

SOFT TISSUE MORPHOLOGY IN BIMAXILLARY PROCLINATION

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ABSTRACT

The purpose of this study was to find the pattern of soft tissue morphology in a sample of Pakistani population with bimaxillary proclination. Lateral cephalograms of 100 patients (50 males and 50 females) exhibiting bimaxillary dental proclination were used to determine the skeletal, dental and soft tissue patterns among the subjects. Cephalometric parameters were evaluated and the database was developed in SPSS 10.0 for windows. The bimaxillary protrusion sample was skeletal class II due to mild mandibular deficiency and the mandibular plane inclination was within normal range. The soft tissue analysis showed the protrusion of both upper and lower lips

Key words: Bimaxillary dental proclination, Cephalometric parameters, soft tissue morphology

INTRODUCTION

Scores of parameters regarding skeletal, dental and soft tissues components are evaluated from the cephalometric radiographs for the diagnosis, treatment planning and stability of orthodontic outcome. Among them the soft tissues plays primary role of physical appearance and facial esthetics. As treatment mechanics are becoming more effective, there has been an increased emphasis on soft tissues, both in diagnostic and treatment results¹.

The standard of beauty varies tremendously among persons, racial groups and according to socioeconomic norms. The individuals exhibiting bimaxillary dental proclination show different soft tissue morphology than normal esthetic group. Various parameters and analysis are used for the diagnosis of skeletal, dental and soft tissue characteristics. Among these, Holdaway², Rickets³, Steiner⁴ and Merrifield⁵ are common in practice.

Very little work has been reported in the orthodontic literature regarding the soft tissue characteristics in subjects having bimaxillary proclination in our region. The present study was carried out to determine the soft tissue morphology in a Pakistani population sample having bimaxillary dental proclination.

METHODOLOGY

100 patients (50 males and 50 females) of bimaxillary dental proclination were recruited in this study. The consent was taken and the patients were informed for the amount of radiation exposure related to cephalometric radiography. The selection criteria for the sample were:

15 - 25 years of age.

Bimaxillary dental proclination.

No previous or active orthodontic treatment.

Mandibular plan angle in the range of 25 – 35.

Lateral cephalometric radiographs of the patients were exposed in centric occlusion. The cephalometric radiographs of patients were traced manually on acetate papers. Each radiograph of the patient was traced at the same sitting to minimize tracing errors.

Following skeletal angular measurements were taken:

<SNA, <SNB, <ANB, <SN-MP, <FMA

Following dental angular measurements were taken to determine dental proclination:

< UI-SN, <IMPA, <IIA.

Following soft tissue angular measurements were used:

Z-angle, <NLA, <ULI, <NI.

Following soft tissue linear measurements were taken:

E-UL, E-LL, S-UL, S-LL, H-LL, H-Pr, USD, LSD, STCT, ULL, LLL.

The database of study sample measurements was developed in SPSS version 10 for the Windows. The arithmetic mean, range and standard deviation for all the concerned variables were determined using the above-mentioned software with the help of SPSS processor.

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Fifty (50) cephalograms were randomly selected and retraced after two weeks of first tracing by the same operator and were compared to the first tracing of the same cephalograms. Paired t-test was applied to find any method error.

RESULTS

There was no statistically significant difference recorded between the first and the second tracings on applying the paired t-test for calculation of the method error.

The mean age of the sample was 20 ± 3.2 years, with a range of 15.2 to 25.0 years.

The mean value of the SNA angle was $83.58^\circ \pm 3.48^\circ$, that of SNB angle was $77.49^\circ \pm 3.59^\circ$ and that of ANB angle was $6.09^\circ \pm 2.36^\circ$. This means that sagittally the sample was class II due to mild mandibular deficiency.

The mean FMA angle was $28.61^\circ \pm 3.20^\circ$ and the mean SN-MP angle was $35.34^\circ \pm 4.08^\circ$ showing the normal mandibular plane inclination (Table 1).

The mean value of the IMPA was $104.78^\circ \pm 5.30^\circ$, and that of UI-SN angle was $118.41^\circ \pm 8.34^\circ$. The mean IIA of the sample was 105.64 ± 7.41 . All these show bimaxillary protrusion, which was one of the selection criteria of the sample (Table 2).

The mean value of the Z angle was $66.64^\circ \pm 5.31^\circ$, that of NLA angle was $91.91^\circ \pm 9.19^\circ$ and ULI angle was $73.97^\circ \pm 7.33^\circ$. These readings show lip protrusion. The mean value of NI angle was $18.31^\circ \pm 7.64^\circ$ which was within the normal range (Table 3).

The mean values of the soft tissue linear measurements E-UL, E-LL were $-0.694 \text{ mm} \pm 2.797 \text{ mm}$, $2.787 \text{ mm} \pm 3.668 \text{ mm}$, S-UL, S-LL were $2.694 \text{ mm} \pm 2.066 \text{ mm}$, $4.750 \text{ mm} \pm 3.243 \text{ mm}$ and that of H-LL, H-Pr were $3.313 \text{ mm} \pm 2.518 \text{ mm}$, $1.431 \text{ mm} \pm 4.088 \text{ mm}$ respectively. Thus both upper and lower lips were protrusive.

The mean value of ULL was $21.46 \text{ mm} \pm 2.64 \text{ mm}$ that of LLL was $44.87 \text{ mm} \pm 3.81 \text{ mm}$, that of USD was $8.531 \text{ mm} \pm 1.675 \text{ mm}$ and the mean value of LSD was $6.962 \text{ mm} \pm 1.776 \text{ mm}$.

The STCT, $11.87 \text{ mm} \pm 1.65 \text{ mm}$, that is within the normal range (Table 4).

TABLE 1: SKELETAL CHARACTERISTICS OF THE SAMPLE (IN DEGREES)

S. No.	Cephalo-metric Para-meter	Mini-mum	Maxi-mum	Mean	Stand-ard devia-tion
1	SNA	76	92	83.58	3.48
2	SNB	69	85	77.49	3.59
3	ANB	0	12	6.09	2.36
4	FMA	25	35	28.61	3.20
5	SN-MP	29	43	35.34	4.08

n=100

TABLE 2: DENTAL CHARACTERISTICS OF THE SAMPLE (IN DEGREES)

S. No.	Cephalo-metric Para-meter	Mini-mum	Maxi-mum	Mean	Stand-ard devia-tion
1	IMPA	97	114	104.78	5.30
2	IIA	84	120	105.64	7.41
3	I-SN	108	148	118.41	8.34

n=100

TABLE 3: SOFT TISSUE ANGULAR MEASUREMENTS OF THE SAMPLE (IN DEGREES)

S. No.	Cephalo-metric Para-meter	Mini-mum	Maxi-mum	Mean	Stand-ard devia-tion
1	Z angle	55	79	66.64	5.31
2	NLA	69	115	91.91	9.19
3	ULI	57	89	73.97	7.33
4	NI	3	38	18.31	7.64

n=100

TABLE 4: SOFT TISSUE LINEAR MEASUREMENTS OF THE SAMPLE (IN MM)

S. No.	Cephalo-metric Para-meter	Mini-mum	Maxi-mum	Mean	Stand-ard devia-tion
1	E-UL	-7.0	6.0	-0.694	2.797
2	E-LL	-5.0	11.0	2.787	3.668
3	S-UL	-3.0	7.0	2.694	2.066
4	S-LL	-2.0	13.0	4.750	3.243
5	H-LL	-3.0	8.0	3.313	2.518
6	H-Pr	-7.0	10.0	1.431	4.088
7	ULL	15	27	21.46	2.64
8	LLL	37	55	44.87	3.81
9	USD	4.0	12.0	8.531	1.675
10	LSD	4.0	12.5	6.962	1.776
11	STCT	8	15	11.87	1.65

n=100

DISCUSSION

The present study was carried out on lateral Cephalometric radiographs of 100 patients (50 males and 50 females). The purpose of the study was to find the soft tissue morphology in the patients with bimaxillary dental proclination. Average age of the whole sample was 20 ± 3.2 years with a range of 15.0 to 25.0 years. The entire sample had bimaxillary dental protrusion, mandibular plane angle ranging between 25 to 35.

The mean value of the SNA angle of the sample was $83.58^\circ \pm 3.48^\circ$. The SNB angle mean value of the sample was $77.49^\circ \pm 3.59^\circ$. The ANB angle mean value of the sample was $6.09^\circ \pm 2.36^\circ$. Thus sagittally the sample was skeletal class II due to mild mandibular deficiency (Table 1).

Firdos¹⁷ in a study on Pakistani Pakhtoon class II subjects also found out retrusive mandible among the individuals, similar to our findings.

The mean value of SNA angle in the present study is slightly larger and SNB angle is less than those presented by Steiner⁴ for the Caucasian population. The differences in SNA and SNB angle between Pakistani bimaxillary protrusion sample and Steiner Caucasian sample of class I are related to the protruded apical base of maxilla and retruded apical base of mandible in our sample. The mean value of the measurement ANB is more ($6.09^\circ \pm 2.36^\circ$) as compared to American Caucasian norms ($2^\circ \pm 2^\circ$).

Bjork⁷ has used a sample of 322 Swedish boys and calculated the mean values of SNA ($82^\circ \pm 3.60^\circ$), SNB ($79.30^\circ \pm 3.70^\circ$) and ANB ($2.70^\circ \pm 2.60^\circ$) and his SNA value is slightly less but the SNB and ANB values are larger than our sample which show the class II skeletal pattern in Pakistani population having bimaxillary protrusion.

Bishara⁸ et al studied 91 adult class II Division 1 cases and found larger ANB ($5^\circ \pm 2.2^\circ$), more retrusive mandible and convex facial profile with SNA value of $82^\circ \pm 4.2^\circ$ and ANB value of $77^\circ \pm 3.7^\circ$. This means that the skeletal pattern of class II Div 1 Caucasians and our bimaxillary proclination Pakistani sample is almost similar.

Tajik⁹ studied 38 class I subjects for cephalometric norms of Pakistani population. He derived the mean values of SNA ($81.25^\circ \pm 3.45^\circ$), SNB ($78.97^\circ \pm 3.56^\circ$) and ANB ($2.28^\circ \pm 2.29^\circ$). In our study the SNA angle and ANB were larger but the SNB angle mean value was slightly less than his norms, which indicate that the bimaxillary dental protrusion sample of Pakistani population has class II skeletal pattern due to mandibular deficiency.

As far as the vertical pattern is concerned, the mean values of FMA and SN-MP angle were $28.61^\circ \pm 3.20^\circ$ and $35.35^\circ \pm 4.08^\circ$ respectively.

As compared to mandibular plane angles values of Down's¹⁴⁹ (FMA= $21.90^\circ \pm 3.24^\circ$) and Ricketts³ (FMA= $26^\circ \pm 4.5^\circ$) and Steiner⁷ (SN-GoGn= 32°) of class I American population, our sample FMA value was larger than Down's and although both FMA and SN-MP angles are slightly larger than Ricketts³ FMA and Steiner's⁷ SN-GoGn but are within the normal range.

Tweed¹¹ used a sample of 95 white patients with good facial esthetics to develop norms. He described the FMA mean value of 25° ranging from 20° to 30° which is coinciding with the FMA values of our study thereby further supporting the normal mandibular plane inclination in bimax Pakistani sample.

Tajik⁹ found out the FMA mean value of $23.21^\circ \pm 4.20^\circ$ and SN-MP angle mean value of $30.13^\circ \pm 5.30^\circ$ in

a group of class I Pakistani population. His mean FMA and SN-MP values are less than the mean values of our study which show that the bimaxillary dental protrusion sample has greater mandibular plane inclination than skeletal class I Pakistani sample.

The mean value of the IMPA was $104.78^\circ \pm 5.30^\circ$, that of UI-SN angle was $118.41^\circ \pm 8.34^\circ$. The mean IIA of the sample was 105.64 ± 7.41 . All these values show bimaxillary protrusion, which was one of the selection criteria of the sample (Table 2).

According to Down's¹² Caucasian analysis, the mean value of IMPA is $91.40^\circ \pm 3.8$ which is quite less than our finding. His mean value of IIA is $135.40^\circ \pm 5.80^\circ$ which is much larger than our measurement. The normal value of IIA (131°) as calculated by Steiner⁴ is also greater than our calculation. Tweed¹¹ mean value of IMPA is 90° , which is again less than the measurement. All these support the bimaxillary dental proclination in our sample.

The mean value of the Z angle was $66.64^\circ \pm 5.31^\circ$, that of NLA angle was $91.91^\circ \pm 9.19^\circ$ and that of ULI angle was $73.97^\circ \pm 7.33^\circ$. These readings show lip protrusion. The mean value of NI angle was $18.31^\circ \pm 7.64^\circ$ which was within the normal range (Table 3).

Merrifield⁵ found the mean value of Z angle ($78^\circ \pm 5^\circ$) in a study of 40 normal faces of class I occlusion collected by Tweed¹¹. His Z angle value is greater than our value, which may be attributed to protruded lips in our sample.

Tajik⁹ also found larger value of Z angle, supporting lip protrusion in our sample.

The range of Nasolabial angle is between 90° to 112° degrees for Caucasians¹⁶. The nasolabial angle in our sample was ($91.91^\circ \pm 9.19^\circ$), pointing towards lip protrusion tendency in our bimax sample.

Qamar¹⁵ found out that mean nasolabial angle in the class II Pakistani individuals was $101.90^\circ \pm 13.34^\circ$. This dictated protrusive lips in class-II sample, which is similar to the present study findings.

Fitzgerald et al¹³ studied 104 class I young white adults with good facial balance. Their mean value for nasolabial angle was $114^\circ \pm 10^\circ$ and for upper lip inclination was $98^\circ \pm 5^\circ$. Both of which are larger as compared to the values of our sample thereby showing protrusive lips in bimaxillary proclination sample of Pakistani population as compared to class I Caucasians. However the nasal inclination angle ($18^\circ \pm 7^\circ$) value of whites coincides with our findings showing the similar nasal profile.

The mean values of the soft tissue linear measurements E-UL, E-LL were $-0.694 \text{ mm} \pm 2.797 \text{ mm}$, $2.787 \text{ mm} \pm 3.668 \text{ mm}$, S-UL, S-LL were $2.694 \text{ mm} \pm 2.066 \text{ mm}$, $4.750 \text{ mm} \pm 3.243 \text{ mm}$ and that of H-LL, H-Pr were $3.313 \text{ mm} \pm 2.518 \text{ mm}$, $1.431 \text{ mm} \pm 4.088 \text{ mm}$ re-

spectively. Thus both upper and lower lips were protrusive in our sample of bimaxillary Pakistani population.

Qamar¹⁵ carried out study on class II subjects and determined E-UL, E-LL, S-UL and S-LL distance. All the values were more than normal exhibiting protrusion of lips, similar to our findings.

Bishara et al⁸ in his study of 91 class II Div 1 adults Caucasians, found protrusive upper and lower lips in relation to Ricketts esthetic plane which is consistent to our finding.

This indicates that both class II Div 1 White population and bimaxillary Pakistani population have same protrusive lip pattern.

The mean value proposed by Ricketts⁶ are not consistent to our findings as our sample had both upper and lower lip protrusion.

Steiner⁴ suggested that both the upper and lower lips should be ideally on the S line which is contrary to our findings. This indicates that lips are protrusive in our sample.

Holdaway² had suggested that the lower lip should be 0.5mm and nose tip should be 9mm anterior to the H line which is contrary to our findings where lower lip was protrusive and the nose was 1.4mm anterior to the H line which may be attributed to protrusive lips and mandibular deficiency in our sample.

The mean values of upper and lower lip length in the sample were 21.46mm \pm 2.64mm and 44.87mm \pm 3.81 respectively.

Arnett and Bergman¹⁴ analyzed normal white faces and found upper lip length 19mm to 22mm, lower lip length 38mm to 44mm and the ratio of upper to lower lip 1:2.1, which are almost consistent to our values.

Holdaway² suggested that depth of sulcus is 2.5mm. Excessive curvature could be caused by lip protrusion or jaw over closure. Our upper lip values are showing lip protrusiveness in the sample.

Lower sulcus depth mean value 96.962mm \pm 1.77mm of the sample is slightly larger than Holdaway² norms again showing the lip protrusion in bimaxillary protrusion sample.

The mean value of soft tissue chin thickness (11.87mm \pm 1.65mm) was consistent with Holdaway's² range of 10mm to 12mm.

The mean value of basic upper lip thickness (15.33mm \pm 1.99mm) is the same as Holdaway's² normal range of 14 to 16mm. Hence it is obvious that soft tissue thickness at point A in bimaxillary Pakistani sample is consistent with Americans' normal value.

Similarly the mean value of vermilion upper lip thickness (13.56mm \pm 1.49mm) of the sample is match-

ing with Holdaway's² for Caucasian population which is 13mm to 14mm.

CONCLUSION

Sagittally the sample is skeletal class II due to mild mandibular deficiency. The mandibular plane inclination of the sample is within the normal range

The soft tissue analysis shows both upper and lower lip protrusion in the sample.

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