SOFT TISSUE FACIAL PROFILE ANALYSIS IN PATIENTS WITH CLASS I AND CLASS II SKELETAL PATTERN VISITING CHILDREN'S HOSPITAL, LAHORE

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ABSTRACT

The soft tissues covering the face play an important role in facial aesthetics, speech and function. Detailed soft tissue analysis is an important component of comprehensive diagnosis and treatment planning. A balance between the dental and the perioral muscles must be achieved to attain stability of the treatment outcome. The aim of the study was to compare soft tissue facial profile between skeletal class I and class II subjects and to find out difference in soft tissues adaptation on the basis of gender. Non probability sampling technique was used. Eighty patients were selected with age ranging 14 to 18 years. For each patient a lateral cephalogram was taken and cephalometric analysis was performed. The study showed that patients with class II skeletal pattern have more convex profile. Both upper and lower lips are more protrusive than the normal and lower lip length in males is slightly greater than the normal.

Key words: *Soft tissue Analysis, Facial Profile, Class I, Class II, Skeletal pattern, Cephalometric analysis*

INTRODUCTION

The study of facial beauty and harmony has been a pivot to the practice of orthodontics, right from its early infancy to date. Determining the facial profile and facial balance is a continuous learning process for an orthodontist.[1] A balanced profile should be one of the key factors in deciding on the methods of treatment for any form of malocclusion, as good occlusion does not necessarily mean good facial balance.[2] In fact the adaptation of soft tissue over underlying skeletal pattern is of prime importance towards the overall appearance of face. Although the underlying hard tissue structures establish most of the facial configuration, the actual appearance results from cutaneous contribution.[3] Moreover, the force generated by the perioral soft tissue structure is known to be the most potent that can effect tooth position and malocclusion.[4] Hence, the soft tissue appraisal was adequate for standard diagnosis, treatment planning and post treatment stability in most of the orthodontic patients.[2]

In orthodontic practice cephalometric radiography is most commonly used to evaluate and analyze the soft tissue pattern. The term cephalometry means the scientific measurement of the dimensions of craniofacial complex.[5] With knowledge of the standard facial traits and patient's soft tissue features, individualized norms can be established to optimize facial attractiveness.[2] A cephalometric approach to facial examination is therefore of great benefit. Although the orthodontist may not reach the cephalometric mean values post treatment, sagittal maxillomandibular relationship and the interlabial gap are the mean area of improvement of soft tissue aesthetics.[6]

The study of the soft tissue adaptation becomes even more important when we come across the patients belonging to different races. By a careful study a researcher comes to know that it is different in different ethnic groups. Not just this but even in the same race there is gender dimorphism as well. For example, the Saudi females have greater angle of convexity than the males and have the shorter lower lip.[7] These results reveal significant difference in most of the soft tissue variables when comparing Saudi with the Caucasian Americans. So along with, the skeletal and dental factors, a more thorough investigation of soft tissue pattern is required.

Among different types of malocclusion, class II type is more common. The aetiology of the class II malocclusion is mutifactorial[8, 9] and soft tissue factor may be a very important aetiological agent of this type of maloc-

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clusion. For example class II div 1 malocclusion may result from a short or hypotonic upper lip. Class II div I incisor relationship may also occur owing to retroclination of the lower incisors by a very active lower Lip.[10]

In case of class II div 2 in which the facial pattern is hypodivergent with short lower facial height,[11] the lower lip line is high which may cause the upper incisors to retrocline.[12] This type of relationship may also results from bimaxillary retroclination caused by active muscular lips, irrespective to the skeletal pattern.

So a closer relationship of the soft tissue with underlying skeletal pattern emphasizes on a more careful evaluation of the soft tissue drape.

METHODOLOGY

The study design was cross-sectional descriptive type, carried out in the Orthodontic department of Children's Hospital, Lahore. Non probability purposive sampling technique was used. Subjects between the age of 14 to 18 years with class I and class II skeletal pattern having no cleft of lip and palate and no traumatic deformity were picked up. Patients with any kind of syndrome were also excluded.

The study utilized the prospective data. Data was collected from patients who visited orthodontic department of the Children's Hospital, Lahore.

For each subject a lateral cephalogram was taken in natural head position with Frankfort horizontal plane of the patient parallel to the floor. Cephalogram was taken from the right side of the patient at a distance of 5-ft from mid-sagittal plane. Tracing was done on the cephalogram. In the first tracing skeletal and dental analysis was done. Patients with class I and class II skeletal pattern were picked up.

Data analysis procedure included tracing of the soft tissues on acetate matt, using 3H pencil, eraser and template etc. In soft tissue analysis 13 variables comprising of 5 angular and 8 linear measurements were used. Angular measurements included Subtelney's analysis of facial profile comprising of soft tissue profile angle and full soft tissue profile angle. Other angular measurements included Merrifield's Z angle, Harmony Angle and Nasolabial angle. Linear measurements mainly comprise of Burstone's analysis in which we measured length of upper lip, length of lower lip, thickness of upper lip and thickness of lower lip. Other linear measurements were the distance of upper lip to E-line, lower lip to E-line, upper lip to S-line and lower lip to S--line. Second tracing of the soft tissue was done one week later by the same operator and all 13 variables were measured.

Mean values of different variables were taken, standard error was calculated and 't' test was applied using SPSS statistical package 10.

SOFT TISSUE ANGULAR MEASUREMENTS

Following soft tissue angular measurements were taken as shown in Fig 1.

1. Nasolabial angle (NLA)
   It is angle between Collumella, Subnasale and Labrale Superius points (i.e. Cm-Sn-Ls)
2. Soft tissue profile angle
   It is angle in degrees between points soft tissue Nasion, Subnasale and soft tissue Pogonion (i.e. N-Sn-Pog)
3. Full soft tissue profile angle
   It is angle in degrees between points soft tissue Nasion, Pronasale and soft tissue Pogonion (i.e. N-Prn-Pog)
4. H-Angle
   It is the angle between N-Pog line and H-line joining Labrale Superius and soft tissue Pogonion (i.e. N Pog-Ls Pog)
5. Z-Angle
   The inner angle between Frankfurt horizontal plane and profile line (i.e. tangent to Pog and more prominent point on upper or lower lip.

SOFT TISSUE LINEAR MEASUREMENTS

Following soft tissue linear measurements were taken as shown in Fig 2

1. Ls to E-plane
It is linear distance in mm from Ls to the tangent plane joining Prn to Pog

2. Li to E-plane
It is linear distance in mm from Li to the tangent plane joining Prn to Pog

3. Ls to S-plane
It is linear distance in mm from Ls to the plane joining Pog to a point midway between Prn and Sn

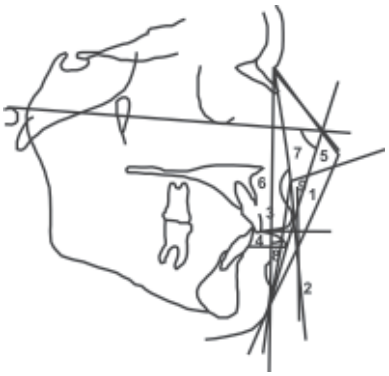
4. Li to S-plane
It is linear distance in mm from Li to the plane joining Pog to a point mid way between Prn and Sn.

5. Upper lip length
It is the linear distance in mm from Stomion to the soft tissue point Subnasale.

6. Lower lip length
It is the linear distance in mm from Stomion to the soft tissue Menton.

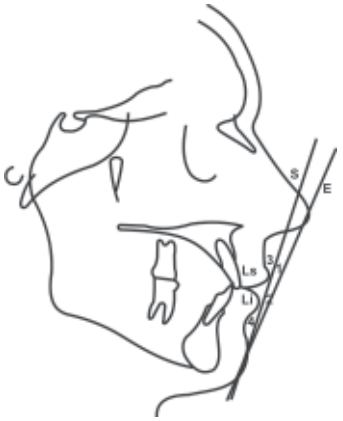
7. Upper lip thickness
It is the linear distance in mm from Ls to the Maxillary incisal tip

8. Lower lip thickness
It is linear distance in mm from Li to the Mandibular incisal tip



1 Upper lip length
2 Lower lip length
3 Upper lip thickness
4 Lower lip thickness
5 Full soft tissue profile angle
6 Soft tissue profile angle
7 Z- angle
8 H-angle
9 Nasolabial Angle

Fig 1: Soft Tissue Linear and Angular Measurements



1 Ls to E-plane
2 Li to E-plane
3 Ls to S-plane
4 Li to S-plane

Fig 2: Soft Tissue Linear Measurements

RESULTS

The mean age of the sample was 15.39 ± 1.29 years, with a range of 14-18 years (Table 1). A total of 80 patients were selected. Of those 41 were having class I skeletal pattern and 39 were found with class II skeletal pattern. The mean age of skeletal class I patients was 15.50±1.39 (Table 3) and those of class II skeletal pattern was 15.27±1.19 (Table 4). The mean age of 44 females was 15.48±1.27(Table 5) and 36 males was 15.27±1.33 (Table 4). The value of angular measurements i.e. soft tissue profile angle, full soft tissue profile angle, Merrifield's Z-angle and H-angle in tables 3 and 4 shows that the patients with class II skeletal pattern have more convex profile than class I patients. However there is not much difference in upper lip length, lower lip length, upper lip thickness and lower lip thickness between class I and class II patients.

When we compare our results on the basis of gender, the results show that females have very slightly more convex profile than the males (Table 5 & 6). This might be due to continued mandibular growth in males after adolescence [13] .

TABLE 1: MEAN/AGE DETAILS

	Minimum	Maximum	Mean	Std. Error	Std. Deviation
AGE (years)	14°	18°	15.39°	.15°	1.29°
SNA	72°	90°	81.45°	.44°	3.80°
SNB	69°	85°	77.11°	.39°	3.39°
ANB	-2°	10°	4.43°	.31°	2.73°
SN-Mandibular Angle	20°	50°	32.46°	.66°	5.71°
SN-Palatal Angle	3°	24°	9.85°	.46°	4.03°
SN-Occlusal Angle	2°	30°	17.59°	.74°	6.40°
Maxillary Mandibular Angle	12°	45°	25.84°	.69°	6.00°
Facial Proportion (%)	50	64	55.55	.78	6.77
JARABAK Ratio (%)	51	77	66.08	.59	5.14

TABLE 2: DESCRIPTIVE STATISTICS (DENTAL) (n=80)

	Minimum	Maximum	Mean	Std. Deviation
UI-Sn	87°	131°	106.7°	7.5°
UI-Pl	100°	138°	115.33°	6.58°
IMPA	69°	118°	99.8°	7.22°
IIA	98°	149°	122°	10.3°

TABLE 3: DESCRIPTIVE STATISTICS OF SOFT TISSUE (CLASS I 41)

Class I	Minimum	Maximum	Mean	Std. Deviation
AGE (years)	14	18	15.50°	1.39°
Soft tissue profile angle	132°	173°	156.94°	8.38°
Full soft tissue profile angle	103°	139°	126.55	7.21
Upper lip length (mm)	12	30	21.53	4.42
Lower lip length (mm)	34	58	45.93	5.53
Harmony angle	9°	30°	19.36°	4.89°
Z-angle	49°	90°	66.49°	9.59°
Nasolabial angle	64°	115°	99.14°	12.28°
Thickness of red part of upper lip (mm)	8	20	13.01	3.22
Thickness of red part of lower lip (mm)	11	22	15.39	2.63
Upper lip to E-line (mm)	-10	11	-1.53	3.98
Lower lip to E-line (mm)	-6	8	.87	3.39
Upper lip to S-line (mm)	-6	8	1.21	3.25
Lower lip to S-line (mm)	-6	8	2.24	3.14

TABLE 4: DESCRIPTIVE STATISTICS OF SOFT TISSUE (CLASS II 39)

Class I	Minimum	Maximum	Mean	Std. Deviation
AGE (years)	14°	18°	15.27°	1.19°
Soft tissue profile angle	139°	165°	153.91°	5.46°
Full soft tissue profile angle	114	134	125.16	4.69
Upper lip length (mm)	15	30	22.09	3.04
Lower lip length (mm)	30	60	47.19	5.60
Harmony angle	10°	28°	21.16°	4.76°
Z-angle	43°	75°	61.31°	8.00°
Nasolabial angle	79°	135°	101.41°	12.19°
Thickness of red part of upper lip (mm)	6	19	12.19	2.86
Thickness of red part of lower lip (mm)	10	20	15.60	2.39
Upper lip to E-line (mm)	--7.0	5.0	-.608	3.051
Lower lip to E-line (mm)	-5.0	8.5	1.459	3.292
Upper lip to S-line (mm)	-4	7	1.58	2.86
Lower lip to S-line (mm)	-4	10	2.08	3.34

DISCUSSION

The results obtained in the present study showed the reliability of landmark location. The nasolabial angle, mandibular angle, palatal angle, occlusal angle and maxillary mandibular angle were found to have large standard deviations. Similar findings were observed in a study conducted on Caucasian American males[14]. The large standard deviations revealed that these measurements showed a great degree of individual variability and indicated that comparisons should be made with the range of normal values rather than with the mean.

The anteroposterior relationship of maxilla and mandible to cranial base as shown by SNA and SNB angles for the sample were 81.45° ± 2.80° and 77.11° ± 3.39 respectively. The mean value for ANB was 4.43° ± 2.73°.

The mean value of maxillary-mandibular plane (MMA) angle for the entire sample was 25.84° ± 6.0°.

It is interesting to note that there was marked difference in value of IMPA between Caucasian norms reported by Tweed[15] (90° ± 5°) and Down[16] (91.40° ± 3.8°) and present study (998° ± 7,22). However other studies on Pakistani sample support our finding that value of IMPA is greater than that of Caucasian norms.

The value of H angle in our study was 20.25° ± 4.88°, indicating relative convexity of soft tissue profile. The values for H angle in this study were similar to those given by Basciftci[17].

Merrifield[18] found higher value of Z angle in adult than adolescents. The average value of Z angle found in 11 to 15-year age group was 78° ± 5°, with females demonstrating higher Z angle values than males In the

TABLE 5: DESCRIPTIVE STATISTICS OF SOFT TISSUE (FEMALE 44)

Female	Minimum	Maximum	Mean	Std. Deviation
AGE (years)	14	18	15.48	1.27
Soft tissue profile angle	132°	173°	156.39°	8.35°
Full soft tissue profile angle	114°	139°	126.31°	5.23°
Upper lip length (mm)	15	30	22.12	3.53
Lower lip length (mm)	36	58	45.61	4.21
Harmony angle	9°	28°	20.06°	5.07°
Z-angle	43.0°	90.0°	63.70°	10.58°
Nasolabial angle	69°	135°	99.44°	11.60°
Thickness of red part of upper lip (mm)	6	19	11.49	2.57
Thickness of red part of lower lip (mm)	11	18	14.76	1.88
Upper lip to E-line (mm)	-10	11	-.44	3.96
Lower lip to E-line (mm)	-5	9	1.80	3.24
Upper lip to S-line (mm)	-5	8	1.43	3.24
Lower lip to S-line (mm)	-4	10	2.23	3.38

TABLE 6: DESCRIPTIVE STATISTICS OF SOFT TISSUE (MALE 36)

Male	Minimum	Maximum	Mean	Std. Deviation
AGE (years)	14	18	15.27	1.33
Soft tissue profile angle	142°	161°	154.24°	5.30°
Full soft tissue profile angle	103°	135°	125.30°	7.10°
Upper lip length (mm)	12	29	21.41	4.11
Lower lip length (mm)	30	60	47.76	6.80
Harmony angle	10°	30°	20.48°	4.70°
Z-angle	49°	79°	64.23°	7.10°
Nasolabial angle	64°	129°	101.30°	13.05°
Thickness of red part of upper lip (mm)	8	20	14.03	3.07
Thickness of red part of lower lip (mm)	10	22	16.44	2.87
Upper lip to E-line (mm)	-7	5	-1.88	2.83
Lower lip to E-line (mm)	-6	6	.35	3.32
Upper lip to S-line (mm)	-6.0	6.0	1.348	2.838
Lower lip to S-line (mm)	-6	8	2.08	3.05

present study the average Z angle value (63.9° ± 9.16°) was considerably lesser than that reported by Merrifield. The value of Z-angle in class II patients was $61.31^0 \pm 8.00$ and class I patients was $66.49^0 \pm 9.59$ in our study, which once again shows that class II patients have more convex profile. In our study the value of Z-angle in females is 63.7010.58 and that of males is 64.237.10.

Ricketts found upper lip to be ideally 4mm posterior to aesthetic plane for adult females while in males it is a bit more retracted. He also found that lower lip be ideally 2.0 mm posterior to this line in males.

The mean value for E-line to upper lip in present study was –1.07mm ± 3.56mm that was more than normal value (–4mm ±2mm), this indicated that upper lip was slightly protrusive.

In the present study the mean value for E-line to lower lip (Li-E line) in the males was –0.35 mm ± 3.32mm and that for the females was –1.8mm ± 3.24mm. So in our study patients have more protrusive upper and lower lips.

In the present study soft tissue profile angle excluding nose was taken as the internal angle between points soft tissue Nasion, Subnasale and soft tissue Pogonion (i.e., N-Sn-Pog) and full soft tissue profile angle was recorded as internal angle between points soft tissue Nasion, Pronasale and soft tissue Pogonion (i.e. N-Prn-Pog).

The value measured for the STPA in present study was 155.33° ± 7.04° that is more acute than that reported by Subtelny[20] (161°), Zylinski[21] (166° ± 4.9°) and Satravaha[21]. The value of STPA in class I patients in

present study is 156.94 8.38 and that of class II patients is 153.9 5.46. In females, the value of STPA is 156.3 8.35 and in males this value is 154.24 5.30.

CONCLUSIONS

On the basis of the results derived from this study, following maybe concluded:

. Lower incisors are slightly proclined when evaluated in relation to mandibular plane.

Subjects with class II skeletal pattern have more convex profile (indicated by STPA).

Both upper and lower lips are more protrusive than the normal.

Lower lip length in males is also slightly greater than that of females but upper lip length has very negligible difference.

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