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Cephalometric features Of Class II Div 1 and Class II Div 2 malocclusion in Maharashtrian population

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ABSTRACT

Objective

To describe and analyze the skeletal and dental characteristics associated with Class II division 1 (Class II/1) and Class II division 2 (Class II/2) malocclusions in the anteroposterior and vertical dimensions in Maharashtrian population.

Materials and Methods

200 lateral cephalograms were evaluated, out of which 100 films were of div 1and 100 films were of div 2 malocclusions, further subdivided based on gender. Lateral cephalograms were traced and different parameters were compared with each other.

Results

average mean ages of both groups was 23 – 26 years When comparison was done between difference in means of two groups (Table 3), there was no significant difference between mean values of parameters SNB, SNPOG, FACIAL ANGLE, Y-AXIS, LAFH, PAFH, FM ANGLE, GONIAL ANGLE, SN-MD ANGLE, MM ANGLE, and SADDLE ANGLE, (i.e. $p>0.05$) and highly significant difference between mean values of parameters SNA, ANB, FACIAL CONVEXITY,LI-MAND,UI-SN, and INTERINCISAL(i.e. $p<0.01$). Class II div 2 subjects showed retrognathic maxilla as compared to div 1 group, whereas incisor inclinations were reduced in div 2 group. In subjects with division1 the maxilla was normally positioned while in division 2 the maxilla was prognathic. Mandible was retrognathic in both groups. Lower incisors were proclined in both groups more so in division 1 malocclusion. Upper incisors were more proclined in div 1 and div 2 showed retroclined upper incisors. Interincisal angle was found acute in div 1 malocclusion while it was obtuse in div 1 malocclusion.

Conclusions

Distinct differences in morphological and dental characteristics were seen in Class II div 1 and div 2 cases should help clinician in deciding a specific treatment for these diverse subtypes of Class II malocclusion.

Keywords: Class II, Division 1, Division 2, Cephalometrics.

INTRODUCTION

In dentofacial Orthopaedics, a thorough knowledge of the skeletal and dental components that contribute to a particular malocclusion is essential because these elements may influence the approach to treatment. [1]

Many studies have been conducted to evaluate these different components in Angles Class II Div1 and Div 2 malocclusions. [2] But these studies have some conflicting findings based on specific ethnic population e.g. according to Rosenblum R E [3], maxilla in Class II Div1 patients was more protrusive and the mandible was normal in size and position, but according to Mcnamara [4], and Craig [5] maxilla was in normal position in Class II patients while the mandible was retrusive. According to Pancherz[1] both maxillary protrusion and mandibular retrusion was seen in Class II Div 1 patients. The limitations of recent study were:

Thus, the value of these studies is limited by several factors including;

1. Lack of a clear definition of Class II malocclusion; the demarcation between Class II and Class I, especially in the mixed dentition is vague.5 (delete)
2. No differentiation between Class II Div 1 and Class II Div 2 malocclusion, as Div 2 subjects may have a specific craniofacial morphology.3,5
3. Insufficient sample size.1

Hence, this study was conducted to compare the antero-posterior and vertical components of Skeletal Class II Division 1 and Division 2 malocclusion with each other between males and females of Maharashtrian marathi population using lateral cephalograms. The aims and objectives of this study was:

AIMS AND OBJECTIVES

1. To compare antero-posterior and vertical components of skeletal Class II Division 1 and Class II Div 2 malocclusion between males and females.
2. To compare antero-posterior and vertical components of skeletal Class II Division 1 malocclusion with skeletal Class II Division 2 malocclusion.

MATERIALS AND METHOD

This was a retrospective study in which 200 hundred lateral cephalograms were collected from previously treated class II Div 1 and Div 2 cases reported in department of Orthodontics.

Patient selection criterior was solely done from cephalograms with Class II molar relationship and class II canine relationship. (Table 1). Cephalograms were divided into two groups:

Group 1

100 Subjects of skeletal Class II malocclusion exhibiting Division 1 features (ANB >4°, proclined maxillary incisors and increased overjet) These were further divided according to gender as subgroups: a) 50 males b) 50 females.

Group 2

100 Subjects of skeletal Class II malocclusion exhibiting Division 2 features (with ANB >4o, retroclined upper central incisors and labially tipped upper lateral incisors overlapping the central incisors.) These were further divided according to gender as subgroup: a) 50 males b) 50 females, Other inclusion criteria included,

1. Maharashtrian Marathi population,
2. Age range of 20 to 30 with average age of 25 years.
3. 3). Subjects with straight and convex profiles.
4. All subjects having complete set of permanent teeth with or without third molar.
5. No history of previous orthodontic treatment.
6. No previous extractions of any tooth/teeth.

Lateral cephalometric radiograph of each patient was taken on Xtronics 2000 machine in natural head position. The lateral cephalograms were taken by the same operator to reduce the chances of error. Manual tracing of lateral cephalograms were done using A4 size, 0.003" thickness acetate paper and 3HB hard lead pencil over well-illuminated viewing screen. Lateral cephalometric films were traced by the same investigator to avoid errors.

CEPHALOMETRIC PARAMETERS

Following cephalometric parameters (with normal values) were used. [6]

Antero-posterior

1. SNA - 82 ± 2°
2. SNB - 80 ± 2°
3. ANB - 2 ± 2°
4. SN-Pog – 79 ± 3°
5. Facial Angle – 87.8°
6. Facial Convexity – 0°
7. Y axis (FH-SGn) - 59.4 ± 3.8°

Vertical

8. LAFH – 63-64mm
9. PAFH – 62 ± 65
10. FMA –- 25 ± 5°
11. Gonial angle (Ar-Go-Me) - 128 ± 7°
12. SN-MD Plane – 32°
13. MMA (PP-MP) - 27 ± 4°
14. Saddle Angle - 123° ± 5°

Dental

15. L1 – MP - 90 ± 3°
16. U1 – SN - 102 ± 2°
17. Interincisal Angle - 131°

STATISTICAL ANALYSIS

Mean, standard deviation, standard error of mean was calculated and comparison of Means, SD & SE was done between the following groups:-
1. Group 1 males vs Group 1 females
2. Group 2 males vs Group 2 females
3. Group 1vs Group 2

Method error

The error involved in this study consisted of both operator and manual errors. To reduce errors due to intra-operators variability 30 lateral cephalometric radiographs were chosen at random and re-traced on a separate session under identical conditions. Measurement error was assessed by Dahlberg's formula ME = $\sqrt{\sum D2/2N}$

Z test was used to compare various parameters within and between two groups. The comparisons were made with level of significance at 5% (α = 0.05).

RESULTS

Calculated measurement error was 0.2 mm for linear and 0.25^0 for angular measurement, which was not significant.

After applying Z test of difference between two means between males and females in group 1 (Table 2), no significant differences were found between parameters SNA, ANB, facial convexity, Y-axis, FM angle, and LI-MAND (i.e. p>0.05) and significant difference were found between parameters SNB, SN-POG, Facial angle, LAFH, PAFH, SN-MD angle, MM angle, Saddle angle, UI-SN, Interincisal angle (i.e. p<0.05). Females with class II div 1 showed forwardly positioned mandible with reduced anterior facial height with more proclined incisors as compared to males in the group.

In group 2 (Table 3) no significant difference between mean values of parameters SNA, SNB, ANB, SNPOG, FACIAL ANGLE, FACIAL CONVEXITY, Y-AXIS, LAFH, PAFH, FM ANGLE, SN-MD ANGLE, MM ANGLE, SADDLE ANGLE, UI-SN, INTERINCISAL (i.e. p>0.05) were seen. Only significant difference was found between parameters GONIAL ANGLE, LI-MAND (i.e. p<0.05) when compared as males V/s females in group 2. Males showed increased gonial angle, while females showed more proclined lower incisors.

When comparison was done between difference in means of two groups (Table 3), there was no significant difference between mean values of parameters SNB, SNPOG, FACIAL ANGLE, Y-AXIS, LAFH, PAFH, FM ANGLE, GONIAL ANGLE, SN-MD ANGLE, MM ANGLE, and SADDLE ANGLE, (i.e. p>0.05) and highly significant difference between mean values of parameters SNA, ANB, FACIAL CONVEXITY,LI-MAND,UI-SN, and INTERINCISAL(i.e. p<0.01). Class II div 2 subjects showed retrognathic maxilla as compared to div 1 group, whereas incisor inclinations were reduced in div 2 group.

DISCUSSION

It is essential to know the descriptive characteristics of different types of malocclusions and their dental and skeletal structures in order to

produce an appropriate treatment plan with suitable treatment mechanics and retention regime.

The dentoskeletal morphology of Class II malocclusion has been analysed in number of cephalometric investigations. [1-5] But no clear differentiation between Class II Division 1 and Class II Division 2 was presented. Such differentiation is important since most of the class II division 2 subjects have a specific craniofacial morphology. [1]

This study was conducted to investigate and compare the antero-posterior and vertical components of skeletal Class II malocclusion exhibiting Division 1 and Division 2 features using lateral cephalograms. Skeletal and dental characteristic were evaluated and compared using various angular and linear measurements.

Antero-posterior variables

When SNA was compared between Group 1, Group 2 and their respective subgroups, it was found that maxilla was similarly positioned in Group 1 (Class II Division1 malocclusion) whereas in Group 2 (Class II Division 2 malocclusion) maxilla was retrognathic in position, in relation to cranial base. Similar maxillary position was found between the males and females of their respective subgroups.

This is in contrast to studies by Karlsen AT [7] who reported normally positioned maxilla while Pancherz H[1], Al-khateeb [8] and Renfroe EW [9] reported prognathic maxilla.

In both the groups mandible was retrognathic but in group 1, females showed significant forward positioning of mandible as compared to males. This is contrast to study by Rosenblum RE [3] who showed normal mandible in class II div 1 cases. Present study is in agreement with many previous studies that indicate mandibular retrusion as common feature of class II div 2. [1, 7, 9] This finding was not supported by Al-Khateeb EA, Al-Khateeb SN [8] who reported normal mandible in class II div 2 cases.

In both the groups there was antero-posterior discrepancy indicating class II skeletal pattern. Similar results were found between the males and females of their respective subgroups. This is in agreement with Al-Khateeb EA, Al-Khateeb SN [8], who reported similar findings in Jordanian population.

The chin was retrusive in both groups. In group 1 males showed more retrusion as compared to females, while in group 2 the distribution was similar. This is in contrast some previous studies [1, 10] which showed more prominent chin in Class II Div2 malocclusion as compared to Class II Div1 malocclusion.

Findings of facial angle and Y axis suggested similar mandibular positionin both groups. According to Al-Khateeb EA, Al-Khateeb SN [8], facial angle and Y axis shows more prognathic mandible in Class II Div 2 malocclusion as compared to Class II Div 1 malocclusion while the present study indicates similar mandibular position in Class II Div 1 and Div 2 malocclusion.

Vertical Variables

All vertical parameters (MM angle, FMA, Gonial angle) were increased in group 1, but were within normal range. The differences in two groups were not significant. Thus both groups almost had similar growth pattern with similar distribution between males and females. This is in contrast to many other studies that had shown (horizontal growth pattern in Class II Division 2 subjects. [1, 7, 11]

Facial height measurements showed increased anterior facial height in males of group1 subjects, while group 2 showed similar distribution. The difference between two groups was non-significant. Similar pattern was seen with posterior face height, where males of group 1 showed decreased values as compared to females, while group 2 had similar distribution. Inter group difference were non-significant. This is in contrast to studies by Al-Khateeb EA, Al-Khateeb SN [8], Renfroe [9] and Wallis [11] who had shown increased posterior face height and decreased anterior face height in class II div 2 subjects.

There was similar position of condyles in glenoid fossa in both groups as shown by saddle angle. Al-Khateeb EA, Al-Khateeb SN [8] have shown more obtuse saddle angle in class div 1 subjects.

Dental Variables

The dental inclinations of divisions of class II are typical, where upper incisors are proclined in div 1 subjects, while Div2 subjects exhibit retroclined upper incisors. In present study lower

incisors were proclined in div 1 subjects, while they were normally positioned in div 2 subjects. This is similar to study by **Al**-Khateeb EA, Al-Khateeb SN [8] but is in contrast to study by Henry RG [12] that had shown normal inclination of lower incisors in div 1 subjects. Increased lower incisor proclination in div 1 subjects can be attributed to dentoalveolar compensation in response to mandibular retrusion. [15]

The inter-incisal angle was significantly increased in div 2 subjects, which is agreement with most of the previous studies. [13, 14]

As with most of the cephalometric studies on dentoalveolar characteristics of different malocclusions, present study contradicts some of the previously reported values. This is mainly because of different ethnic backgrounds, age and size of the studied sample or due to the use of different reference lines.

Table 1: Distribution of the Groups under study:

GROUP 1	CLASS II DIVISION 1 MALOCCLUSION	MALES (subgroup 1)	50
	CLASS II DIVISION 1 MALOCCLUSION	FEMALES (subgroup 2)	50
GROUP 2	CLASS II DIVISION 2 MALOCCLUSION	MALES (subgroup 1)	50
	CLASS II DIVISION 2 MALOCCLUSION	FEMALES (subgroup 2)	50

Table 2: Comparison of mean and SD values of all parameters in Group 1 (Class II Division 1 malocclusion males and females)

Parameters	Males (n=50)	Females (n=50)	SEM	'Z' test value	'p' value	Significance
	Mean ± SD	Mean ± SD				
SNA	82.24±3.42	83.28±3.4	1.10	1.53	p>0.05	Not significant
SNB	76.6±3.05	78.0±3.48	1.92	2.15	p<0.05	Significant
ANB	5.88±1.31	5.48±1.67	1.23	1.33	p>0.05	Not significant
SNPOG	78.4±3.77	80.16±3.72	0.93	2.98	p<0.05	Significant
FACIAL ANGLE	83.88±3.56	85.52±2.78	0.78	2.65	p<0.05	Significant
FACIAL CONVEXITY	8.96±3.68	7.86±4.72	0.45	1.21	p>0.05	Not significant
Y-AXIS	60.88±2.56	60.08±3.47	1.54	0.92	p>0.05	Not significant
LAFH	65.72±5.0	62.56±4.66	0.82	3.27	p<0.05	Significant
PAFH	68.56±3.15	70.58±4.63	0.88	2.76	p<0.05	Significant
FM ANGLE	22.78±3.97	22.32±4.72	1.44	0.52	p>0.05	Not significant
GONIAL ANGLE	125.04±5.45	121.9±5.54	1.01	2.49	p<0.05	Significant
SN-MD ANGLE	28.44±3.22	26.78±4.95	1.21	2.78	p<0.05	Significant
MM ANGLE	22.76±4.70	21.24±4.79	0.87	1.99	p<0.05	Significant
SADDLE ANGLE	126.08±4.97	124.44±5.48	1.29	2.87	p<0.05	Significant
LI-MAND	104.2±5.36	105.24±6.8	1.11	1.32	p>0.05	Not significant
UI-SN	115.2±8.63	119.36±7.99	1.23	3.82	p<0.05	Significant
INTERINCISAL	112.52±10.98	107.84±9.72	1.43	3.69	p<0.05	Significant

Table 3: Comparison of mean and SD values of all parameters in Group 2 (Class II Division 2 malocclusion males and females)

Parameters	Males (n=50)	Females (n=50)	SEM	'Z' test value	'p' value	Significance
	Mean ± SD	Mean ± SD				
SNA	80.2±2.61	80.92±3.91	1.01	1.09	p>0.05	Not significant
SNB	75.76±2.89	76.24±3.98	1.32	1.34	p>0.05	Not significant

ANB	4.44±0.95	4.68±1.99	1.10	1.23	p>0.05	Not significant
SNPOG	78.04±3.17	78.4±4.49	0.92	1.87	p>0.05	Not significant
FACIAL ANGLE	83.84±4.53	85.08±3.40	0.97	1.55	p>0.05	Not significant
FACIAL CONVEXITY	6.08±3.35	7.2±5.54	1.98	1.67	p>0.05	Not significant
Y-AXIS	60.0±2.65	60.44±2.87	1.2	0.52	p>0.05	Not significant
LAFH	63.24±5.39	63.64±5.0	1.1	0.43	p>0.05	Not significant
PAFH	67.88±3.46	69.48±5.18	1.2	1.97	p>0.05	Not significant
FM ANGLE	23.80±4.32	21.88±4.49	1.1	1.72	p>0.05	Not significant
GONIAL ANGLE	124.24±6.07	119.96±5.2	0.98	3.78	p<0.05	Significant
SN-MD ANGLE	27.4±5.35	28.64±5.21	0.92	1.17	p>0.05	Not significant
MM ANGLE	20.79±4.64	21.72±4.69	0.91	1.56	p>0.05	Not significant
SADDLE ANGLE	125.48±6.39	126.96±6.64	1.2	1.34	p>0.05	Not significant
LI-MAND	93.04±5.14	97.4±9.79	0.99	2.79	p<0.05	Significant
UI-SN	92.28±10.22	92.28±10.22	1.23	0	p>0.05	Not significant
INTERINCISAL	139.56±13.85	139.6±13.85	0.97	0.1	p>0.05	Not significant

Table 4: Comparison of mean values of all parameters in Group 1 and Group 2:

Parameters	Group 1	Group 2	SEM	'Z' test value	'p' value	Significance
	Mean ± SD	Mean ± SD				
SNA	82.65±3.21	80.64±2.46	0.87	3.52	p<0.01	Highly significant
SNB	77.58±3.01	76.32±2.15	1.23	1.01	p>0.05	Not significant
ANB	5.65±1.52	4.54±1.03	1.09	2.14	p<0.01	Highly significant
SNPOG	79.02±3.21	78.14±3.14	1.45	1.39	p>0.05	Not significant
FACIAL ANGLE	84.53±3.02	84.88±3.45	1.02	0.91	p>0.05	Not significant
FACIAL CONVEXITY	8.23±3.35	6.87±3.09	1.01	3.32	p<0.01	Highly significant
Y-AXIS	60.01±2.76	60.12±2.14	1.2	0.62	p>0.05	Not significant
LAFH	64.65±4.57	63.44±4.73	1.47	1.23	p>0.05	Not significant
PAFH	69.63±4.56	68.74±4.32	1.56	0.96	p>0.05	Not significant
FM ANGLE	22.24±3.34	22.74±3.61	1.78	0.83	p>0.05	Not significant
GONIAL ANGLE	123.45±5.02	122.43±4.54	1.92	1.06	p>0.05	Not significant
SN-MD ANGLE	27.84±4.01	27.85±4.34	0.91	1.34	p>0.05	Not significant
MM ANGLE	21.86±3.92	21.18±3.67	0.99	0.89	p>0.05	Not significant
SADDLE ANGLE	125.64±3.84	126.39±6.03	0.95	1.02	p>0.05	Not significant
LI-MAND	104.76±5.31	95.73±4.59	0.98	4.33	p<0.01	Highly significant
UI-SN	118.76±7.03	92.28±9.99	1.65	5.32	p<0.01	Highly significant
INTERINCISAL	110.62±8.42	139.59±12.8	1.12	7.89	p<0.01	Highly significant

CONCLUSIONS

Morphological, skeletal and dental differences do exist between Class II Div1 and Class II Div2 malocclusions and both the malocclusions should be considered as a separate entity.

These differences could be a feature of different ethnic backgrounds which should be considered in formulating treatment plans to these populations.

The present study was conducted to compare the antero-posterior (saggital) and vertical position of Class II Div1 malocclusion and Class II Div2 malocclusion using lateral cephalograms and evaluate whether a correlation exists between the two divisions of Angle's Class II malocclusion. From the total of 200 lateral cephalograms, 100 cephalograms were of skeletal Class II Division 1 malocclusion and 100 cephalograms of skeletal

Class II Division 2 malocclusion. Each group was further sub-divided into 50 males and 50 females. Lateral cephalometric films were traced and statistically compared. The following results were apparent:

When Class II Division 1 Malocclusion was compared with Class II Division 2 Malocclusion, maxilla was retro-positioned in Class II Division 2 Malocclusion as compared to Class II Division 1 Malocclusion. Lower incisors were more proclined in Class II Division Div 1 Malocclusion as compared to Class II Division Div 2 Malocclusion. Upper incisors were more proclined in Class II Division Div 1malocclusion as compared to Class II Division Div 2 malocclusion. And increased interincisal angle was found in Class II Division 2 Malocclusion as compared to Class II Division 1 Malocclusion.

Thus, it was found that morphological, skeletal and dental difference do exist between Class II Div1 and Class II Div2 malocclusions and both the malocclusions should be considered as a separate entity.

A discussion of present findings should be prefaced by an emphasis on the fact that, mean values are involved. Although the statistical tools used were designed to account for the variation in the sample, only an examination of the individual cases can give a true picture of the extent of the variation seen within each class of malocclusion.

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