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Facial Asymmetry in Individuals with Skeletal Class II Malocclusions.

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Research Article

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ABSTRACT

Three dimensional evaluations of skeletal features is very important to differentiate skeletal and dental malocclusions and the factors contributing for malocclusion per se. Hence this study was designed with aim and objective of assessing the facial asymmetry in transverse plane in individuals having skeletal class II jaw discrepancy. 90 subjects (45 males and 45 females) aged 18-30 years were selected as per inclusion criteria. The facial asymmetry of skeletal class II individuals were compared using Grummon's analysis in frontal cephalograms. The data obtained was statistically analyzed using Paired't' test. Significant differences were observed between right side and left side values in relation to Ag-Me in males and Co-Ag-Me in females in group III individuals. Significant differences were observed between right side and left side values in relation to J-MSR in males in Group II individuals. Significant differences were observed between right side and left side values in relation to Me-MSR in males in Group II individuals. Facial asymmetry exists between right and left sides in class II individuals. Maxilla is more asymmetrical than mandible in patients with maxillary excess. Asymmetry showed male dominance in individuals with maxillary excess and mandibular deficiency.

INTRODUCTION

Three dimensional evaluations of skeletal features is very important as it helps in differentiating skeletal and dental malocclusions and the factors contributing for malocclusion per se [1]. In general, many studies have compared the craniofacial morphology in sagital and vertical plane only. Interestingly, studies of the transverse relationship of the maxilla to the mandible in class II subjects have been limited to the analysis of the arch widths measured on dental casts [2].

Analysis of vertical components, although easily viewed from sagital cephalometric radiographs, cannot be fully understood without the assistance of a P-A cephalometric radiograph as bilateral vertical asymmetries can only be evaluated from a frontal view [3] . Although faces look symmetrical on soft tissue examination, varying degree of asymmetries can be noticed in PA cephalographs [4].

Furthermore, facial growth studies that include the transverse component have been even fewer. In relation to diagnosis and treatment, the specialty has been overwhelmingly preoccupied with vertical and sagittal relationships of the dentofacial structures. Those available do not include a detailed analysis of the P-A cephalometric radiographs [3].

Transverse problems are a great concern to the orthodontist and have been mentioned as having great potential for relapse [5].

It is therefore essential to evaluate the skeletal relationship in all three planes of space. Hence this study was designed and conducted with the objective of assessment of facial asymmetry in transverse plane in individuals having skeletal class II jaw discrepancy.

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MATERIALS AND METHODS

90 subjects (45 males and 45 females) between 18 and 30 years of age were selected as per the following criteria.

Inclusion criteria for study group

- All intact permanent dentition (excluding 3rd molar)
- Clinically obvious maxillary excess/ mandibular deficiency
- Individuals with Class II profile

Exclusion criteria

- Skeletal abnormalities like cleft lip and palate and other cranio facial deformities
- Prior orthodontic /surgical treatment
- Deviation of mandible on opening and closing

Inclusion criteria for the control group

The subjects for the control group were selected based on their pleasing class I profile, normal dental occlusion with normal overjet and overbite with no midline deviations.

Written informed consent was obtained from each individuals and the project was approved by the Institutional Review Committee. Lateral cephalograms were made and the subjects were classified based on their sagittal relationship as follows.

Group I Control group: 30 Individuals with class I malocclusion (15-Males, 15-Females) with SNA=82+-2 and SNB=80 +-2

Group II: 30 individuals (15-Males, 15-Females) with Skeletal class II with maxillary excess having SNA> 88^0, N PER A (II HP) >6mm and SNB=80+-2^0

Group III: 30 individuals (15-Males, 15-Females) with Skeletal class II with mandibular deficiency having SNA= 82+-2, N PER B (II HP)> -4mm and SNB< 76.

Postero-Anterior (P-A) cephalograms were made for all the selected subjects under standardized conditions and were traced on 0.03 acetate paper by a single operator.

The landmarks were identified for analysis [4] in Postero-Anterior cephalometric tracing (Fig 1) and skeletal asymmetry analysis was carried out (Fig 2).

Measurements used in the study (Fig 2) are as follows

Mandibular Morphology

Left – right triangles are formed from the heads of the condylar processes or condylion (Co), Antegonial notch (Ag) and Menton (Me). These are split by ANS-Me line and compared.

Volumetric Comparison

Two volumes are calculated from the area defined by each Co-Ag-Me and the intersection with a perpendicular from Co-MSR.

Maxillo – Mandibular Comparison of Asymmetry

Perpendiculars are drawn to MSR from J and Ag and connecting lines from Cg-to J and Ag. This produces 2 pairs of triangles, each is bisected by MSR.

Linear Asymmetries

The linear distance is measured from MSR to Co, J, Ag and Me.

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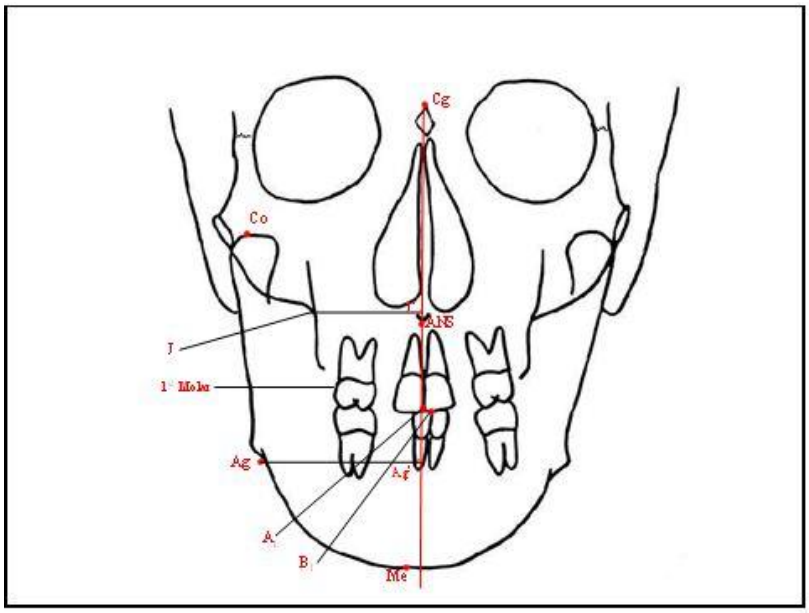

Figure1. Land marks on postero-anterior (P-A) cephalogram

- Ag - Antegonial Notch
- ANS - Anterior Nasal Spine
- Cg - Crista Gall
- Co – Condylion
- J - Jagal process
- Me - Menton
- A1 - Upper central incisal edge
- B1 - Lower central incisal edge
- Ag' - Constructed point at MSR
- J' - Constructed point at MSR

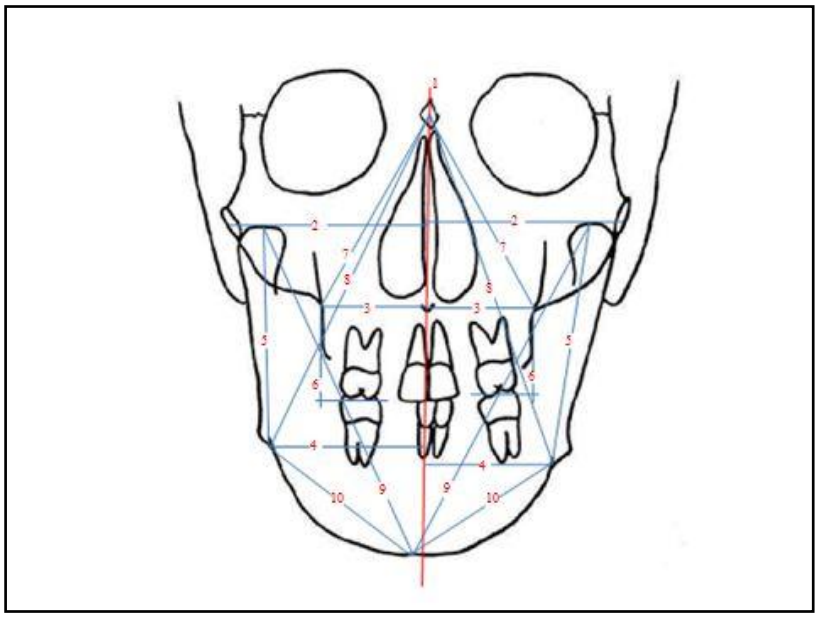

Figure2. Linear measurements on postero-anterior (P-A) cephalogram

1. MSR – Mid-sagittal reference plane
2. Co-MSR – Condylion - Mid-sagittal reference plane
3. J-MSR – Jugal Process - Mid-sagittal reference plane
4. Ag-MSR – Antegonial notch - Mid-sagittal reference plane
5. Co-Ag – Condylion - Antegonial notch plane
6. Buccal surface of 1st molar - J – Buccal surface of 1st molar – Jugal Process
7. Cg-J – Crista galli - Jugal Process plane
8. Cg-Ag – Crista galli - Antegonial notch plane
9. Co-Me – Condylion - Menton plane
10. Ag- Me – Antegonial notch- Condylion plane
11. Gonial angle (Go ang)

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Statistical analysis

The mean and standard deviation for each measurement 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.

RESULTS

The skeletal asymmetry of skeletal class II individuals was analysed using Grummons analysis and the following results were obtained:

Mandibular Morphology (Table 1,2,3):

Table 1: Mandibular morphology and volumetric comparison for group I

Variables	Gender	N	Side	Mean (mm)	T stat	T critical	Remarks
Co-Me	M	15	Right	104	0.289	2.144	NS*
			Left	104.5			
	F	15	Right	99.4		2.144	
			Left	99			
Ag-Me	M	15	Right	49.7	-1.11	2.144	NS
			Left	50.5			
	F	15	Right	45.8		2.144	
			Left	46.4			
Co-Ag-Me	M	15	Right	122.1	-0.37	2.144	NS
			Left	123			
	F	15	Right	121.1		2.144	
			Left	122.4			
Co- MSR	M	15	Right	56.4	0.09	2.144	NS
			Left	56.8			
	F	15	Right	53.7		2.144	
			Left	53.7			
Co-Ag	M	15	Right	68.5	1.52	2.144	NS
			Left	67.7			
	F	15	Right	66		2.144	
			Left	64.2			

*NS= Not significant

Table 2: Mandibular morphology and volumetric comparison for group II

Variables	Gender	N	Side	Mean (mm)	T stat	T critical	Remarks
Co-Me	M	15	Right	99.8	-0.38	2.144	NS*
			Left	103			
	F	15	Right	98.4		2.144	
			Left	97			
Ag-Me	M	15	Right	45	-1.47	2.144	NS
			Left	47.7			
	F	15	Right	47.5		2.144	
			Left	48.4			
Co-Ag-Me	M	15	Right	121.4	2.08	2.144	NS
			Left	118.7			
	F	15	Right	126.4		2.144	
			Left	125.1			
Co- MSR	M	15	Right	52.2	0.43	2.144	NS
			Left	53.5			
	F	15	Right	53.4		2.144	
			Left	50.7			
Co-Ag	M	15	Right	63.4	-0.46	2.144	NS
			Left	70.4			
	F	15	Right	63.4		2.144	
			Left	64.7			

*NS=Non Significant

Statistically significant differences were observed between right side and left side values in relation to Ag-Me in males and Co-Ag-Me in females in group III individual's. However, no significant differences were observed between right side and left side values in relation to Co-Ag in both in males and females of Group I, Group II and Group III individuals.

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Volumetric Comparison (Table 1,2,3)

No significant difference were observed between right side and left side values in relation to Co-MSR and Co-Ag and in both males and females of Group I , Group II and Group III individuals.

Table 3: Mandibular morphology and volumetric comparison for group III

Variables	Gender	N	Side	Mean (mm)	T stat	T crit	Remarks
Co-Me	M	15	Right	100.5	-0.94	2.144	NS
			Left	100.2			
	F	15	Right	96.7		2.144	
			Left	98.8			
Ag-Me	M	15	Right	47.5	2.34	2.144	P<0.01
			Left	43.5			
	F	15	Right	43.4		2.144	
			Left	43.1			
Co-Ag-Me	M	15	Right	122.1	-2.23	2.144	P<0.01
			Left	124.4			
	F	15	Right	110.7		2.144	
			Left	114.1			
Co- MSR	M	15	Right	53.7	0.31	2.144	NS
			Left	52.4			
	F	15	Right	52.7		2.144	
			Left	53.7			
Co-Ag	M	15	Right	63.2	0	2.144	NS
			Left	61.7			
	F	15	Right	73.1		2.144	
			Left	74.1			

*NS= Not significant

Maxillo–Mandibular comparison of asymmetry (Table 4,5,6)

Table 4: Maxillo-mandibular comparision and linear measurements for group I

Variables	Gender	N	Side	Mean (mm)	T stat	T critical	Remarks
J-MSR	M	15	Right	37	0.46	2.144	NS*
			Left	35.5			
	F	15	Right	39.1		2.144	
			Left	39.2			
Ag-MSR	M	15	Right	44.5	-0.66	2.144	NS
			Left	43.5			
	F	15	Right	37.1		2.144	
			Left	38.8			
Cg-J	M	15	Right	60.8	-0.11	2.144	NS
			Left	62.2			
	F	15	Right	60.2		2.144	
			Left	59.4			
Cg-Ag	M	15	Right	108.5	1.55	2.144	NS
			Left	108.8			
	F	15	Right	101.5		2.144	
			Left	99.4			
Co-MSR	M	15	Right	59.2	0.76	2.144	NS
			Left	58.2			
	F	15	Right	59.2		2.144	
			Left	59.5			
Me-MSR	M	15	Right	0.57	-1.38	2.144	NS
			Left	1.71			
	F	15	Right	0.28		2.144	
			Left	1.28			

*NS= Non Significant

Significant difference were observed between right side and left side values in relation to J-MSR in males in Group II individuals, but no significant difference were observed between right side and left side values in relation to Cg-J, Cg-Ag, Ag-MSR of Group I, Group II, Group III individuals.

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Linear Asymmetries (Table 4,5,6)

Statistical significant differences were observed between right side and left side values in relation to Me-MSR in males in Group II individuals .

Table 5: Maxillo-mandibular comparision and linear measurements for group II

Pariables	Gender	N	Side	Mean (mm)	T stat	T critical	Remarks
J-MSR	M	15	Right	33.7	-2.59	2.144	Significant P<0.01
			Left	35			
	F	15	Right	29.5		2.144	
			Left	30.7			
Ag-MSR	M	15	Right	41.5	-1.07	2.144	NS
			Left	43.5			
	F	15	Right	41.4		2.144	
			Left	41.5			
Cg-J	M	15	Right	62.1	-0.25	2.144	NS
			Left	61.5			
	F	15	Right	57.5		2.144	
			Left	57.8			
Cg-Ag	M	15	Right	105.4	0.9	2.14	NS
			Left	103			
	F	15	Right	96.2		2.14	
			Left	96.7			
Co-MSR	M	15	Right	52.2	0.34	2.144	NS
			Left	53.5			
	F	15	Right	53.4		2.144	
			Left	50.8			
Me-MSR	M	15	Right	0	-2.5	2.144	Significant P<0.01
			Left	0.71			
	F	15	Right	1.14		2.144	
			Left	0.42			

*NS= Non Significant

Table6. Maxillo-mandibular comparision and linear measurements for group III

Variables	Gender	N	Side	Mean (mm)	T stat	T critical	Remarks
J-MSR	M	15	Right	33.4	0.33	2.144	NS
			Left	34.2			
	F	15	Right	34		2.144	
			Left	32.7			
Ag-MSR	M	15	Right	42.1	0.9	2.144	NS
			Left	37.4			
	F	15	Right	40.8		2.144	
			Left	40.2			
Cg-J	M	15	Right	60.2	-1.1	2.144	NS
			Left	61.4			
	F	15	Right	66.2		2.144	
			Left	66.5			
Cg-Ag	M	15	Right	101.7	-1.29	2.144	NS
			Left	103			
	F	15	Right	104.2		2.144	
			Left	104.2			
Co-MSR	F	15	Right	59	1.04	2.144	NS
			Left	57.7			
	F	15	Right	52.7		2.144	
			Left	52.2			
Me-MSR	M	15	Right	0.71	0.7	2.144	NS
			Left	0.28			
	F	15	Right	0.42		2.144	
			Left	0.71			

*NS= Non Significant

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DISCUSSION

Dentofacial structures need to be evaluated in three planes of space (i.e sagital, transverse and vertical) which helps to differentiate between dentoalveolar and skeletal discrepancies and to evaluate their relative contribution towards the creation of malocclusion. It is also essential for evolving a comprehensive diagnosis and treatment plan [1]. Hence, this study was planned and designed for the assessment of skeletal symmetry in skeletal class II individuals.

Postero-anterior cephalograms were used to assess skeletal asymmetry. PA view is a valuable tool in the study of right and left structures since they are located at relatively equal distance from the film and X-ray source, as a result the effect of unequal enlargement by the diverging rays is minimized and the distortion is reduced. Comparison between sides is therefore more accurate since the midlines of the face and dentition can be recorded and evaluated [6].

There are many types of postero-anterior analysis used for assessment of the facial asymmetry like Svanholt and Solow analysis, Grayson analysis, Hewitt analysis and Ricketts analysis [6]. Analysis proposed by Grummons and Kappeyne Van De Cappello [7] contains quantitative assessment of vertical dimensions and proportions.This is a comparative and quantitative postero-anterior analysis. This type of analysis provides a practical, functional method of determining the location and amount of facial asymmetry [7]. Hence, the present study was undertaken using the analysis proposed by Grummon et al for the assessment of l skeletal asymmetry in individuals with skeletal class II malocclusion. 10 cephalometric measurements were made to determine and. evaluate the dentoskeletal characteristics in transverse plane.

The mean and standard deviation for each measurement were calculated. Paired t-test was used to test the significance in the difference between the right and left sides of the face and for any gender difference.

In this study, statistically significant difference were observed between right side and left side values in relation to Ag-Me in males and Co-Ag-Me in females with mandibular deficiency. This finding is in agreement with studies by Rossi M et al, [8] Server TR and Profit[9] but is in contradiction to studies by Shore IL [10], Shah and Joshi[11]according to which there is a tendency for the maxilla to be more asymmetric than mandible.

The present study reveals a tendency for the mandible to be more asymmetric than maxilla which may be because (1) the mandible grows longer than the maxilla and thus is likely to show more deviation and (2) the mandible is a mobile apparatus whereas the maxilla is connected rigidly to its adjacent skeletal structures [9].The study done by Franchi and T Baccetti shows that individuals with Class II malocclusion exhibit significant size difference in craniofacial configuration in the frontal plane when compared with subjects with normal occlusions [2]. These differences in size mainly involved the contraction of the maxilla. No significant difference in size was detected in the mandible on the transverse plane when comparing Class II or Class III subjects to Class I controls.

In the present study, majority of the parameters showed male dominance and the difference was statistically significant. This finding is in accordance with studies by Giovanoli P et al [12], Farkas LG [13]. This is thought to be because of greater growth of the facial musculature and skull of males compared with females [12].

The present study showed that the asymmetries decrease in magnitude, as we approach higher in the craniofacial skeleton. The upper facial region presents with asymmetries having the least magnitude, whereas the mandibular region (lower facial region) shows asymmetries of highest magnitudes. This finding is in accordance with a study done by Sumit et al [14] but is contradictory to a study done by Farkas LG [13] according to which the largest amount of asymmetry was observed in upper third of face.

In this study, significant difference observed between right side and left side values in relation to Maxillary width represented by J-MSR in males having maxillary excess. This finding is in accordance with a study done by L Franchi et al [2] in which deficiency in transverse dimension in maxilla has been noted.

In the present study, lower dental arch midline was found to be shifted to left side in females. This finding is in contradiction with a study done by Debra.G et al who found it is shifted towards right [1].

The present study reveals significant skeletal asymmetry in transverse plane in individuals with class II malocclusion. This aspect has to be considered during diagnosis and treatment planning.

Further studies with large sample size comprising of different skeletal and dental malocclusions in various racial groups at different age groups will be required for assessment of skeletal and dental asymmetries.

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CONCLUSIONS

- Variations in facial symmetry exist on right and left sides in class II individuals.
- Maxilla is more asymmetrical than mandible in patients with maxillary excess.
- Mandible is more asymmetrical in patients with mandibular deficiency.
- Asymmetry showed male dominance in individuals with maxillary excess and mandibular deficiency.

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