Research Article

Cephalometric characteristics of class II div 1 patients visiting tertiary care hospital in Southeastern Nepal

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ABSTRACT

Introduction: Class II malocclusion can result from aberrant maxillary or mandibular dentoskeletal components with or without the involvement of soft tissue component. Identification of the cause in class II div 1 malocclusion with the help of lateral cephalograms is crucial in diagnosis and treatment planning.

Materials and Method: Digital copies of lateral cephalograms of Class II div 1 patients visiting the Orthodontic department at Nobel Medical College were obtained. Web-based digital tracing, Webceph Plus version 1.5.0, was used for Steiner's and McNamara's analyses. The cephalometric values were compared with the established values of the Caucasians and the Nepalese norms wherever applicable. The comparison was done using an independent t-test with a level of significance set at 5%.

Result: As compared to Caucasians and Nepalese normal, Class II div 1 patients in our study had significantly increased ANB angle (6.4±2.1°, p<0.001) and proclined upper (UI-NA=28.7±7.3°, p< 0.001) and lower incisors (LI-NB=29.6±6.9° p< 0.001). The Class II patients revealed decreased maxillary and mandibular effective lengths and maxilla-mandibular differences that were statistically significant, (p<0.001). The effective maxillary and mandibular lengths as well as the maxilla-mandibular difference were significantly greater in males than in females (p<0.05).

Conclusion: The study showed that class II div 1 patients had a combination of maxillary prognathism and mandibular retrognathism along with proclined maxillary and mandibular incisors. The effective lengths of the maxilla and mandible were greater in males as compared to females.

KEYWORDS: Class II Division 1; Lateral cephalogram; Mandibular retrognathism; Maxillary prognathism

INTRODUCTION

Class II div 1 malocclusion as defined by Angle is the mandibular arch distal as compared to maxillary arch to the extent of more than one half the cusp width and maxillary incisors being proclined. This malocclusion can result from both dental or skeletal aberrations in the maxilla or mandible or both.[1] After the invent of cephalometry and cephalometric analyses, it has been established that different ethnic groups have different cephalometric norms. Nepalese population has been studied by different authors and normal cephalometric values have been given based on different geographical locations and ethnicities.

Various studies describing the class II malocclusion has been reported in the literature.[3-15] Woodside in 1968 reported two-thirds of Class II division 1 patients had significant skeletal discrepancy.[2] Rosenblum in 1995 reported that the maxilla in Class II division 1 patients was more prognathic and the mandible was normal in size and position.[14] However, other studies showed that the maxilla was normal and the mandible was retrognathic.[4,9,11] It has also been found that skeletal patterns in class II were due to a combination of maxillary prognathism and mandibular retrognathism.[14,15,16,17]

Class II division 1 malocclusion in Saudi children living in the western region was characterized by significantly increased ANB angle, prognathic maxilla, normal mandible and proclined upper incisors.[18] This study suggested specific treatment concepts, such as harnessing maxillary growth or camouflage dental treatment for

Class II division1 malocclusion in Saudi children.[18] A study conducted in Kathmandu, Nepal, reported that the small size of the mandible was the main cause of the Class II Div 1 pattern in the Nepalese population and also concluded that prognathic maxilla and retroclined maxillary incisors and retrognathic mandible with proclined lower incisors were the most common class II div 1 characteristics.[19] Class II div 1 patients exhibit malocclusion resulting from either one or a combination of skeletal, dental or soft tissue components. Similarly, in a study by Shrestha et al conducted in Bhairahawa, Nepal, retrognathic mandible was the reason for skeletal class II whereas a well-positioned maxilla was observed in majority of subjects.[20]

No such research was conducted in Southeastern part of Nepal. So, the aim of our study was to investigate various cephalometric characteristics of class II div 1 patients visiting the Orthodontic department at Nobel Medical College Teaching Hospital, Biratnagar, Nepal.

MATERIALS AND METHOD

Digital copies of lateral cephalograms of Class II div 1 patients visiting the Orthodontic department at Nobel Medical College Teaching Hospital, Biratnagar, Nepal for the last 3 years (2020 November to 2023 October) were collected from the archives according to purposive sampling method fulfilling the inclusion criteria. Ethical clearance was obtained from Institutional Review Committee of Nobel Medical College Teaching Hospital (IRC-NMCTH 807/2023). Inclusion criteria were patients having skeletal class II with ANB angle greater than or equal to 4, proclined maxillary incisors, no history of previous orthodontic treatment, trauma, congenital malformations. All age groups were chosen irrespective of growth status of the patients fulfilling the inclusion criteria. Cephalograms were taken with the spines erect, teeth in maximum intercuspation and lips relaxed and in natural head position.Web based digital tracing WebcephPlus which is an artificial intelligence driven online orthodontic diagnostic software version 1.5.0 was used to perform Steiner's and Mc Namara's analyses (Figure 1).

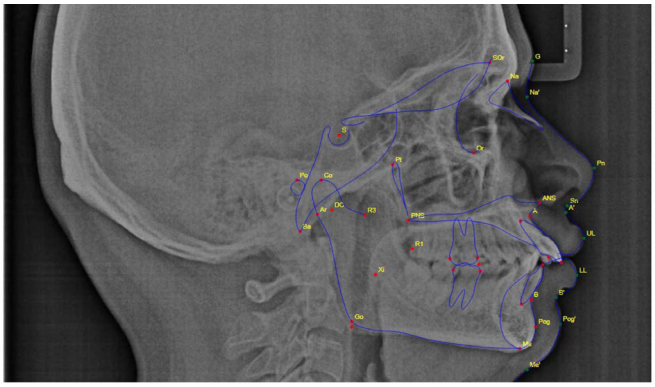

Figure 1: Digital cephalometric tracing using Webceph Plus

The data obtained were entered in Statistical Package for Social Science (SPSS) version 17. The mean values were compared with the established values of the Caucasians and the Nepalese norms wherever applicable. The comparison was done using an independent t-test with a level of significance set at 5%.

RESULT

The total number of patient records assessed was 67 out of which there were 60 class II div 1 patients reported during the study period that fulfilled the inclusion criteria. Out of them 19(31.7%) were males and 41(68.3%) were females. As compared to Caucasians and Nepalese normal, Class II div 1 patient in our study had significantly increased ANB angle (6.4±2.1°, p<0.001) and proclined upper (UI-NA=28.7±7.3°, p<0.001) and lower incisors (LI-NB=29.6±6.9° p< 0.001) (Table1 and 2).

Table 1. Comparison of class II Nepalese with the Caucasian normal

Cephalometric measurement	Caucasian Normal	Class II Nepalese		Difference		p-value*
		Mean	SD	Mean	95% CI	
SNA (°)	82	84.2	3.9	2.2	1.2 to 3.1	<0.001
SNB (°)	80	77.8	3.8	-2.2	-3.1 to -1.3	<0.001
ANB (°)	2	6.4	2.1	4.4	3.9 to 4.9	<0.001
GoGn to SN (°)	32	28.2	5.8	-3.8	-5.3 to -2.4	<0.001
Upper Incisor to NA (°)	22	28.7	7.3	6.7	4.9 to 8.5	<0.001
Upper Incisor to NA (mm)	4	5.5	2.8	1.5	0.8 to 2.2	<0.001
Lower Incisor to NB (°)	25	29.6	6.9	4.6	2.9 to 6.3	<0.001
Lower Incisor to NB (mm)	4	5.9	2.5	1.9	1.3 to 2.5	<0.001
* t-Test; p-value <0.05 signifies statistical significance						

Table 2. Comparison of class II Nepalese with the Nepalese norms

Cephalometric measurement	Nepalese Normal	Class II Nepalese		Difference		p-value*
		Mean	SD	Mean	95% CI	
SNA (°)	83.2	84.2	3.9	1.0	0.1 to 2.0	0.035
SNB (°)	79.8	77.8	3.8	-2.0	-2.9 to -1.0	<0.001
ANB (°)	3.4	6.4	2.1	3.0	2.5 to 3.5	<0.001
GoGn to SN (°)	27.9	28.2	5.8	0.2	-1.2 to 1.7	0.728
Upper Incisor to NA (°)	21.3	28.7	7.3	7.4	5.6 to 9.2	<0.001
Upper Incisor to NA (mm)	5.6	5.5	2.8	-0.1	-0.8 to 0.6	0.720
Lower Incisor to NB (°)	26.3	29.6	6.9	3.4	1.7 to 5.0	<0.001
Lower Incisor to NB (mm)	6.3	5.9	2.5	-0.4	-1.0 – 0.2	0.181
* t-Test; p-value <0.05 signifies statistical significance						

While in McNamara's analysis, Class II patients (both males and females) in our study revealed decreased maxillary and mandibular effective length and decreased maxillomandibular difference that were statistically significant (Table 3 and 4).

Table 3. Comparison of class II Nepalese males with the Caucasian normal

Cephalometric measurement	Caucasian Normal	Class II Nepalese Males		Difference		p-value*
		Mean	SD	Mean	95% CI	
Effective maxillary length (mm)	99.8	76.6	14.9	-23.2	-29.8 to -16.6	<0.001
Effective mandibular length (mm)	134.3	98.3	18.5	-36.0	-44.2 to -27.8	<0.001
Maxillo-mandibular difference (mm)	34.5	21.7	5.7	-12.8	-15.4 to -10.3	<0.001
Upper Incisor to Point A (mm)	5.3	7.0	3.3	1.7	0.3 to 3.2	0.021
Lower Incisor to A-Pog (mm)	2.3	1.6	2.3	-0.7	-1.7 to 0.3	0.170
* t-Test; p-value < 0.05 signifies statistical significance						

Table 4. Comparison of class II Nepalese females with the Caucasian norms

Cephalometric measurement	Caucasian Normal	Class II Nepalese Females		Difference		p-value*
		Mean	SD	Mean	95% CI	
Effective maxillary length (mm)	91	68.4	12.1	-22.6	-26.3 to -19.0	<.001
Effective mandibular length (mm)	120.2	86.7	15.1	-33.5	-38.0 to -28.9	<0.001
Maxillo-mandibular difference (mm)	29.2	18.4	4.2	-10.8	-12.1 to -9.6	<0.001
Upper Incisor to Point A (mm)	5.4	5.5	2.4	0.1	-0.6 to 0.8	0.822
Lower Incisor to A-Pog (mm)	2.7	1.8	2.4	-0.9	-1.6 to -0.1	0.020
* t-Test; p-value < 0.05 signifies statistical significance						

When males and females Class II div 1 patients were compared, effective maxillary length, mandibular length and maxilla-mandibular difference were significantly more in males than in females (Table 5).

Table 5. Comparison between class II Nepalese males and females

Cephalometric measurement	Class II Nepalese Males		Class II Nepalese Females		Difference		p-value*
	Mean	SD	Mean	SD	Mean	95% CI	
Effective maxillary length (mm)	76.6	14.9	68.4	12.1	8.3	0.9 to 15.7	0.030
Effective mandibular length (mm)	98.3	18.5	86.7	15.1	11.6	3.1 to 20.1	0.008
Maxillo-mandibular difference (mm)	21.7	5.7	18.4	4.2	3.3	0.5 to 6.1	0.022
Upper Incisor to Point A (mm)	7.0	3.3	5.5	2.4	1.6	-0.04 to 3.2	0.056
Lower Incisor to A-Pog (mm)	1.6	2.3	1.8	2.4	-0.2	-1.4 to 1.0	0.729
* t-Test; p-value < 0.05 signifies statistical significance							

DISCUSSION

This hospital-based study was conducted to investigate various cephalometric characteristics of class II div 1 patients visiting a tertiary hospital in Southeastern Nepal. We utilized computerized tracing due to its user-friendly and time-saving characteristics when working with direct digital images, making it preferable to hand tracing.[21]

As compared to Caucasian normal our study groups had the features of typical class II div 1 patients. Maxilla had been positioned anteriorly as compared to Caucasians or Nepalese normal population. This is in accordance with the study by Hassan[18] whereas study by Bajracharya et al showed contradictory results in which maxilla was relatively normally positioned in their study sample.[19] This contradiction could be because of the different geographical and ethnical background of the study sample in our study.

Similarly, our study group had significantly proclined maxillary and mandibular incisors as compared to Caucasian or Nepalese normal groups. Reidel[5], Hitchcock[9] and Bajracharya et al[19] in their studies also had significantly proclined maxillary incisors. The mandibular incisor proclination (3.4° greater than Nepalese norm) found in our study is the natural compensation of the retrognathic mandible which was in accordance to the study by Shrestha et al.[20]

The retrognathic mandible in our study (SNB=77.8°) resulting in skeletal class II is in accordance with findings of Bajracharya et al and Shrestha et al.[19,20] In contrast to our findings Hassan had found normally positioned mandible in class II div 1 patients, prognathic maxilla being the cause of skeletal class II in his study.[18] This could largely be due to ethnic differences in the study populations.

The effective lengths of both maxilla and mandible were significantly shorter in the study group as compared to the Caucasian normal. Though Nepalese people residing in the southeastern part are a mixture of different races, huge differences in their ethnicity from that of Caucasians could be the cause of this difference. Similarly, the effective lengths of the maxilla and mandible in female class II div 1 subjects were significantly smaller than the male subjects in our study. This finding is in accordance with a study conducted in Kathmandu by Bajracharya et al.[19]

CONCLUSION

The study showed that class II div 1 patients attending a tertiary care hospital in Southeastern Nepal had a combination of maxillary prognathism and mandibular retrognathism along with proclined maxillary and mandibular incisors. The effective lengths of the maxilla and mandible were greater in males as compared to females. Further research including orthodontic patients from other orthodontic clinics in the region could be more conclusive.

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