(e) ISSN Online: 2321-9599
(p) ISSN Print: 2348-6805

SJIF (Impact factor) 2017= 6.261
Index Copernicus value = 80.90

ORIGINAL ARTICLE

A Frontal Cephalometric Evaluation of Asymmetry in Class II Subdivision Malocclusions

Vineet Kumar[1], K.S Negi[2], Jai Ram Kaundal[3], Nishant Negi[4], Sanjeev Vaid[5]

[1]Junior Resident, [2]Professor & Head, [3]Professor, [4]Assistant Professor, HPGDC, Shimla, H.P., [5]Assistant Professor, DR Y. S. P. G. M. C, Nahan, H.P., India

***ABSTRACT*:**
Introduction: The purpose of this study was to determine whether Angle class II subdivision malocclusions have skeletal or dental asymmetries between the class II and class I sides. **Methods:** Thirty subjects with Angle class II subdivision malocclusions were assessed with postero-anterior cephalometric radiographs. Paired t-test was applied on paired measurements for statistical analysis of class II and class I sides. Non Parametric Chi-sq test was applied on unpaired measurements. **Results:** There was statistically highly significant association for mandibular dental midline deviation towards class II sides. On the other hand maxillary dental midline showed statistical significance for coincidence with facial midline. No statistically significant difference was found between class II side and class I side. **Conclusions:** The etiology of class II subdivision malocclusions is dentoalveolar. Distal positioning of mandibular molars is responsible for producing asymmetry between class II and class I sides.
Key words: Subdivision, Asymmetry, Postero-anterior radiograph.

Corresponding author: Dr. Vineet Kumar, Junior Resident, HPGDC, Shimla, H.P, India

This article may be cited as: Kumar V, Negi KS, Kaundal JR, Negi N, Vaid S. A Frontal Cephalometric Evaluation of Asymmetry in Class II Subdivision Malocclusions. J Adv Med Dent Scie Res 2017;5(11):99-103.

Access this article online	
Quick Response Code	Website: www.jamdsr.com
	DOI: 10.21276/jamdsr.2017.5.11.25

INTRODUCTION

Class II subdivision malocclusion is defined as "the occurrence of a unilateral malocclusion, whereby molar occlusion is Class II on one side and Class I on the other.'' [1] Class II subdivision malocclusions are unique in that they display characteristics of both Class I and Class II malocclusions within the same patient. Class II subdivisions are estimated to account for upto 50% of all class II malocclusions and are among the most common asymmetries in orthodontic population.[2,3]

Clinicians often find difficulty in diagnosing the cause of malocclusion as it could be dental, skeletal or a combination of both involving maxilla, mandible, maxillary dentition or mandibular dentition.[4] Since treatment of asymmetry requires asymmetric extractions or mechanics, which can be complicated it's very important to accurately pinpoint the etiology of asymmetry. [5,6] 2- Dimensional radiographs have been used to evaluate subdivisions for dental and skeletal asymmetries between class I and class II sides of skull and dentition. [4-6] Alavi et[7] al were the first to determine that class II subdivisions result mainly from asymmetry in the mandibular first molars. However, they did not determine whether this was due to dentoalveolar or skeletal asymmetry. Rose et al[8] confirmed those results and concluded that class II subdivisions occur from distal positioning of mandibular first molars on the class II side. Janson et al[9] found the subdivisions to be dentoalveolar, and the primary contributor to the difference between subdivision and normal side was the distal positioning of mandibular first molars on the class II side. A secondary contributor was mesial positioning of maxillary first molars on the class II side.

However, few studies discovered tendencies for skeletal asymmetries and suggested further research to explore this area. [10-12] Sanders et al[13] found the mandible to be shorter and posteriorly positioned on the class II side. Minich et al[14] found significant skeletal and dental differences between class I and class II sides with skeletal asymmetries accounting for one third of total asymmetry.

The purpose of this study was to analyze class II subdivision malocclusions for skeletal and dental asymmetries by using PA-cephalograms.

MATERIAL AND METHODS

The sample consisted of 30 adult subjects selected with the following criteria- 1) Subjects with full complement of permanent teeth upto the first molars. 2) A complete Class I molar relationship on one side of the dental arch with a full Class II molar relationship on the other side. 3) No history of previous orthodontic treatment. 4) No history of facial trauma or medical condition that might have altered growth. 5) The absence of crowding. 6) No lateral mandibular shift during closure as determined by clinical examination. The machine used for the posteroanterior radiograph was Cranex Excel Ceph Machine manufactured by Sorerdex Helsinki- Finland. The distance from the focal point to the ear rods was standardized at 152 cm, and the distance from the ear

rods to the film was fixed at 16 cm. Exposure parameters were at 75 KVp at 10 milliampere for 1 second. Each radiograph was taken with teeth in maximum intercuspation, lips relaxed and subjects were oriented in a position in which Frankfort Horizontal plane was parallel to the floor. The cephalometric landmarks, planes, angular, linear parameters used in the study are shown in figure 1, 2 and 3 respectively. The cephalometric measurements were obtained according to the method of Grummons and Van De Coppello.[15]

STATISTICAL ANALYSIS

Descriptive statistics (mean, standard deviation and range) were calculated for all the variables. The Normality of quantitative data was checked by measures of Kolmogorov-Smirnov tests of Normality. As our data was Normally distributed Paired t-test was applied on paired measurements for statistical analysis of 2 classes (these were 2 sides of same patient) .Non Parametric Chi-sq test was applied on unpaired measurements.[16] To see reliabiliity of Intra Observer error; Cronbach's Alpha reliability was calculated.[17] All the statistical tests were two-sided and significance of p value was determined at 0.05(*significant), 0.01(**highly significant) and 0.001(***very highly significant) level of confidence. Statistical analysis was conducted using IBM SPSS STATISTICS (version 22.0).

RESULTS

Means and standard deviations for the differences between class I and class II sides for all the variables and the results of the t test and Chi-sq test between them are listed in Table 1 and 2. Skeletal parameters showed no statistically significant differences between the two sides (Table 1). However, there was highly significant difference for mandibular dental midline deviation towards class II sides. On the other hand maxillary dental midline showed statistical significance for coincidence with facial midline (Table 2).

Table 1: The Comparison of paired measurements between Class I and Class II sides

S. No.	Variable	Class I	Class II	Paired Differences					t	df	Sig. (2-tailed) p value
				Mean Difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
							Lower	Upper			
1.	Z Plane Angle	90.50	89.55	.95	3.18	.58	-.23	2.13	1.63	29	.113
2.	Occlusal Plane Angle	90.23	89.81	.41	3.06	.55	-.72	1.56	.74	29	.462
3.	Antegonial Plane Angle	89.97	90.20	-.23	3.71	.67	-1.61	1.15	-.34	29	.733
4.	Antegonial Angle	122.20	121.00	1.20	3.86	.70	-.24	2.64	1.69	29	.100
5.	Z- MSR	48.08	48.38	-.30	2.16	.39	-1.10	.50	-.75	29	.454
6.	Co- MSR	53.80	54.91	-1.11	3.95	.72	-2.59	.35	-1.54	29	.133
7.	ZA- MSR	65.35	66.60	-1.25	3.65	.66	-2.61	.11	-1.87	29	.071
8.	NC- MSR	16.13	16.96	-.83	2.71	.49	-1.84	.18	-1.68	29	.103
9.	J- MSR	33.80	34.31	-.51	3.09	.56	-1.67	.63	-.91	29	.368
10.	Ag- MSR	43.77	44.73	-.96	4.76	.86	-2.74	.81	-1.11	29	.275
11.	Co- Ag	65.90	65.73	.16	2.83	.51	-.89	1.22	.32	29	.750
12.	Co- Me	98.07	97.80	.26	2.86	.52	-.80	1.33	.51	29	.614
13.	Me- Ag	47.38	47.16	.21	3.75	.68	-1.18	1.61	.31	29	.754
14.	Occlusal Plane Tilt	83.65	83.25	.40	1.77	.32	-.26	1.06	1.23	29	.228

*=p<0.05, **=p<0.01, ***=p<0.001

Table 2: Chi-Square Test Statistics of Unpaired Measurements

S.No.	Measurement	Deviation Towards Class I Side	Deviation Towards Class II Side	No Deviation	Chi Square(a)	df	Asymp. Sig
1.	ANS Deviation	8	11	11	.600	2	.741
2.	Mandibular Deviation	7	15	8	3.80	2	.150
3.	Maxillary Dental Midline Deviation	5	9	16	6.20	2	.045*
4.	Mandibular Dental Midline Deviation	4	23	3	25.4	2	<.001***

*=p<0.05, **=p<0.01, ***=p<0.001

Figure 1: Cephalometric landmarks & Planes

1. NC	**2. Z**	**3. ZA**	**4. J**	**5. Co**	**6. Go**	**7. Ag**
8. Me	9. Cg	10. ANS	11. A1	12. B1	13. Z Plane	14. MSR Plane

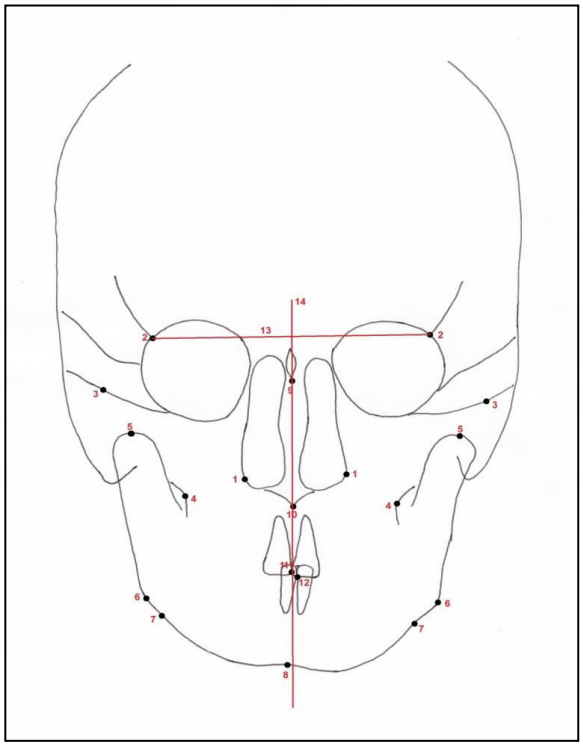


Figure 2: Angular Parameters

1. Z Plane Angle	**2. Occlusal Plane Angle**	**3. Antegonial Plane Angle**	**4. Antegonial Angle**

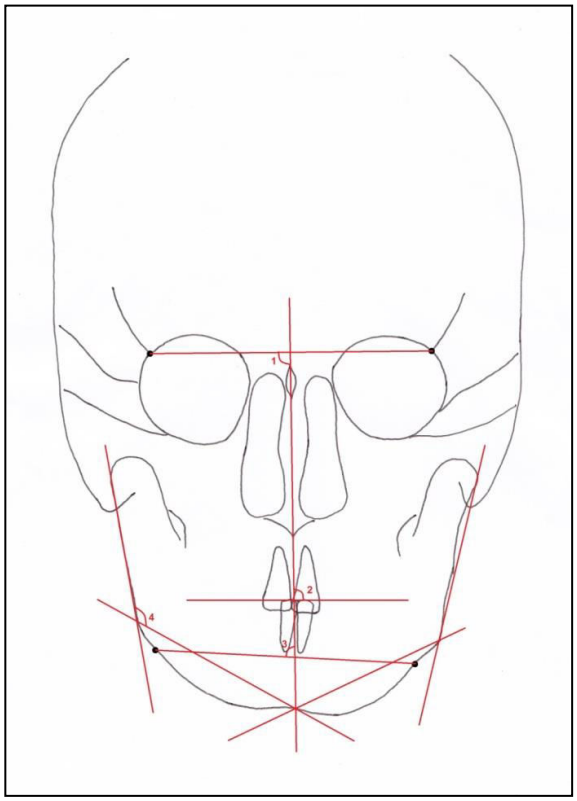
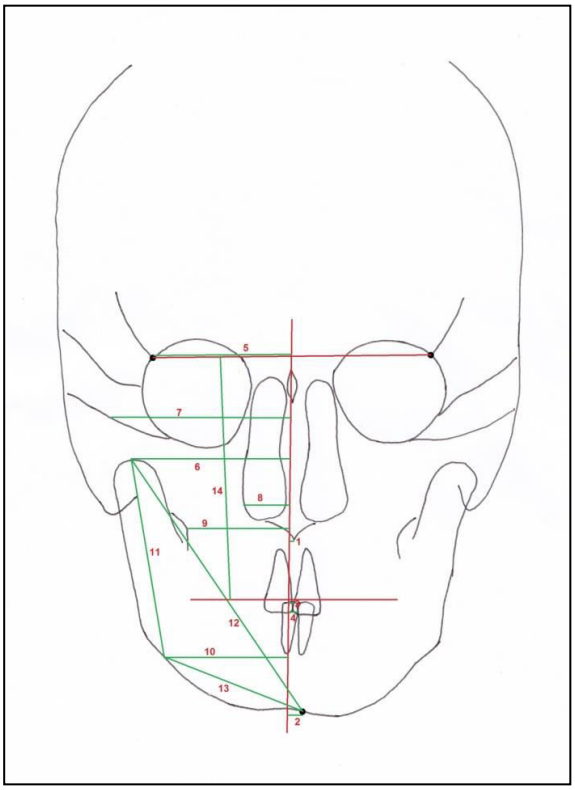


Figure 3: Linear Parameters

1. ANS Deviation	**2. Mandibular Deviation**	**3. Maxillary Dental Midline Deviation**	**4. Mandibular Dental Midline Deviation**	**5. Z-MSR**	**6. Co-MSR**	**7. ZA-MSR**
8. NC- MSR	9. J- MSR	10. Ag- MSR	11. Co- Ag	12. Co-Me	13. Me-Ag	14. Occlusal Plane tilt



DISCUSSION

Alkofide[18] stressed that since half of class II patients have a subdivision, it is crucial to carefully diagnose asymmetries found in class II subdivision malocclusions so that they can be properly analyzed to determine correct etiology and treatment protocol. Asymmetry in craniofacial areas can be recognized as differences in the size or relationship of the two sides of face. Clinical facial asymmetry in the craniofacial complex ranges from the barely detectable to gross discrepancies between the right and left halves of the face. Posteroanterior cephalogram is a valuable tool in the study of the right and left structures since they are located at relatively equal distances from the film and x-ray source. As a result, the effects of unequal enlargement by the diverging rays are minimized and the distortion is reduced. Comparison between the two sides is therefore more accurate since the midlines of the face and dentition can be recorded and evaluated.[19] Ideally, posteroanterior radiographs should be taken in centric relation to detect any functional mandibular deviation that might interfere with the evaluation of mandibular asymmetry in relation to the maxilla and cranial base.[20] Since our selection criteria included subjects with no functional mandibular deviations, posteroanterior cephalograms were recorded in centric occlusion.

The fact that sample consisted of male and female subjects in different proportions is insignificant as studies have not found any correlation between gender and asymmetries.[21,22]

Studies have found that main factor in producing asymmetry is the distal positioning of the mandibular first molar on class II side with a mandibular dental midline deviation towards class II side (type 1). A secondary factor was the mesial positioning of the maxillary first molar on the class II side with a maxillary dental midline deviation away from the class II side (type 2). [4,7,9,10] Our result also points towards dentoalveolar etiology of asymmetries. We found the mandibular teeth to be positioned asymmetrically between class II and class I sides. There was very highly significant association for mandibular midline deviation towards class II side implicating the distal positioning of mandibular first molars in producing subdivisions on class II side. Maxillary dental midline was found to be coincident with facial midline. This finding was contrary to most studies who also reported secondary role of mesial drifting of maxillary second molars in producing asymmetry.[21,22] As there was no significant difference amongst skeletal parameters between the two sides, the etiology of asymmetry was dentoalveolar only. On the contrary Sanders et al[13] found that the shorter and posteriorly

positioned mandible on the class II side to be responsible for producing asymmetry. Minich et al[14] were the first to report that asymmetric maxilla in addition to mandibular asymmetry, was also involved in etiology of subdivisions. As the dentoalveolus acts as a region of compensation for skeletal disharmonies, the possibility remains that subtle skeletal asymmetries might have been accommodated in the dentoalveolar compartment.[9]

In such asymmetries, one of the best treatment options would be to extract 2 maxillary premolars and 1 mandibular premolar on the class I side, if the patient's profile allows for retraction of the maxillary and mandibular incisors.[23-25]

CONCLUSIONS: The following conclusions can be drawn from this study:

1. The components that contributed to the asymmetric occlusal relationship in Class II subdivision malocclusions were mainly dentoalveolar. The contribution of skeletal asymmetries was negligible.
2. Mandibular dental midline deviation was more frequent than maxillary dental midline deviation. Therefore the involvement of mandibular dental midline will be implicit in the more distal positioning of mandibular molars.
3. Distal positioning of mandibular molars was responsible for producing asymmetry on class II side.

REFERENCES

1. Siegel MA. A matter of Class: interpreting subdivision in a malocclusion. Am J Orthod Dentofacial Orthop. 2002;122:582-6.
2. Sheaths RD, McGorray SP, Musmar Q, Wheeler TT, King GJ. Prevalence of orthodontic asymmetries. SeminOrthod 1998;4:138-45.
3. Smith RJ, Bailit HL. Prevalence and etiology of asymmetries in occlusion. Angle Orthod 1979;49:199-204.
4. Turpin DL. Correcting the class II subdivision malocclusions. Am J Orthod Dentofacial Orthop 2005;128:555-6.
5. Janson GR, Dainesi EA, Henriques JF, de Freitas MR, de lima KJ. Class II subdivision treatment success rate with symmetric and asymmetric extraction protocols. Am J Orthod Dentofacial Orthop 2003;124:257-64.
6. Bishara SE, Burkey PS, Kharouf JG. Dental and facial asymmetries: a review. Angle Orthod 1994; 64:89-98.
7. Alavi DG, BeGole EA, Schneider BJ. Facial and dental arch asymmetries in Class II subdivision malocclusion. Am J Orthod Dentofacial Orthop. 1988;93:38-46.
8. Rose JM, Sadowsky C, BeGole EA, Moles R. Mandibular skeletal and dental asymmetry in Class II subdivision malocclusions. Am J Orthod Dentofacial Orthop.1994;105:489-95.
9. Janson GR, Metaxas A, Woodside DG, de Freitas MR, Pinzan A. Three-dimensional evaluation of skeletal and dental asymmetries in Class II subdivision malocclusions. Am J OrthodDentofacialOrthop. 2001;119:406-18.
10. Janson G, de Lima KJRS, Woodside DG, Metaxas A, de Freitas MR, Henriques JF. Class II subdivision malocclusion types and evaluation of their asymmetries. Am J Orthod Dentofacial Orthop.2007;131:57-66.
11. Azevedo ARP, Janson G, Henriques JFC, Freitas MRD. Evaluation of asymmetries between subjects with Class II subdivision and apparent facial asymmetry and those with normal occlusion. Am J Orthod Dentofacial Orthop. 2006;129:376-83.
12. Janson GR, Cruz KS, Woodside DG, Metaxas A, de Freitas MR, Henriques JF. Dentoskeletal treatment changes in class II subdivision malocclusions in submentovertex and posteroanterior radiographs. Am J Orthod Dentofacial Orthop 2004;126:451-63.
13. Sanders DA, Rigali PH, Neace WP, Uribe F, Nanda R. Skeletal and dental asymmetries in Class II subdivision malocclusions using cone-beam computed tomography. Am J OrthodDentofacialOrthop. 2010;138:542.e1-542.e20.
14. Minich CM, Araujo EA, Behrents RG, Buschang PH, Tanaka OM, Kim KB. Evaluation of skeletal and dental asymmetries in Angle class II subdivision malocclusions with cone beam computed tomography. Am J Orthod Dentofacial Orthop. 2013;144:57-66.
15. Grummons DC, Van De Coppello MAK. A frontal asymmetry analysis. J ClinOrthod 1987; 21:448-65.
16. Mahajan BK. Methods in Biostatistics for Medical students and research workers. 6th ed. Jaypee Brothers Medical Publishers Ltd. 1997.
17. Cronbach. Coefficient Alpha and the internal structure of test. Psychometrika. 1951;16.
18. Alkofide EA. Class II division 1 malocclusions: the subdivision problem. J ClinPediatr Dent. 2001;26:37-40.
19. Bishara SE, Burkey PS, Kharouf JG. Dental and Facial asymmetries: a review. Angle Orthod. 1994;64:89-98.
20. Forsberg CT, Burstone CJ, Hanley KJ. Diagnosis and treatment planning of skeletal asymmetry with the submental- vertical radiograph. Am J Orthod. 1984;85:224-37.
21. Arnold TG, Anderson GC, Liljemark WF. Cephalometric norms for craniofacial asymmetry using submental-vertical radiographs. Am J Orthod Dentofacial Orthop. 1994;106:250-6.
22. Melnik AK. A cephalometric study of mandibular asymmetry in a longitudinally followed sample of growing children. Am J Orthod Dentofacial Orthop. 1992;101:355-66.
23. Burstone C. Diagnosis and treatment planning of patients with asymmetries. Semin Orthod 1998;4:153-64.
24. Cheney E. The influence of dentoskeletal asymmetry upon treatment procedures. Am J Orthod 1952; 38:934-45.
25. Wertz R. Diagnosis and treatment planning of unilateral class II malocclusions. Angle Orthod 1975;45:85-94.

Source of support: Nil **Conflict of interest:** None declared