Original Article

Cephalometric Assessment of Lips in Skeletal Class II Patients by Steiner's Line

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Abstract

Introduction: Steiner's (S) Line has been used as reference line to assess antero-posterior position of lips cephalometrically and has been an effective diagnostic aid in this era of soft tissue paradigm. Norms for S-line has been established for different populations and it has been used widely to assess treatment outcomes in Skeletal Class II malocclusion, however antero-posterior position of lips and determinants of lip position in Skeletal Class II has not been explored.

Study Design: This Prospective study was aimed to find out the antero-posterior position of lips on cephalograph using S-line in patients with retrognathic profile and to establish correlation between determinants of lip prominence. Data was collected using non-probability convenience sampling technique following the selection criteria.

Materials and Methods: The study was conducted on 65 subjects, with retrognathic profile as judged by orthodontists in consensus and confirmed by lateral cephalogram (ANB > 4°). S-Line was drawn on lateral cephalograph to assess the prominence of upper Lip and lower lip. SPSS 17.0 was used for statistical evaluation.

Results: Antero-posterior position of upper and lower lip in patients with retrognathic profile with reference to S-line was 1.96 ± 2.6 mm and 3.09 ± 3.16 mm respectively. Moreover it was found that statistically significant correlation existed between lower lip prominence as assessed by S-line and upper lip prominence using the same reference line (r = 0.411), Lower incisor inclination (r = 0.535) and Skeletal Class II as assessed by ANB angle (r = 0.27). Upper lip prominence as assessed S-line was found to be statistically significantly correlated with lower incisor inclination and lower lip prominence.

Discussion: Results were compliant with the previous studies.

Conclusion: In the present study both upper and lower lips were more prominent in Skeletal Class II patients as compared to Steiner's norms for skeletal class I.

Keys: Retrognathic Progile, Skeletal II Class Malocclusion, Lip Prominence, S-Line.

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Introduction

In the recent past diagnosis and treatment planning in orthodontics has been shifted towards facial planning and nose – lip – chin balance in three planes of spaces

Cephalometric Lip Assessment (Antero-posterior Position)

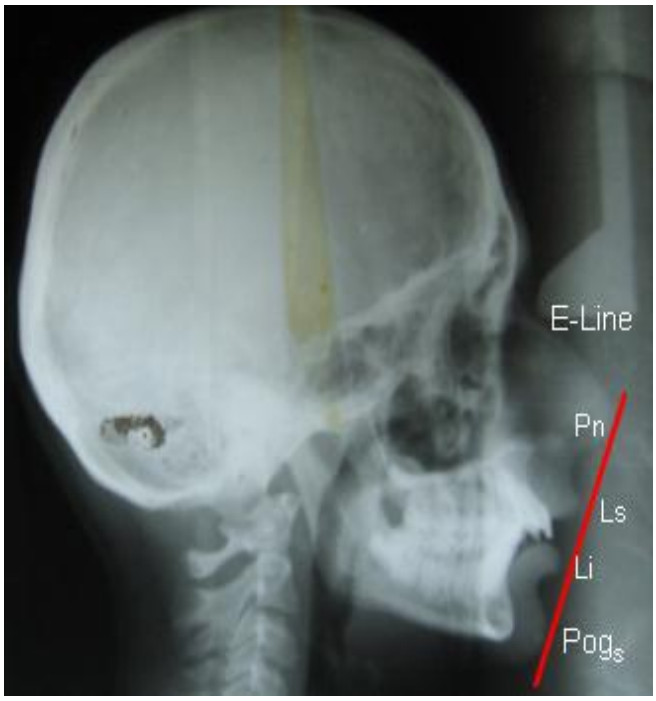

Fig. 1: E-line, Line drawn from the tip of the nose to the shaped soft tissue pogonion.

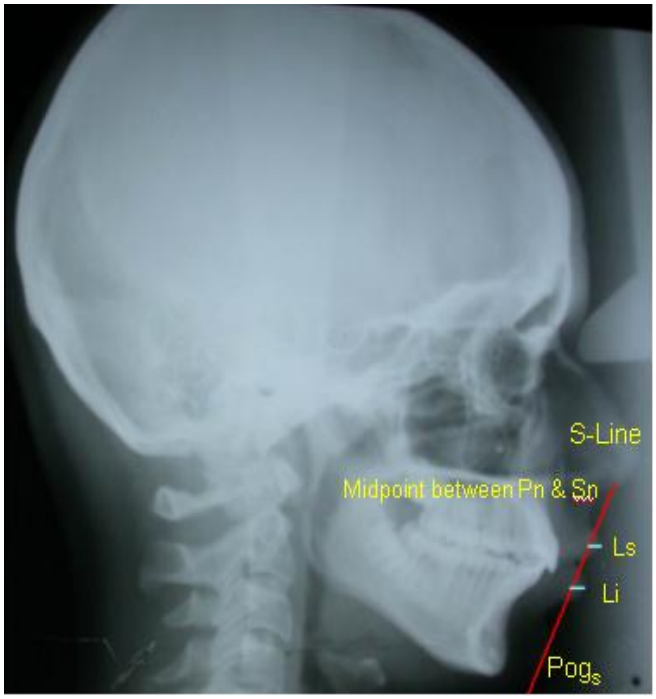

Fig 2: S-Line Line drawn from the center of the S – curve between the tip of the nose and the skin sub-nasale to the soft tissue pogonion.

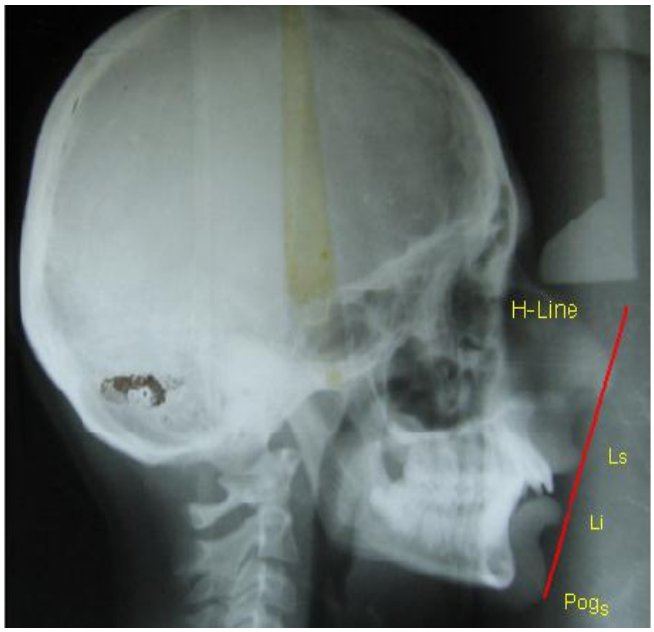

Fig. 3: H Line – Line tangent to the upper lip from the soft tissue pogonion.

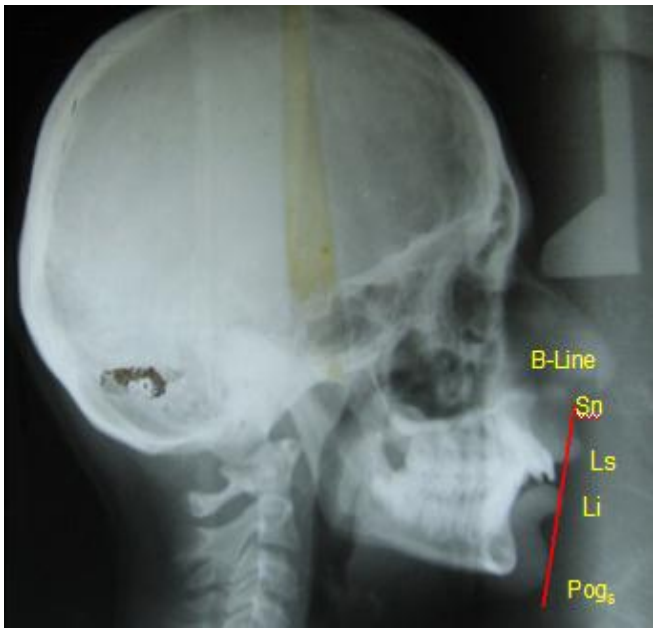

Fig. 4: Line joining the soft tissue sub-nasale as the upper point and skin pogonion as the lower point.

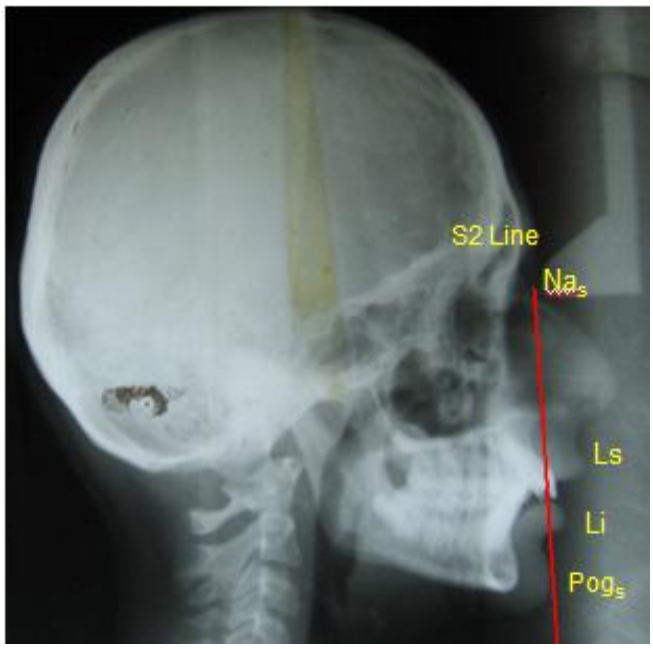

Fig. 5: Line drawn from the soft tissue nasion to the skin pogonion.

has been emphasized and stressed.[1-3] Lip balance has been critically assessed and has been given due respect in orthodontic diagnosis in the recent past. In cephalometric and photographic analysis, several reference lines have been introduced to assess antero-posterior position of the upper and lower lips. Ricketts' 'E' line,[4] Steiner's S line[5], Holdaway's 'H' line,[6] Burstone's 'B' line,[7] and Sushner's 'S2' line[8] are common lip assessment lines used by Orthodontists in diagnosis and treatment planning. Norms for different reference lines have been established for different populations and some of them have been used widely to assess treatment outcomes in Skeletal malocclusions,[9-12] however antero-posterior position of lips and determinants of lip position in different Skeletal malocclusions have not been explored.

S-Line is one of the most commonly used reference lines in orthodontic diagnosis and treatment planning. S-Line is drawn from midpoint between subnasale (Sn) and Pronasale (Pn) to soft tissue pogonion (Pog) and lip prominence with reference to this line is assessed. Its cephalometric norms are as follows: Upper lip to S Line (0 ± 2 mm), Lower lip to S Line (0 ± 2 mm). Steiner used S-Line with the idea that Ricketts E-Line is affected by nose length. Norms for different populations have been established[13-14] and S-line has effectively been used to assess treatment outcomes of Skeletal Class II malocclusion.[9-12] Lip prominence however in Skeletal Class II malocclusion has not been assessed.

Moreover it has been reported in different studies that lip prominence is dependent upon the tonicity of lip muscles, inclination of incisors, prominences of jaws, prominence of nose and chin.[15] Though lip prominence has been assessed in patients with orthognathic profile but lip prominence for patients with retrognathic profile has not been addressed and impact of different variables on lip prominence in patients with retrognathic profile is needed to be explored.

Aim of this study was thus to find out the antero-posterior position of lips on cephalograph using S-line in patients with retrognathic profile with underlying skeletal class II div 1 malocclusion and to establish correlation between determinants of lip prominence with the purpose that it might help in getting better lip positions and profiles in the patients.

Methodology

The study was conducted on 65 subjects (35 females, 30 males) having age above 09 years, who reported at Orthodontic Department, University College of Dentistry, The University of Lahore. Subjects having retrognathic profile as judged in consensus by orthodontists, were selected and lateral cephalogrm was taken. Patients confirmed cephalometrically (ANB >4°) were then included in the study. Patients with skeletal Class I Malocclusion, Skeletal Class III Malocclusion, Skeletal Class II div II and with gross facial asymmetries, having supernumerary or congenitally missing teeth, already undergoing with orthodontic treatment and Syndromes, were excluded from the study. Sample was collected using the non-probability convenience sampling technique.

Lateral Cephalograph was drawn for each selected subject and landmarks were listed as shown in Figure 5., linear distances from upper and Lower Lip to S-Line is determined to assess the prominence of upper Lip and lower lip. Upper lip prominence dependence if any on lower lip prominence (LL-S-Line), Maxillary prominence (SNA), upper incisor distance form maxilla (UI – NA dis) and upper incisor inclination (UI – NA angle) was assessed by establishing co-relation between UL – S line and the determents mentioned above. Lower lip prominence dependence if any on Mandibular prominence (SNB), lower incisor distance form mandible (LI – NB dis) and lower incisor inclination (LI – NB angle) was assessed by establishing

correlation between LL- S line and the determents mentioned above as shown in Fig. 6.

SPSS 17.0 was used for statistical evaluation. Mean, Standard Deviation, Variance, Minimum and Maximum value and Range were calculated for each variable for each subject. Correlation coefficients(r) were determined.

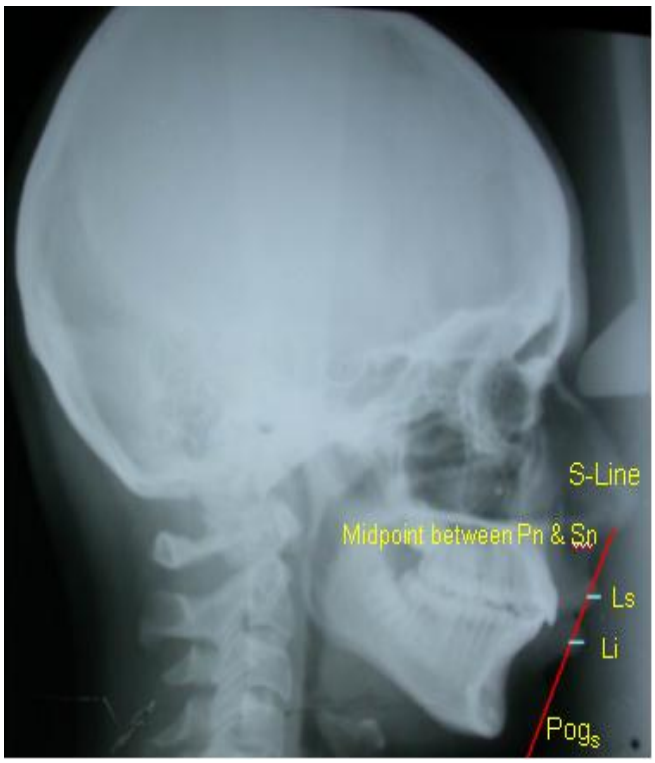

Fig. 6: Lateral Cephalograph showing Soft Tissue Landmarks used in this study: Pn (Pronasale), Sn (Subnasale), Ls (Labius Superiorus), Li (Labius Inferiorus), Pog (Soft Tissue Pogonion), S – Line (Sn – Pog), Upper Lip to S – Line (Ls – S – Line), Lower Lip to S – Line (Li – S – Line), < UI – NA Upper Incisor to NA line angle, < LI – NB (dis) Lower Incisor to NB line distance, < LI – NB Lower Incisor to NB line angle.

Results

The study was conducted on 65 subjects (35 females and 30 males) with mean age 11.35 ± 2.81. Patients with retrognathic profiles as assessed by orthodontists in consensus were selected and those patients with ANB > 4° were then finally included in the study as shown in table 1. Antero-posterior prominence of lips was assessed by S – Line as shown table 2. Descriptive statistics for the factors which could affect the lip prominence in Skeletal Class II patients is shown in table 3. Moreover statistically significant comparison and correlation was found between upper lip and lower

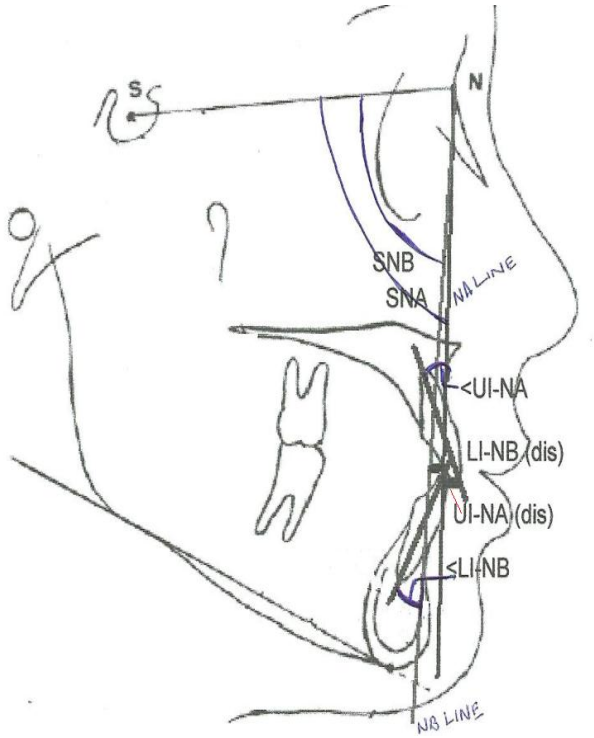

Fig. 7: Lateral Cephalogram Tracing showing Bony and Dental Landmarks, < SNA (Maxillary Prominence), < SNB (Mandibular Prominence), ANB = (SNA – SNB), UI – NA (dis) Upper Incisor to NA line distance

Table 1:
Cepahalometric Assessment of Skeletal Class II Malocclusion.

	Minimum	Maximum	Mean	Standard Deviation
SNA	73.00	89.00	81.6000	3.3948
SNB	66.00	82.00	74.5077	3.5974
ANB	5.00	15.00	7.1231	1.7722

Table 2: Assessment of antero-posterior position of upper and lower lips by S – Line in patients with retrognathic profile.

Descriptive statistics				
	Minimum	Maximum	Mean	Standard Deviation
UL – S Line	-5.00	8.50	1.9615	2.5985
LL – S Line	-3.00	10.00	3.0923	3.1646

Table 3: Factors which could affect the lip prominence in Skeletal Class II patients.

Descriptive Statistics					
		Minimum	Maximum	Mean	Standard Deviation
Maxillary	SNA	73.00	89.00	81.6000	3.3948
Mandibular Prominence	SNB	66.00	82.00	74.5077	3.5974
Skeletal Pattern	ANB	5.00	15.00	7.1231	1.7722
Upper Incisor Prominence	UI – NA (dis)	7.00	48.00	27.1231	9.5123
Upper Incisor Inclination	NA (degree)	-2.00	12.00	6.2231	3.1734
Lower Incisor Prominence	LI – NB (dis)	20.00	46.00	31.0769	5.9380
Lower Incisor Inclination	LI – NB (degree)	2.00	13.00	7.1385	2.2750

Table 4: Paired T-Test for Lip Prominence and Factors which could affect the Lip Prominence in Patients with Skeletal Class II Malocclusion.

Paired Samples Test								
	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Standard Deviation	Standard Error Mean	Lower	Upper	t	df	Sig. (2–Tailed)
UI – NA (dis) – UL – S Line	25.1615	9.8127	1.2171	22.7301	27.5930	20.673	64	.000
UI – NA (deg _ UL – S Line	4.2615	3.7885	.4699	3.3228	5.2003	9.069	64	.000
LI – NB (dis) – LL – S Line	27.9846	6.1001	.7566	26.4731	29.4961	36.986	64	.000
LI – NB (deg) – LL – S Line	4.0462	2.7368	.3395	3.3680	4.7243	11.919	64	.000
ANB – UL – S Line	5.1615	2.7770	.3444	4.4734	5.8496	14.985	64	.000
ANB – LL – S Line	4.0308	3.1831	.3948	3.2420	4.8195	10.209	64	.000
SNA – UL – S Line	79.6385	4.1472	.5144	78.6108	80.6661	154.819	64	.000
SNB – UL – S Line	71.4154	4.9770	.6173	70.1822	72.6486	115.687	64	.000
UL – S Line – LL – S Line	-1.1308	3.1626	.3923	-1.0144	-.3471	-2.883	64	.005

Table 5: Correlation between Lip Prominence and Factors which could affect the Lip Prominence in Patients with Skeletal Class II Malocclusion.

Correlations								
	SNB	ANB	UA – NA (dis)	UA – NA (deg)	LI – NB (dis)	LI – NB (deg)	UL – S Line	LL – S Line
SNA	.870**	.146	-.015	.077	.150	.198	.061	.057
SNB		-.356**	.158	.216	.067	.008	-.066	-.080
ANB			-.355**	-.280*	.146	.372**	.237	.270*
UI – NA (dis)				.733**	-.048	-.165	.019	-.143
UI – NA (degree)					-.091	-.126	.150	.083
LU – NB (dis)						.535**	.218	.215
LI – NB (degree)							.245*	.535**
UL – S Line								.411**

**.Correlation is significant at the 0.01 level (2 – tailed).
**.Correlation is significant at the 0.05 level (2 – tailed).

lip prominence as assessed by S – Line and the factors affecting Lip Prominence in Patients with Skeletal Class II Malocclusion as shown in table 4 and table 5.

Discussion

S – Line[5] is one of the most commonly used reference lines in orthodontic diagnosis and treatment planning. S – Line to upper lip is (0 ± 2 mm) and S Line to lower lip is (0 ± 2 mm) as defined by Steiner in his popular cephalometric analysis in subjects with orthognathic profile. Muhammad et al in their study on Malaysian Malays showed a significant difference in respect of their upper and lower lips which were more protrusive when compared to the Caucasian.[16] Sharma JN in his study on Nepalese found more protrusive lower lip (lower lip – S line mean difference, 0·9 mm; P = 0·003) in patients with orthognathic profile.[13] Erbay EF et al in their study on ninety-six adults (55 females, 41 males,) with Angle Class I occlusal relationships investigated cephalometrically the horizontal lip position of Anatolian Turkish adults and concluded that the upper and lower lips were retrusive according to the norms of Steiner.[17] Naidu D. L[18] in another study assessed photographs and cephalograms of one hundred mixed Indian student population with attractive facial profiles and concluded that B line was found to be the best in terms of consistency and sensitivity followed by the E line and S – Line in terms of consistency but not sensitivity. Asad S et al in another study found that Antero-posterior position of upper and lower lip with reference to S – line is 3.72 ± 2.85 mm and 1.18 ± 3.23 mm respectively.[19] Lip prominence was dependent on nasal and chin position.[20-21] Lip prominence however in Skeletal Class II patients utilizing S – Line have not been extensively assessed; deficient chin in such patients may affect the lip prominence.[22-25] In the present study UL – S Line was found to be 1.96 ± 2.6 while LL – S Line was 3.09 ± 3.16 suggesting that both upper lip and lower lip were slightly more prominent in Skeletal Class II patients as compared to patients with skeletal class I. However in comparison to Pakistani sample with orthognathic profile Upper lip is slightly retrusive and lower lip is slightly protrusive.

Moreover it was found that statistically significant correlation existed between lower lip prominence as assessed by S – line and upper lip prominence using the same reference line (r = 0.411), Lower incisor inclination (r = 0.535) and Skeletal Class II as assessed by ANB angle (r = 0.27). This showed that lower lip prominence is dependent upon skeletal pattern, lower incisor inclination and upper lip prominence.

While as far as upper lip prominence is concerned, statistically significant correlation existed with lower lip (r = 0.411) and lower incisor inclination (r = 0.245). Paired t-test also showed statistically significant relationship between all the pairs tested.

Conclusions

In the present both upper and lower lip were more prominent in Skeletal Class II patients as compared to Steiner's norms for skeletal class I. Paired t-test for Lip Prominence and Factors which could affect the Lip Prominence in Patients with Skeletal Class II Malocclusion showed statistically significant relationship (p-value < 0.05). Statistically significant correlation existed between lower lip prominence and upper lip prominence, Lower incisor inclination and ANB angle. Upper lip prominence as assessed S-line was found to be statistically significantly correlated with lower incisor inclination and lower lip prominence.

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