ORIGINAL ARTICLE

Facial Profile Convexity in Skeletal Class II Malocclusion: How Soft Tissue Angle of Facial Convexity (SA-FC) Correlate with Angle ANB in Skeletal Class II Subjects

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OBJECTIVE: The research was conducted to determine the correlation between Soft tissue angle of facial convexity (SA-FC) and angle ANB in skeletal class II malocclusion. The outcome of the study will help in determining if the routine consideration of ANB angle while the lack of defined thresholds for convexity of soft tissue profile justified for choosing the treatment modality.

METHODOLOGY: Lateral cephalograms of 141 skeletal class II subjects (ANB>4°) were obtained. Angular parameters including soft tissue angle of facial convexity (SA-FC) and angle ANB were determined. Gender dimorphism of the variables was assessed by Mann Whitney U test. Correlation between SA-FC and angle ANB were determined utilizing Spearman's correlation coefficient.

RESULTS: The angle SA-FC and ANB depicted moderately positive correlation ($r = 0.662$, $p<0.001$). Gender dimorphism exists with increased mean value of ANB (7.88±1.90) and SA-FC (23.22±7.61) in females.

CONCLUSIONS: Angle SA-FC depicts moderately positive correlation with angle ANB among skeletal class II subjects, hence suggesting the need of soft tissue guidelines along-with hard tissue parameters for selection of treatment modality.

KEYWORDS: Cephalometry, Malocclusion, Diagnosis, soft tissue, correlation.

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INTRODUCTION

Orthodontics include analysis of various diagnostic records such as lateral cephalogram, photographs etc to formulate a treatment plan.[1]

The most common lateral cephalometric parameters that diagnose the skeletal malocclusion include angle ANB, Witt's value and Beta angle etc.[2] Among soft tissue parameters for the assessment of facial harmony, facial angle, soft tissue angle of facial convexity (SA-FC), Nasolabial angle and H line are commonly used in diagnosis.[3]

Skeletal class II malocclusion is one of the most prevalent malocclusion.[4] Treatment modality for skeletal class II discrepancies involve growth modification, camofluage or combined Orthodontic orthognathic surgical treatment.[5] Current standards used for decision making in orthognathic surgical treatment planning are largely based on hard tissue parameters such as angle ANB > 9°, Pogonion-Zero meridian line >18mm and Gonion-Pogonion <70mm.[6,7]

Orthodontic paradigm shift to the soft tissue, psychosocial impact of aesthetics and its role as successful treatment outcome requires significant consideration of profile. However, current literature lacks in providing the threshold values of soft tissue parameters for different treatment options.[8,9,10] There also lies subjectivity in perception of profile between orthodontists and lay persons.[11] A study conducted about the perception of profile changes in females representing class II div I malocclusion as assessed by orthodontists and general public concluded that the orthodntists prefer the straight profile in constrast to the laypersons who prefers more convex profile.[12] Another study carried out on saudi population suggested increased tolerance of lay persons regarding smile aesthetics compared to the orthodontists and restorative dentists.[13] The results of the study conducted on the local population indicated significant difference (P-value 0.001) between orthodontist's and patient's ranking of preferred facial profiles.[14]

The purpose of the present study was to assess whether the ANB angle correlates with the SA-FC in skeletal class II subjects. The frequent consideration of angle ANB in delineating the treatment options in Orthodontics makes it

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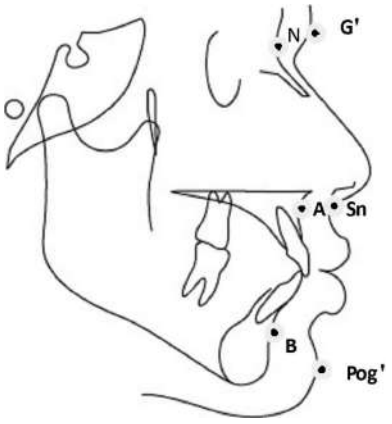
imperative to assess its correlation with the soft tissue profile convexity through -SA-FC for aesthetic considerations. The outcome of the study will help in assessing the need of standard quantified soft tissue parameters of SA-FC for choosing the treatment modality instead of exclusive use of hard tissue thresholds such as of angle ANB and subjective perceptions of profile.

METHODOLOGY

The study was conducted on retrospective data from the records of Orthodontics department, XYZ. Sample size of 127 was calculated by keeping Alpha (α) at 0.05, correlation coefficient between class II malocclusion and angle of facial convexity (r) 0.491 and power of the study (β) at 80%.15 The sample size was increased by 10% and total 141 cephalograms of Skeletal class II normo-divergent patients were included.

Age of the subjects ranged from 11 - 29 years was included. Patient who was having history of syndromes, obvious facial asymmetry, previous orthodontic treatment and trauma were excluded from the study.

Figure 1



Cephalograms were traced manually on acetate sheets with 0.5mm black pointer by the corresponding author. Following landmarks were anatomically located on lateral cephalograms (Figure 1) (Table 1)[15]:

Table 1: Anatomical landmarks

Nasion (N)	The most anterior point on the Nasofrontal suture on the mid sagittal plane.
Point A	The deepest midline point on the premaxilla between ANS and prosthion.
Point B	Deepest point on the mandibular symphysis in the mid-sagittal plane.
Glabella (G`) (soft tissue)	The most prominent point of midsagittal plane of forehead.
Subnasale (Sn)	The deepest point at which collumela intersects with the upper lip.
Soft tissue pogonion (Pog`)	The most anterior point on soft issue chin.

Figure1: Anatomical landmarks N, Nasion. A, Point A.B, Point B. G',Glabella. Sn, Subnasale. Pog', soft tissue pogonion.

Following angular measurements were recorded (Figure 2) (Table 2)[16,17]:

Figure 2

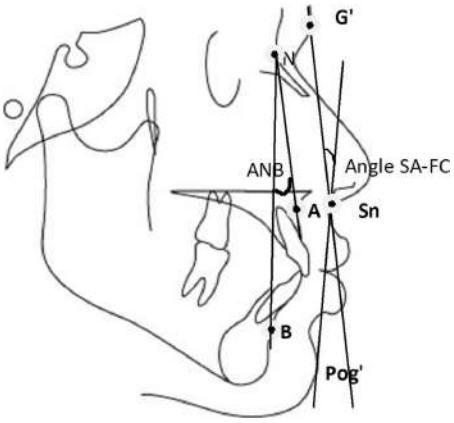


Figure 2: Angular measurements ANB, angle ANB. Angle SA-FC, Soft tissue angle of facial convexity.

Table 2: Angular measurements

ANB	Angle formed by point A, Nasion(N) and point B Normal value =0°-4°. [11]
Soft tissue angle of facial convexity (SA-FC)	Angle between soft tissue glabella (G`) to subnansale (Sn) and soft tissue pogonion (Pog`). Normal value = 8°-16°, value greater than 16° shows convexity. [12]

Standard units were used for measurements, mm for linear relations and degrees for angular assessments. Twenty two cephalograms were selected randomly and traced again by the corresponding author to assess the intra-examiner reliability (Table 3).

Table 3: Reliability Testing of measurements (n=22)

Angular measurement (in degrees)	N	Mean ± SD (measurement 1)	Mean ± SD (measurement 2)	ICC (95% CI)	P Value
ANB	22	7.045±1.73	7.273± 1.8043	0.961	0.001*
SA-FC	22	18.18±4.79	18.27± 4.692	0.993	0.001*

SD - Standard deviation; SA-FC = Soft tissue angle of facial convexity
ICC - Intra-class Correlation coefficient
*P< 0.001

Data analysis was done using SPSS software (version 17). Data was recorded and demographics were assessed. Descriptive statistics for quantitative variables were reported as Mean, standard deviation and standard error of mean, while gender distribution was reported in terms of frequency distribution. Shapiro-Wilk test was used to assess the normal distribution of dependant and independent variables. Mann-

Whitney U test was applied to assess gender dimorphism. Spearman's correlation coefficient was used to assess the correlation of ANB and age with the SA-FC. P-value ≤ 0.05 was considered as significant.

RESULTS

The Mean distribution with standard error of mean and standard deviation for age, ANB, and SA-FC are given in (Table 4). Mean ANB angle and SA-FC was 7.51° ± 1.83° and 21.94° ± 7.54° respectively. Gender distribution in terms of frequency is presented in (Table 5) males (n= 56), females (n= 85).

Table 4: Age, ANB and Soft tissue angle of facial convexity distribution of the sample (n=141)

	Range	Minimum	Maximum	Mean	Std. Error	SD	P value˜
Age	18	11	29	17.48	.398	4.722	0.001*
ANB	7.0	5.0	12.0	7.511	.1548	1.8385	0.001*
SA-FC	32	9	41	21.94	.635	7.543	0.004**

Std. Error- Standard error; SD - Standard Deviation ; SA-FC = Soft tissue angle of facial convexity
*p < 0.001, ** p <0.05
˜Shapiro-Wilk test

Table 5: Gender distribution of the sample (n=141)

	Frequency	Percent	SD	Std. Error of Mean
Male	56	39.7		
Female	85	60.3	0.491	0.041
Total	141	100.0		

Std. Error- Standard error; SD - Standard Deviation

Table 6: Gender dimorphism for variables ANB and Soft tissue angle of facial convexity (n=141)

Variables	Male (n=56) Mean ± SD	Female (n=85) Mean ± SD	P value
ANB	6.946 ± 1.58	7.882± 1.905	0.004*
SA-FC	20 ± 7.068	23.22 ± 7.612	0.011*

SD - Standard Deviation
SA-FC = Soft tissue angle of facial convexity
*p < 0.05
˜Mann - Whitney U test

Table 7: ACorrelation of Soft tissue angle of facial convexity with angle ANB and age (n=141)

Parameters	R	P- Value
ANB	0.662*	0.001†
Age	0.004**	0.960††

r - spearman's Correlation coefficient
*Moderately positive correlation = (0.5 < r < ± 0.8); †p < 0.001
**Weak Correlation = (0.01 < r < ± 0.5); ††p >0.05

Gender distribution for angle ANB and SA-FC showed significant dimorphism (p=0.004 and p=0.011 respectively) (Table 6). SA-FC showed more convex profile for females (mean angle 23.22° ± 7.612°) as compared to males (mean angle 20° ± 7.068°) p = 0.01. SA-FC showed moderately positive correlation with ANB (r= 0.662, p<0.001) while age and SA-FC showed statistically non significant correlation (r= 0.004, p<0.960) (Table 7).

DISCUSSION

Orthodontists use diagnostic threshold criteria based on cephalometric hard tissue values in finalizing the treatment plan.[18] However literature reports variation in soft tissue thickness among individuals and imperfect adaptation to the underlying hard tissues.[19] Lay people may have different perception of esthetics than do orthodontists.[20] Hence the objective of the present study was to evaluate if the correlation exists in hard and soft tissue assessment of sagittal discrepancy by angle ANB and SA-FC respectively.

Angle SA-FC has been described in the literature by various landmarks such as soft tissue Glabella (G), Nasion (N') and Subnasale (Sn) or Pronasale (Prn) along with soft tissue pogonion (Po').21Evidence suggested Glabella (G') and subnasale (Sn) are the most reliable landmarks for the soft tissue measurement thus used in the present study.[22]

The mean SA-FC in skeletal class II malocclusion (21.94°±S.D 7.543°) differs than the reported value by Habib M.23 (31.40°) in the same population with sample involving all three skeletal malocclusions. However the author also mentioned non-significant difference among skeletal malocclusion groups. Moreover both the studies depicted remarkably higher value of SA-FC in the local population in contrast to the standard Caucasian norms.[17]

Current study suggested difference of mean angle of facial convexity in males and females (p-value 0.011) with more convex profile in females in contrast to the researches by Ahmed.[15] (p-value 0.955), Imani.[24] (p-value 0.423) and Hamid MM.[25] (p-value 0.74) where the results showed non-significant gender dimorphism for SA-FC. Another study conducted on Pakistani population by Mahmood HT.[26] found increased mean angle of facial convexity in males in contrast to our findings. The varying results were possibly due to different inclusion criteria for sample collection without reporting skeletal malocclusions based on ANB angle.

In the present study sample of 141 skeletal class II subjects showed moderately positive correlation (r= 0.662, p<0.001) between angle ANB and SA-FC. However the

study conducted by Ahmed M.15 showed strong positive correlation (r = 0.90) between ANB and SA-FC while subjects with class II facial contour angle showed weak correlation (r = 0.49). The difference might be due to presence of three classes of malocclusion in the study by Ahmed M. 15 with inclusion criteria based on soft tissue angle while the current study applied ANB classification for the selection of skeletal class II subjects.

Malá, P. Z. et al.[27] concluded in their study the weak coefficient of determination between skeletal and soft tissue profiles (r2=0.02), predictive power of the soft tissue profile due to hard tissue variability was 23.2% based on landmark based morphometric analysis, while the current study showed moderate correlation of coefficient between hard and soft tissue convexity (r = 0.66) based on angular measurements.

Our results of moderate correlation between SA-FC and angle ANB (r=0.66) were in agreement with the study conducted by Parastesh A. et al.[28] who reported significantly correlated hard and soft tissue convexity angle (r = 0.7), however the sample included in the study were not distinctly defined in terms of skeletal malocclusion, whereas the present study included subjects with skeletal class II malocclusion.

There was statistically non significant weak correlation of age and SA-FC (r=0.004 p-value 0.96) found in our study, which is supported by the findings of Kumar A.[22] (males p-value 0.479, for females p-value 0.52) and Rakshan V.[29] (p-value 0.15).

LIMITATIONS OF THE STUDY

Although efforts were done to conduct the study in a manner to effectively generalize the results however the sample showed more females presentation. The reason of this representation might be greater aesthetic concerns of females thus increased reporting ratio to orthodontic clinics, as also supported by the literature.[4,30,31,32] Non normal distribution of class II with greater female prevalence in the population was also validated by the study conducted by Aslam A.[33] who reported the ratio 1:2.6 between males and females. Future studies with larger sample size and equal gender distribution of the sample will help in further validation of the results.

CONCLUSION

There was only moderately positive correlation found between angle ANB and SA-FC convexity in skeletal class II subjects which emphasizes the need of either highly correlated hard tissue diagnostic values or the threshold considerations of soft tissue parameters in effective treatment planning.

CONFLICT OF INTEREST

None declared

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