors have described the soft tissue profile analysis with respect to sagittal

Figure-1: Reference lines on a lateral cephalograms.
Yellow = Burstone B line, Red = Sushner S2 line, Green = Steiner S1 line, White = Rickette's E line, Blue = Holdaway H line

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discrepancies but very few have evaluated and compared the effects of vertical growth patterns on upper and lower lip's sagittal positions, thickness and length.[6-8] Therefore, the objective of this study was to compare anteroposterior lip positions, length, and thickness in sagittal and vertical malocclusion by using soft tissue cephalometric analysis.

Materials and Methods

This retrospective cross-sectional study was conducted in the department of orthodontics of Dr Ishratul Ebad Khan Institute of Oral Health Sciences, DOW University of Health Sciences (DUHS) over a period of six months (from September 2020 to January 2021). Ethical approval for the study was taken from the IRB (Institutional Review Board, Ref. no. IRB-1789/DUHS/Approval/2021/214) department of DUHS along with patients' consents.

The calculated sample size was 99 (33 per group) by using the PASS software (V.11)[9] with 95% confidence interval & 95% power of test, intended by employing the values of type α (type I error) and β (type II error) at 5% and 20% respectively. The value of variance of measurements σ2 (standard deviation) was based on a previous study.[10] Mean and standard deviation of UL to E line in Class I=1.11 ±2.19, Class II=2.14±2.5, Class III=0.82±1.40. This sample size was inflated to 180 instead of 99 because the classes I, II and III malocclusion were further sub classified as per their vertical growth pattern.

The inclusion criteria was: age between 18-40 years with good quality and standardised lateral cephalograms having all dentitions except wisdom teeth. Subjects with craniofacial syndromes, severe discrepancy that require orthognathic and surgical treatment, previous orthodontic and prosthodontic treatment and anterior or posterior cross bite were excluded.

The cephalograms were traced on acetate sheets of 0.05µm thickness. Skeletal malocclusion was graded according to ANB (A point, nasion, B point) and Wits analysis, and the sagittal maxillary and mandibular relationship as defined by Steiner's.[11] Vertically, the malocclusion was graded into normodivergent, hyperdivergent, and hypodivergent growth pattern based upon FHMP angle and LFH. Linear measurements were recorded using digital Vernier calibre.

Sagittal lip position: It was measured using reference lines: aesthetic E line (from soft tissue pogonion to nasal tip) and Steiner's S1 line (from the centre of the chin soft tissue contour to the middle of an S shaped by the lower nose boundary). The standard values for the reference lines are: Steiner's S1 line: lips should trace the reference line, Ricketts E line: 3 to 4mm UL / -2mm LL, Upper lip length: it has been taken from subnasal to the most inferior portion of the upper lip at the midline, Lower lip length: it has been recorded from most superior portion of lower lip to the soft tissue gnathion, Upper lip thickness: it has been measured from prosthion (lowermost point of the alveolar bone between the left and right upper, central incisors) to labrale superioris and lower lip thickness: It has been scaled from infradentale (the utmost anterior part of alveolar bone the left and right lower central incisors) to the vermilion border of the lower lip. (Fig. 2)

Figure-2: Soft tissue landmarks.
Na = Nasion, Ps = pronasale, Sn = subnasale, Ls = labrale superioris, Li = labrale inferioris, Pog = soft tissue pogonion

The data were analysed by using SPSS for windows (version 19.0, SPSS Inc. Chicago). Kolmogorov-Smirnov test was used to assess the normality of the measurements. The test displayed normal distribution; hence parametric tests were applied. To compare lip positions, thickness, and length in both genders, Independent Sample T Tests were used. One-way ANOVA was used to compare lip measurements in sagittal and vertical malocclusion. A. Post Hoc Dunnett T3 test was implemented to compare lip measurements among sagittal and vertical malocclusion groups. P-value ≤ 0.05 was considered statistically significant.

For judging the intra-examiner reliability of the measurements, 30 cephalograms were arbitrarily chosen and reinvestigated by the principal investigator. The

intra-class correlation coefficient was done which displayed that repetitive measurements were extremely interrelated.

Results

The study sample encompassed of 91 (50.55%) males and 89 (49.44%) females with mean age of 21.93 ± 9.55 years. Independent sample T test was applied to evaluate gender differences among all studied variables and it showed non-significant differences, hence further data were not stratified according to gender.

Among sagittal class I, II and III malocclusions, one way ANOVA was employed. It showed statistically significant differences ($p < 0.05$) in anteroposterior (AP) upper and lower lips position with respect to E and S plane as well as in upper and lower lips thickness among all three malocclusion (Table 01). To further confirm our results and to see if these differences exist between classes of malocclusion, post-hoc Dunnet T3 applied and it showed that the AP upper lip position was significantly varied in adjacent malocclusion groups with both E and S planes. For the lower lip, with respect to E plane, we found significant differences in class II v/s III only, and with respect to S plane, between class I v/s II and I v/s III only. Similarly the thickness of UL varied significantly in class II v/s class III and class I v/s class III and thickness of LL in class I v/s class II and class I v/s class III. (Table 02)

Table-1: One-way ANOVA for sagittal malocclusion.

Variables	Malocclusion (Mean ± SD)			*P* value
	Class I	Class II	Class III	
E-plane UL	-2 ± 2.86	-0.36 ± 2.32	-4.21 ± 2.30	0.00
E-plane LL	-0.22 ± 2.79	0.95 ± 2.80	-0.30 ± 2.42	0.017
S-plane UL	-0.21 ± 2.04	1.71 ± 2.07	-1.13 ±1.73	0.000
S-plane LL	0.81 ± 2.62	2.53 ± 2.82	1.84 ± 2.10	0.01
UL thickness	10.55 ± 1.80	10.03 ± 1.8	11.43 ± 2.15	0.000
LL thickness	13.03 ± 2.09	14.12 ± 2.17	12.82 ± 2.01	0.002
UL length	19.88 ± 1.88	20.10 ± 1.91	19.87 ± 1.83	0.750
LL length	34.13 ± 37.93	30.05 ± 4.33	30.37 ± 2	0.531

One-way ANOVA test
P-value ≤ 0.05, SD = standard deviation

Table-2: One-way ANOVA for vertical malocclusion.

Variables	Groups	N	Mean	Std. Deviation	ANOVA
E plane UL	Normodivergent	58	-2.095	3.0942	0.127
	Hyperdivergent	62	-1.710	3.0361	
	Hypodivergent	60	-2.785	2.6679	
E plane LL	Normodivergent	58	-.069	2.6564	0.002
	Hyperdivergent	62	1.08	2.5353	
	Hypodivergent	60	-0.62	2.7458	
S plane UL	Normodivergent	58	-0.19	2.0834	0.43
	Hyperdivergent	62	0.71	2.3670	
	Hypodivergent	60	-0.18	2.2903	
S plane LL	Normodivergent	58	1.22	2.5823	0.001
	Hyperdivergent	62	2.75	2.5874	
	Hypodivergent	60	1.16	2.4070	
Thickness UL	Normodivergent	58	10.71	1.883	0.26
	Hyperdivergent	62	10.36	1.747	
	Hypodivergent	60	10.95	2.325	
Thickness LL	Normodivergent	58	13.10	2.269	0.28
	Hyperdivergent	62	13.18	1.833	
	Hypodivergent	60	13.68	2.340	
UL length	Normodivergent	58	19.74	1.585	0.000
	Hyperdivergent	62	20.81	1.827	
	Hypodivergent	60	19.27	1.858	
LL length	Normodivergent	58	33.88	38.641	0.54
	Hyperdivergent	62	31.35	3.089	
	Hypodivergent	60	29.40	3.136	

Among vertical malocclusions, one way ANOVA showed statistically significant difference between AP lower lip position and upper lip length (Table 03). For further verification and to ascertain the differences exist between the classes of vertical malocclusion, post-hoc Dunnet T3 applied and it revealed that AP position of LL with E and S plane and UL length was statistically significant among Normodivergent v/s Hyperdivergent and Normodivergent v/s Hypodivergent groups. (Table 03)

Conclusion

Table-3: Multiple comparison between sagittal malocclusion (Post Hoc Dunnet T3).

Variables	Class I v/s class II	Class I v/s Class III	Class II v/s Class III	Normodivergent v/s Hyperdivergent	Normodivergent v/s Hypodivergent	Hyperdivergent v/s Hypodivergent
E plane Upper lip	.003	.000	.000	--	--	--
E plane Lower lip	.065	.997	.028	.050	.602	.002
S plane upper lip	.000	.027	.000	.084	1.000	.104
S plane lower lip	.002	.059	.343	.005	.999	.002
Thickness UL	.302	.048	.001	--	--	--
Thickness LL	.019	.916	.003	--	--	--
Upper lip length	--	--	--	.003	.357	.000
Lower lip length	--	--	--	--	--	--

From the results of our study, we have obtained our conclusion that no sexual dimorphism exists within soft tissue variables. The AP position of UL and LL with both E and S planes and fullness of both lips are significantly associated with sagittal malocclusion whereas sagittal malocclusion has no effect on lip length. The AP position of only LL with both E and S planes and upper lip length are significantly associated with vertical malocclusion having no effect on other variables.

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Conflict of Interest: None.

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