Original Article

Assessment of facial asymmetry in individuals having skeletal Class II malocclusion in Uttar Pradesh population: A cephalometric study

ABSTRACT

Objective: The objective was to assess facial asymmetry in individuals having skeletal Class II malocclusion in Uttar Pradesh population.

Materials and Methods: A total of sixty individuals (thirty males and thirty females) between 18 and 27 years of age were selected. The pretreatment lateral cephalograms of the samples selected (n = 60) for the study were divided into two groups, Group I and Group II, after which posteroanterior cephalograms were taken for the measurement of asymmetry. All the cephalometric parameters were defined as quantitative variables. The mean and standard deviation (SD) for each measurement was calculated. The results were presented in frequencies, percentages for qualitative data, and mean ± SD for quantitative data. Paired t-test was used to test the significance (P = 0.05 or less) in the difference between the right and left sides of the face. Chi-squared test was used to check the significance of difference in proportions. All the analyses were carried out on MS-Excel and SPSS 16.0 version (Chicago, Inc., Illinois, USA).

Results: In Group II, the parameters for mandibular morphology and volumetric comparison and the mean of all parameters taken were statistically insignificant, but the mean for condylion-antegonial notch was greater for the right side, and the difference between the left and right sides was statistically significant (P = 0.019). When comparing the cephalometric parameters between the left and right sides in Group I and Group II, none of the mean values were proved to be statistically significant, but the right side parameters revealed to be greater than the left side of the measured parameters.

Conclusion: All participants showed mild skeletal asymmetry on posteroanterior cephalograms, which was not statistically significant. In Group II, the relative mean of condylar asymmetry was statistically significant, which proves the presence of some amount of condylar asymmetry in this group. The other cephalometric parameters measured in our study showed that the value of the same was greater for the right side than the left side.

Keywords: Facial asymmetry, mandibular asymmetry, posteroanterior cephalogram

INTRODUCTION

Humans may although have an innate preference for what looks acceptable and beautiful. Even a sculptor, the one obsessed with the form and shape of things, imprisons asymmetry in the replica of a man and thus creates a beautiful statue.

The term "asymmetry" is used to make reference to the dissimilarity between homologous elements, altering the

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balance between structures. Facial asymmetry is common in the overall population and is often presented subclinically. Nevertheless, on occasions, significant facial asymmetry results not only in functional, but also in esthetic issues.[1]

The oldest method for the measurement was on dry skulls, whereas the latest and most common method includes cephalometric analysis which precisely incorporates posteroanterior cephalograms. The various studies conducted also conclude that environmental agents can produce right and left differences of the skull.

Woo[2] in his study concluded that the human skull is definitely and markedly asymmetrical. It is not a question of the bones of individual crania differing from a symmetrical type, but the type of cranium is itself asymmetrical.

Interestingly, studies of transverse relationship Class II individuals have been limited to the arch widths and dental casts. Some prior studies of craniofacial asymmetry using oriented posteroanterior (PA) cephalometric tracings have been conducted.[3] Thus, the objective of this study was to assess the facial asymmetry in individuals with Class II malocclusion using PA cephalometric method among Uttar Pradesh population, as there have been no such similar studies in accordance with facial asymmetry conducted in the past in this population.

MATERIALS AND METHODS

This study was approved by the institutional research and development committee and institutional human ethical committee and was conducted to evaluate facial asymmetry in skeletal Class II malocclusion in Uttar Pradesh population in Saraswati Dental College, Lucknow, Uttar Pradesh. Sixty individuals (thirty males and thirty females) between 18 and 27 years of age were selected. The sample size was calculated on the basis of difference of the left and right side values of the variable jugular point-midsagittal plane (J-MSR) (the variable with most significant difference) using the formula for comparison of means discussed in "A. Indrayan, Basic Methods of Medical Research" by putting pooled standard deviation (SD) of J-MSR as 1.3 which is equal to the mean difference of J-MSR, and a difference of 1.25 was considered to be clinically significant.

Considering 95% confidence level, 90% power of study, and 10% loss to follow-up, the sample size was calculated to be 60.

The inclusion criteria for the study were all intact permanent dentition and individuals with Class I and Class II skeletal patterns. The exclusion criteria for the study were skeletal abnormalities such as cleft lip and cleft palate and other craniofacial deformities, history of temporomandibular joint disorder, no history of previous orthodontic treatment, and no history of trauma. The pretreatment lateral cephalograms of the samples selected ($n = 60$) for the study were divided into the following two groups:

- Group I: Thirty individuals (15 males and 15 females) with Class I skeletal pattern group (ANB angle of 1°–2°, SNA = 82 ± 2, and SNB = 80 ± 2)
- Group II: Thirty individuals (15 males and 15 females) with Class II skeletal pattern group (ANB of >3°, SNA >88°, and SNB = 80 ± 2)
- While recording the PA, cephalogram patient's correct orientation is of utmost importance. The cephalostat head holder was rotated 90° so that the patient faced the X-ray cassette, and the central X-ray beam passed through the skull in a posteroanterior direction bisecting the transmeatal axis perpendicularly
- While recording the lateral cephalograms, the patients were placed in the standing upright position and asked to look directly into the reflection of their own eyes in a mirror directly ahead in the middle of the cephalostat.

PA cephalograms were made for all the selected participants under standardized conditions and were traced on 0.03 acetate paper by a single operator [Figure 1].

Measurements taken in the study were as follows

1. ANB angle – ANB angle of all the participants was measured
2. Mandibular morphology and volumetric comparison

   The mandibular morphology was compared to that of the left and right sides with the linear

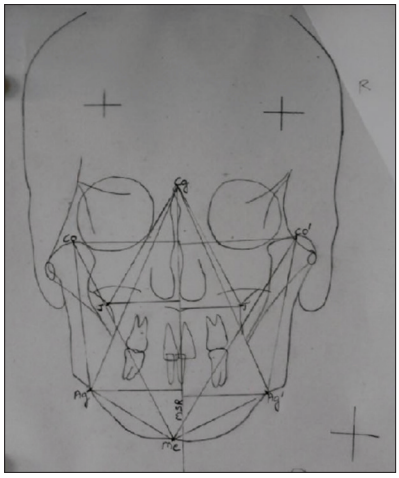

Figure 1: Tracing of posteroanterior cephalogram

measurements of Condylion-Menton (Co-Me), Antegonial Notch-Me (Ag-Me), Co-Ag, and Co-MSR also the left and right triangles formed by the points Co-Ag-Me, and the volume was compared

3. Maxillomandibular comparison and linear measurements taken of the left and right sides were J-MSR, Ag-MSR, Crista Galli-Ag (Cg-Ag), Crista Galli-Jugular process (Cg-J), and Me-MSR.

The mean and SD was calculated. Paired *t*-test was used to test the significance ($P = 0.01$ or less) in the difference between the right and left sides of the face and for any gender difference.

The skeletal asymmetry of skeletal Class II individuals was analyzed using Grummon's analysis, and the following results were obtained [Tables 1-3].

RESULTS

When comparing the cephalometric parameters between the left and right sides in Group I, the parameters for mandibular morphology and volumetric comparison and the relative mean of the following Co-Me, Co-Ag, and Co-MSR were greater for the right side and Ag-Me and Co-Ag-Me were greater for the left side, whereas among the maxillomandibular linear measurements, the parameters with mean greater for the right side were J-MSR, Ag-MSR, Cg-Ag, and Me-MSR, and only the mean of Cg-J was greater for the left side, although none of the difference was statistically significant.

In Group II, the parameters for mandibular morphology and volumetric comparison and the mean of all parameters taken under this, i.e., Co-Me, Ag-Me, Co-MSR, and Co-Ag-Me, were greater for the right side, whereas the mean of the parameters greater for the right side were J-MSR, Ag-MSR, Cg-Ag, Cg-J and only that of Me-MSR was greater for the left side. All the values covered under this group were statistically insignificant, but the mean for Co-Ag was greater for the right side and the difference between the left and right sides was statistically significant ($P = 0.019$). On comparing the left and right symmetry of Group II and Group I, among mandibular morphology and volumetric comparison, the mean values for the following parameters were more in Group I, i.e., Co-Me, Co-MSR, and Co-Ag-Me, whereas the parameters Ag-Me and Co-Ag were high in Group II. The values were not statistically significant, which implied that there was no significant asymmetry present in both Group I and Group II individuals.

DISCUSSION

In Group I, the age range of the participants was 18–27 years, with 40% of participants aged 21 years or below and the remaining 60% were aged above 21 years. In Group II, the age range of the participants was 17–26 years, with 56.7% of participants aged 21 years or below and the remaining 43.3%

Table 1: Comparison of cephalometric parameters between left and sides in Group I (Class I skeletal type)

Type	Parameter (Group I)	Side	Mean (mm)±SD	*t*	*P*
Mandibular morphology and volumetric comparison	Co-Me	Left	87.33±6.93	−1.48	0.150
		Right	88.73±7.57		
	Ag-Me	Left	40.03±5.05	0.39	0.701
		Right	39.53±5.97		
	Co-Ag	Left	61.77±5.87	−1.77	0.088
		Right	62.87±5.44		
	Co-MSR	Left	45.63±5.50	−0.39	0.697
		Right	46.10±4.12		
	Co-Ag-Me	Left	1240.83±219.06	0.23	0.818
		Right	1231.10±236.93		
Maxillomandibular comparison and linear measurement	J-MSR	Left	28.87±2.64	−1.59	0.122
		Right	29.73±3.25		
	Ag-MSR	Left	35.77±4.24	−0.44	0.666
		Right	36.17±4.60		
	Cg-Ag	Left	103.9±9.07	−1.13	0.267
		Right	104.6±8.57		
	Cg-J	Left	64.9±6.02	0.27	0.792
		Right	64.8±5.31		
	Me-MSR	Left	1.47±1.80	0.05	0.958
		Right	1.43±2.10		

Co-Me: Condylion-Menton, Ag-Me: Antegonial Notch-Menton, Co-MSR: Condylion-Midsagittal reference plane, Co-Ag-Me: Condylion-Antegonial Notch-Menton Triangle, J-MSR: Jugular point-Midsagittal plane, Cg-Ag: Crista Galli-Antegonial Notch, Cg-J: Crista Galli-Jugular process, Me-MSR: Menton-Midsagittal reference plane, Co-Ag: Condylion and Antegonial notch, Ag-MSR: Antegonial notch and midsagittal reference plane, SD: Standard deviation

Table 2: Comparison of cephalometric parameters between left and right sides in Group II (Class II skeletal type)

Type	Parameter (Group II)	Side	Mean (mm)±SD	*t*	*P*
Mandibular morphology and volumetric comparison	Co-Me	Left	90.13±5.16	−0.94	0.355
		Right	90.87±5.51		
	Ag-Me	Left	41.53±5.28	0.25	0.802
		Right	41.23±5.86		
	Co-Ag	Left	63.63±6.50	−2.49	0.019
		Right	65.30±5.79		
	Co-MSR	Left	45.80±4.05	−1.36	0.184
		Right	47.17±3.90		
	Co-Ag-Me	Left	1289.63±170.11	−1.21	0.237
		Right	1344.07±214.48		
Maxillomandibular comparison and linear measurement	J-MSR	Left	30.63±3.39	−1.70	0.099
		Right	31.50±3.60		
	Ag-MSR	Left	38.10±3.47	−1.25	0.221
		Right	39.17±4.09		
	Cg-Ag	Left	103.80±8.76	−1.61	0.119
		Right	104.73±8.46		
	Cg-J	Left	64.03±4.54	−1.18	0.246
		Right	64.67±5.09		
	Me-MSR	Left	2.03±2.70	1.12	0.272
		Right	1.20±2.07		

Co-Me: Condylion-Menton, Ag-Me: Antegonial Notch-Menton, Co-MSR: Condylion-Midsagittal reference plane, Co-Ag-Me: Condylion-Antegonial Notch-Menton Triangle, J-MSR: Jugular point-Midsagittal plane, Cg-Ag: Crista Galli-Antegonial Notch, Cg-J: Crista Galli-Jugular process, Me-MSR: Menton-Midsagittal reference plane, Co-Ag: Condylion and Antegonial notch, Ag-MSR: Antegonial notch and midsagittal reference plane, SD: Standard deviation

Table 3: Comparison of left and right differences (magnitude of asymmetry) between Group II and Group I

Type	Parameter	Group	Mean (mm)±SD	*t*	*P*
Mandibular morphology and volumetric comparison	Co-Me	Group II	3.33±2.71	−1.02	0.313
		Group I	4.13±3.35		
	Ag-Me	Group II	4.90±4.17	−0.35	0.725
		Group I	5.30±4.59		
	Co-Ag	Group II	3.40±2.09	0.94	0.353
		Group I	2.90±2.04		
	Co-MSR	Group II	4.17±3.78	−0.90	0.373
		Group I	5.07±3.98		
	Co-Ag-Me	Group II	176.30±178.36	−0.23	0.817
		Group I	185.73±131.60		
Maxillomandibular comparison and linear measurement	J-MSR	Group II	2.40±1.61	0.41	0.685
		Group I	2.20±2.16		
	Ag-MSR	Group II	3.80±2.85	−0.36	0.720
		Group I	4.07±2.89		
	Cg-Ag	Group II	1.93±2.68	−0.37	0.711
		Group I	2.20±2.86		
	Cg-J	Group II	1.97±2.24	−0.06	0.950
		Group I	2.00±1.84		
	Me-MSR	Group II	3.23±2.56	0.58	0.562
		Group I	2.90±1.81		

Co-Me: Condylion-Menton, Ag-Me: Antegonial Notch-Menton, Co-MSR: Condylion-Midsagittal reference plane, Co-Ag-Me: Condylion-Antegonial Notch-Menton Triangle, J-MSR: Jugular point-Midsagittal plane, Cg-Ag: Crista Galli-Antegonial Notch, Cg-J: Crista Galli-Jugular process, Me-MSR: Menton-Midsagittal reference plane, Co-Ag: Condylion and Antegonial notch, Ag-MSR: Antegonial notch and midsagittal reference plane, SD: Standard deviation

were aged above 21 years. The age range was taken considering that the growth of most craniofacial bones had been completed.

When comparing the cephalometric parameters between the left and right sides in Group I [Table 1], the parameters for mandibular morphology and volumetric comparison and the relative mean of the corresponding Co-Me, Co-Ag, and Co-MSR were greater for the right side and Ag-Me and Co-Ag-Me were greater for the left side, whereas among the maxillomandibular linear measurements, the parameters with mean greater for the

right side were J-MSR, Ag-MSR, Cg-Ag, and Me-MSR, and only the mean of Cg-J was greater for the left side, although none of the difference was statistically significant. Thus, here the right side was found to be dominant, which was in accordance with the study done by Woo.[2]

In Group II [Table 2], the parameters for mandibular morphology and volumetric comparison and the mean of all parameters taken under this, i.e., Co-Me, Ag-Me, Co-MSR, and Co-Ag-Me, were greater for the right side, whereas the mean of the parameters under the maxillomandibular comparison and linear measurement greater for the right side were J-MSR, Ag-MSR, Cg-Ag, and Cg-J only that of Me-MSR was greater for the left side. All the values covered under this group were statistically insignificant, but the mean for Co-Ag was greater for the right side and the difference between the left and right sides was statistically significant ($P = 0.019$). Therefore, mandibular asymmetry was seen in Group II population, which was also seen in the study done by Mishra *et al*.[4] and Franchi and Baccetti,[5] whereas Rogers[6] had explained that the size and shape of the condyle of a subject was altered as a result of protrusive and lateral movements and a decrease in the occlusal forces.

The asymmetry in the present study may also be due to the variation in the sample size and age consideration taken in the study, and also the ethnicity of the population brings in a considerable difference.

On comparing the left and right symmetry of Group II and Group I [Table 3] among mandibular morphology and volumetric comparison, the mean values for the following parameters were more in Group I, i.e., Co-Me, Co-MSR, and Co-Ag-Me, whereas the parameters Ag-Me and Co-Ag were high in Group II.

An important finding of this study was that most of the parameters for the right side were larger than the left side in all the individuals in Group I and Group II, however this laterality was not statistically significant, which was in accordance with the study done by Reddy *et al*.,[7] Farkas and Cheung,[8] Ferrario *et al*.,[9] Shah and Joshi,[10] and Peck *et al*.,[11] who also showed that the right side of the face was more dominant than the left; Vig and Hewitt[12] also indicated that the left side of the face was more developed than the right side. This study showed that the measured values of the right sides were greater than the left sides; the possible reason given by Woo[2] is the increased size of the right hemisphere of the brain. The right side dominance in the brain affects the functional activities and facial structures, and also that right craniofacial dominance may be naturally favored for neuroanatomical development reasons. Shah and Joshi[10] observed that significantly more individuals were chewing on the right side than on the left side as a matter of habit. Because the forces of mastication are transmitted from the teeth to the facial and cranial bones, this may be a factor responsible for the righter side being larger than the left side.

Sodawala *et al*.[13] also said that the condylar measurements were not affected by gender and ANB angle. On the contrary, in the study done by Anistoroaei Daniela *et al*.,[14] the results obtained a significant correlation, which was evidenced between facial asymmetry and type of malocclusion, age, and type of dentition, whereas Cook[15] in his study concluded that certain traumatic, pathological, or genetically determined anomalies can result in gross asymmetry of the craniofacial skeleton.

CONCLUSION

Almost everyone has some amount of facial asymmetry of the face present, while it also depends on the patient's age, malocclusion, gender, skeletal type, and many others. The main components contributing to the asymmetry of the face are present in the lower third of the face.

1. All participants showed mild skeletal asymmetry on posteroanterior cephalograms, which was not statistically significant
2. In Group II, the relative mean of condylar asymmetry was statistically significant, which proves that some amount of condylar asymmetry is present in this group
3. The other cephalometric parameters measured in our study showed that the value of the same was greater for the right side than the left side.

Limitations

As every prospect of knowledge has its pros and cons, this study and the methodology involved in it has some cons too, as the reliability of the landmarks marked in the posteroanterior cephalogram involves random errors with limited evidence of the same.

Further scope of the study

In near future well-designed studies of both digital and analog radiographs are required to enable the orthodontist to choose the proper cephalometric analysis.

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Conflicts of interest

There are no conflicts of interest.

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