

CEPHALOMETRIC CHARACTERISTICS OF CLASS II MALOCCLUSION IN A PAKISTANI SAMPLE

*REHAN QAMAR, BDS, FCPS (Orthodontics)

**M WAHEED-UL-HAMEED, BDS, MCPS, MS (Turkey)

ABSTRACT

The purpose of this study was to determine the cephalometric characteristics of class II malocclusion in a Pakistani population sample, visiting the department of Orthodontics, de'Montmorency College of Dentistry, Lahore. Lateral cephalometric radiographs of 60 patients (30 male and 30 female) exhibiting class II malocclusion were traced and evaluated. 16 angular and 8 linear measurements were used to determine the skeletal, dental and soft tissue patterns of the class II subjects. The results revealed a deficient mandible, both positionally and morphologically. However, vertically the sample showed normal angle findings. The sample revealed a bimaxillary proclination with lower incisors more proclined, as found usually for class-II dentoalveolar compensation. Both the upper and lower lips of the sample subjects indicated protusiveness. It was concluded from the study that sagittally the skeletal class II pattern was due to mandibular deficiency. The Dental characteristics were bimaxillary dental proclination and the soft tissue also was protusive, with lower lips more protrusive than the upper.

Key words: Cephalometric, Class-II characteristics, malocclusion.

INTRODUCTION

Radiographic cephalometry was first developed as a method to study craniofacial growth and development and later the use was extended to study the facial form. Analysis of lateral cephalometric radiographs has been practiced for the prediction of growth, diagnosis, treatment planning and evaluation of treatment response for many years¹. Different cephalometric analysis has been used that attempt to relate craniofacial landmarks, in a meaningful way, to the profile and occlusion². Among the analyses used, most common ones are devised by Ricketts³, Steiner⁴, McNamara⁵ and Downs⁶.

Class II malocclusion may present a variety of skeletal and dental configurations'. Maxillary protrusion and mandibular retrusion positionally and morphologically is a frequent dentofacial abnormality in

various populations^{8,9,10,11}. Skeletal class II patterns arise from not only horizontal, but also from vertical discrepancies¹².

Widely studied characteristics like those of Caucasians used in numerous cephalometric skeletal and dental analyses might be inadequate for application to different racial or ethnic groups. Persons from different ethnic groups exhibit variations in cephalometric measurements, so much so that persons belonging to the same race and different geographical regions might have differences too¹³. Very little work has been reported in the orthodontic literature regarding the cephalometric characteristics of class II malocclusion in Pakistan. The present study was carried out to determine class-II characteristics in a Pakistani population sample. This study might be useful in diagnosis and determining different treatment modalities for class II malocclusion in our region.

Assistant Professor, Lahore Medical and Dental College, Lahore — Pakistan

** Professor, Head of Orthodontic Dept, de'Montmorency College of Dentistry, Lahore — Pakistan

Correspondence: Dr Ch Rehan Qamar, 421/ 2 / C-I, Township, Lahore. Ph: 0321-4787303 [Email: dr.rehanqamar@gmail.com](mailto:dr.rehanqamar@gmail.com)

The present study was designed to find out the cephalometric characteristics of class II malocclusion in a Pakistani population sample.

MATERIAL AND METHODS

The present study was carried out at Orthodontic Department, de'Montmorency College of Dentistry, Lahore. Lateral cephalograms of sixty patients (30 male and 30 female) exhibiting class II molar relation according to Angle's classification, were selected for the measurements. The selection criteria for the sample were: Age range between 12-15 years, < ANB angle more than 5 degrees, Permanent set of dentition from first molar to first molar and no previous history of orthodontic treatment. All the lateral cephalometric radiographs were traced manually on the acetate tracing paper with a lead pencil.

Following were the skeletal angular measurements used in Sagittal and vertical analysis:

<SNA, SNB, ANB, SN-Pog, SN-MxP, SN-MnP, MMA, Y-axis, N-S-Ar, Ar-Go-Gn

The skeletal linear measurements taken were:

S-N length, Mandibular corpus length (MCL), Jarabak Ratio, Ratio of lower anterior face height to Total Anterior Facial Height (LAFH/TAFH)

Following were the Dental angular measurements taken:

UI-SN, UI-MxP, IMPA, Interincisal angle (IIA).

The following soft tissue angular and linear measurements were used:

Nasolabial angle, Upper lip-E line distance, Lower lip—E line distance, Upper lips — S line distance, Lower lip -S line distance.

STATISTICAL ANALYSIS

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.

Thirty (30) 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.

SKELETAL CHARACTERISTICS OF THE SAMPLE (Table 1 & 2)

The mean value of SNA angle was $83.50^{\circ} \pm 3.38^{\circ}$, that of SNB angle was $76.23^{\circ} \pm 3.00^{\circ}$. Mean ANB angle was $7.30^{\circ} \pm 1.52^{\circ}$. So in our class II study sample, the maxilla was normal while mandible found to be retrognathic. Similarly mean anterior cranial base length (S-N distance) was $71.77\text{mm} \pm 4.26\text{mm}$ and the Mandibular corpus length ($\text{Go}_c\text{-Gn}_c$) in the total study sample was $76.80\text{mm} \pm 5.03\text{mm}$. This means that sagittally the sample was class II due to mandibular deficiency. The mean SN-Pog angle, however was $78.03^{\circ} \pm 3.31^{\circ}$ which is within normal ranges.

Vertically the mean value of S-N- Mandibular plane angle was $32.42^{\circ} \pm 6.10^{\circ}$, and SN-Maxillary Plane was $7.00^{\circ} \pm 2.80^{\circ}$, within normal range.

Similarly the mean values of MMA and Y-axis angle were $26.20^{\circ} \pm 5.15^{\circ}$ and $68.63^{\circ} \pm 3.34^{\circ}$ respectively, which are the normal standard values for the respective cephalometric values. The mean of Sum of posterior inner angles ($142.75^{\circ} \pm 9.65^{\circ}$) and the Gonial angle ($123.08^{\circ} \pm 6.76^{\circ}$) were also found within normal ranges.

The Jarabak relation ($66.81^{\circ} \pm 4.6^{\circ}$ and the lower face height ($57.96 \pm 4.24\%$) were also within normal ranges.

All the above characteristics indicated a normal vertical pattern in the entire study sample.

DENTAL CHARACTERISTICS (Table 3)

Regarding dental characteristics the mean value of UI-SN angle was $109.25^{\circ} \pm 9.70^{\circ}$ and UI-MxP angle showed a mean value of $115.50^{\circ} \pm 10.05^{\circ}$. For lower incisor mean value of IMPA in the sample was computed $99.70^{\circ} \pm 7.72^{\circ}$. All the above values found to be more than normal range indicating a mild bimaxillary dental proclination.

TABLE 1: SKELETAL ANGULAR MEASUREMENTS OF THE SAMPLE
(in degrees)

S.No	Cephalometric Parameters	Minimum	Maximum	Mean	Standard deviation
1.	SNA	76	93	83.50	3.38
2.	SNB	70	83	76.23	3.00
3.	ANB	6	13	7.30	1.52
4.	SN-Pog	71	87	78.03	3.31
5.	SN-MxP	1	12	7.00	2.80
6.	SN-MnP	13	49	32.42	6.10
7.	MMA	13	37	26.20	5.15
8.	SN-Ba	118	134	129.78	7.67
9.	Y-axis	60	76	68.63	3.44
10.	S-Ar-Goc	118	164	142.75	9.65
11.	Ar-Goc-Gnc	110	138	123.08	6.76

TABLE 2: SKELETAL LINEAR MEASUREMENTS OF THE SAMPLE
(in millimeters)

S. No	Cephalometric Parameters	Minimum	Maximum	Mean	Standard deviation
1 .	SN length	62	82	71.77	4.26
2 .	Goc-Gnc	67	91	76.80	5.03
3 .	PFIDTAFH	55	77	66.81	4.67
4 .	LAFHITAFH	48	70	57.96	4.24

TABLE 3: DENTAL ANGULAR CHARACTERISTICS OF THE SAMPLE
(in degrees)

S. No	Cephalometric Parameters	Minimum	Maximum	Mean	Standard deviation
1.	UI-SN	82	127	109.25	9LAFH
3	UI-SN	86	130	115.50	10.05
4	IMPA	76	117	99.70	7.78
6	IIA	100	160	117.92	14.75

TABLE 4: SOFT TISSUE ANGULAR AND LINEAR MEASUREMENTS OF THE SAMPLE
(in millimeters)

S. No	Cephalometric Parameters	Minimum	Maximum	Mean	Standard deviation
1.	Upper lip E-line	-7	+8	+7.50	3.19
1	Upper lip S-line	-4	+10	+2.71	2.99
3.	Lower lip E-line	-7	+11	+2.06	4.24
4.	Lower lip S-line	-5	+13	+3.72	4.19
5.	Nasolabial angle	66	131	101.90	13.34

SOFT TISSUE CHARACTERISTICS

Regarding soft tissue nasolabial angle was found to be $101.90^{\circ} \pm 13.34^{\circ}$, that is quite well within the normal ranges. The linear measurements were as follows:

Upper lip-E line distance $+7.50 \pm 3.19$ mm, Lower lip E line distance $+2.06 \pm 4.24$ mm, Upper lip S line distance $+2.71 \pm 2.99$ mm and Lower lip S line distance was $+3.72 \pm 4.19$ mm. All the above values are more than normal, thus exhibiting protusiveness of both upper and lower lips.

DISCUSSION

The present study was carried out on lateral Cephalometric radiographs of 60 patients (30 males and 30 females), exhibiting a class II molar relationship. Average age of the total sample subjects was 13.7 ± 1.02 years with a range of 12-15 years. The mean age of the male sample subjects was 13.6 ± 1.06 years with a range of 12-15 years, while mean age offemales was 13.8 ± 0.09 years with a range of 12-15 years.

The mean value of angle SNA was $83.50^{\circ} \pm 3.38^{\circ}$, angle SNB of the total sample was $76.23^{\circ} \pm 3.00^{\circ}$ and angle ANB was $7.30^{\circ} \pm 1.52^{\circ}$ in the present study. The angle SNA is slightly larger, SNB angle is less while the mean angle ANB of our study sample is significantly greater than those presented by Stienier⁴ (SNMcNamara⁵, 140° and Berzniak¹⁵). The above results clearly show that the present sample was class II sample due to mandibular deficiency.

The present study sample of class II subject Rosenblum¹¹ had a retruded mandible. the same was

found to be true in a study by McNamara^{5,14} and Berzniak¹⁵ in which the retruded mandible was found to be the major contributory factor in class II malocclusion. The present study however does not agree to Rosenblum¹¹ who reported that 27% of his sample subjects showed mandibular retrusion, while 56% had a prognathic maxilla, indicating maxillary prognathism to be the factor responsible for skeletal class II presentation in contrary to our findings.

The present study sample subjects had slightly more prognathic maxillae ($< \text{SNA } 83.41^{\circ} \pm 4.2^{\circ}$), more retrusive mandibles and convex profiles with SNB $76.15^{\circ} \pm 3.48^{\circ}$ and ANB $7.35^{\circ} \pm 1.73^{\circ}$ as compared to Bishara et al¹⁶ who studied 91 adult class II division I cases and found out that mean value of angle SNA was $82^{\circ} \pm 4.2^{\circ}$, SNB $77^{\circ} \pm 3.7^{\circ}$ and ANB was $5^{\circ} \pm 2.2^{\circ}$ in his sample.

Firdos¹⁷ in a study on Pakistani pakhtoon subjects (50 males and 50 females), showed same results as in our sample. However, more retrusive mandible with lesser horizontal growth pattern and more convex profile was found as compared to ours.

The mean values of our study sample for sagittal characteristics were ($< \text{SNA } 83.50^{\circ} \pm 3.38^{\circ}$, $< \text{SNB } 76.23^{\circ} \pm 3.00^{\circ}$, $7.30^{\circ} \pm 1.52^{\circ}$ and $< \text{SNB } 78.03^{\circ} \pm 3.31^{\circ}$ respectively). Lau and Hagg¹⁸ evaluated lateral cephalometric radiographs of 105 (50 males and 55 females) Chinese individuals exhibiting class II division I malocclusion. Found the mean values to be $< \text{SNA } 83.1^{\circ} \pm 3.8^{\circ}$, SNB $77^{\circ} \pm 3.7^{\circ}$, ANB $6^{\circ} \pm 1.9^{\circ}$, and SN-Pog $77.5^{\circ} \pm 3.8^{\circ}$. These values were found to be quite similar to ours. This means that Pakistani class II subjects have almost

same sagittal cephalometric characteristics as the Chinese.

In the vertical plane of space the mean value of the cephalometric parameters in our study (<SN-Ba $129.78^{\circ} \pm 5.15^{\circ}$, SN-MxP $7^{\circ} \pm 2.80^{\circ}$, SNMnP $32.42^{\circ} \pm 6.10^{\circ}$, Y-axis $68.63^{\circ} \pm 3.44^{\circ}$, S-Ar-Go_c 142.75° , <Ar-Go_dGn_c $123.08^{\circ} \pm 5.5^{\circ}$, Jarabak relation $66.81 \pm 4.67\%$ and LAFH/TAFH $57.96 \pm 4.24\%$) were found to be within normal range, thus indicating that vertically, the class II sample was a normal angle. This finding is also similar to McNamara^{5, 14} findings but does not agree with the findings of Berzniak and coworkers, where the study sample was found to be hypodivergent sample.

The vertical cephalometric characteristics in Chinese class II subjects evaluated by Lau and Hagg¹⁸ (SN-Ba $128.3^{\circ} \pm 5.2$, SN-MxP $(8.5^{\circ} \pm 3.5^{\circ})$, SN-MnP $36.7^{\circ} \pm 6.4^{\circ}$, and angle MMA was $28.4^{\circ} \pm 6.1^{\circ}$) when compared to Pakistani subjects (SNMxP $7^{\circ} \pm 2.80^{\circ}$, SNMnP $32.42^{\circ} \pm 6.10^{\circ}$, and MMA $26.20^{\circ} \pm 5.15^{\circ}$) showed lower vertical values as compared to those of Chinese class-II subjects. This indicated that Pakistani class II patients had a slight lower vertical pattern as compared to those of Chinese class II subjects.

The findings of our study were also found to be contrary to those of Firdos¹⁷ in which our subjects showed a lesser downward and backward rotation of mandible than that of pakhtoon subjects of Pakistan.

The mean values of dental cephalometric parameters of present study sample demonstrate that angle UI-SN, UI-MxP, IMPA and IIA had mean values of $109.25^{\circ} \pm 7.72^{\circ}$, $115.50^{\circ} \pm 10.5^{\circ}$, $99.70^{\circ} \pm 7.72^{\circ}$ and $117.92^{\circ} \pm 14.74^{\circ}$ respectively. All above values are more than the normal values standardized by Steiner⁴ and Down⁹, indicating a bimaxillary dental proclination in class II Pakistani subjects. The larger mean angle IMPA of our class II sample ($99.70^{\circ} \pm 1.72^{\circ}$), than the normal standardized value ($91.40^{\circ} \pm 3.8^{\circ}$) showed a severe dentoalveolar compensation for class II sample, as is found commonly in class II patients with deficient mandibles. The same was found when our results were compared with the study carried out by Carter⁷. The same was found to be true on comparing the dental characteristics of our results with those of Firdos¹⁷ sample subjects.

On comparing the dental characteristics of Chinese sample i.e. UI-MxP $123.9^{\circ} \pm 8.3^{\circ}$, IMPA $96.6^{\circ} \pm 7.0^{\circ}$ and IIA $111.3^{\circ} \pm 10.3^{\circ}$, our sample exhibited retroclined upper incisors in relation to maxilla than that of Chinese and proclined lower incisors (IMPA- 100.4°) than those of Chinese class-II individuals.

The value of nasolabial angle is of great importance while planning the orthodontic treatment. The normal value of this angle is $102^{\circ} \pm 10^{\circ}$ and ranges from 90° to 112° for Caucasians. The mean nasolabial angle in the present class II study was $101.90^{\circ} \pm 13.34^{\circ}$, which is slightly less than the normal. This dictated more upper and lower protrusive lips in our class-II sample as compared to normal values suggested by Steiner⁴.

Bishara et al¹⁶ found protrusive upper lip in relation to Ricketts esthetic plane, which is similar to the findings of the present study. This means that both Caucasian and Pakistani class II subjects exhibited protrusive lips in the sagittal plane.

CONCLUSIONS

Following conclusions can be drawn from the present study on a Pakistani sample exhibiting class II malocclusion:

- 1 Sagittally the sample was found to be skeletal class II due to the mandibular deficiency.
- 2 The increased mean value of IMPA than that of normal indicates a dentoalveolar compensation for class II malocclusion, as is commonly revealed in class II anomaly especially with deficient mandibles.
- 3 The soft tissue analysis demonstrates protrusive upper and lower lips.
- 4 The lower lip in the sample showed slightly more protrusion than the upper lip.

ACKNOWLEDGEMENT

I express my deep gratitude to Dr. Sajid Naeem (Assist. Prof Prosthodontics) and Dr. M Qasim Saeed (Assist. Prof Orthodontics) Lahore Medical and Dental College, Lahore, for their guidance enabling me to write this article.

REFERENCES

- 1 Broadbent BH. A new x-ray technique and its application to orthodontia. *Angle Orthod* 1931; 1: 45-66.
- 2 Hamid WU, Asad S. Prevalence of Skeletal Components of Malocclusion using Composite Cephalometric Analysis. *Pak Oral Dental J* 2003; 23:137-44.
- 3 Rickets RM. Esthetics, environment and law of lip relations. *Am J Orthod* 1968; 54: 272-89.
- 4 Stienen CC. The use of Cephalometrics as an aid to planning and assessing Orthodontic Treatment. *Am J Orthod* 1960; 46: 721-35.
- 5 McNamara JA Jr. Cephalometric analysis of untreated adults with ideal facial and occlusal relationships. *Int J Orthod Oral Surg* 1988; 3:221-31
- 6 Downs WB. Variations in facial relationships: Their significance in treatment and prognosis. *Am J Orthod* 1948; 34: 812-40.
- 7 Carter N E. Dentofacial changes in untreated Class II Div I subjects. *Br J Orthod* 1987; 14:225-34.
- 8 Profit W R, Fields H W, Moray L J. Prevalence of malocclusion and Orthodontic treatment need in United States; Estimates from the NHANES III Survey. *Intern J Orthodont Orthogen Surg* 1998; 13:97-106.
- 9 Lew K K, Foong W C, Loh E. Malocclusion prevalence in an ethnic Chinese population. *Aust Dent J* 1993; 39:442-49.
- 10 Susami R Y, Hirose K K T, Hayashi I. The prevalence of malocclusion in Japanese school children. I. Total frequency. *J Jap Orthod Soc* 1971; 30:221-29.
- 11 Rosenblum RE. Class II malocclusion: mandibular retrusion or maxillary protrusion? . *Angle Orthod* 1995; 1:49-62.
- 12 Adams C P, Kerr W J. Overbite and face height in 44 male subjects with class II/1 and class II/2 occlusion 1981; 3:125-9
- 13 Cotton W.N, Tanakano WS, and Wong WM. The Downs' analysis applied to three other ethnic groups. *Angle Orthod* 1951; 22:213-20.
- 14 McNamara JA Jr, Peterson JE Jr, Alexander RG. Three-dimensional diagnosis and management of class II malocclusion in the mixed dentition. *Semin Orthod* 1996; 2:114-37.
- 15 Berzniak N, Arad A, Heller M, Dinbar A, Wassertein A. Pathognomic cephalometric characteristics of Angle class II Division 2 malocclusion. *Angle Orthod* 2002; 72:251-57.
- 16 Bishara SE, Zaher AR, Cumins DM, Jakobson JR. Effects of orthodontic treatment on growth of individuals with class II division 1 malocclusion. *Angle Orthod* 1996; 64:221-30.
- 17 Firdos T. Investigation of class II malocclusion-A study conducted at Khyber College Of Dentistry, Peshawar-Pakistan. *Pakistan Oral and Dental Journal* 2000; 20: 158-64.
- 18 Lau JW, Hagg U. Cephalometric morphology of Chinese with class II division 1 malocclusion. *Br Dent J* 1999; 186: 188-90.