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ASSESSMENT OF SKELETAL AND DENTAL COMPONENTS OF CLASS II DIVISION 1 MALOCCLUSION IN GUJARATI POPULATION – A CEPHALOMETRIC STUDY

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Abstract

Background: The Class-II Division-1 (Cl-II Div-1) malocclusion is found with a vivid range of sagittal and vertical dento-skeletal components and the picture varies in each population. It is necessary for the orthodontist to locate the underlying morphology and decide the right treatment plan. Extensive research has been done to extract the underlying dento-skeletal picture of Cl-II Div-1 malocclusion in different populations but literature shows scarcity of such research in Gujarati population wherein Cl-II Div-1 malocclusion shows highest prevalence.

Aims: The aim of this study is to assess various skeletal and dento-alveolar components of Class II Div-1 malocclusion in sagittal and vertical planes in local Gujarati population using cephalometric radiographs.

Material and Methods: A sample of 184 participants of Gujarati origin was selected and their lateral cephalograms were traced and analysed for 18 dental and skeletal parameters and tabulated for statistics.

Results: Mandibular retrognathism (87.5%) and horizontal growth pattern (64.13%) were found to be the major skeletal components comprising Cl-II Div-1 malocclusion in Gujarati population. Maxillary dental protrusion (89.13%) and maxillary incisor extrusion (72.28%) were found to be the major dental components.

Conclusions: Cl-II Div-1 malocclusion comprises of varied dento-skeletal components. Maxillary retrusion, maxillary dental protrusion, mandibular retrusion and mandibular dental retrusion with horizontal growth pattern was found to be the most frequent dento-skeletal combination (23.37%) underlying the Cl-II Div-1 malocclusion in Gujarati population.

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INTRODUCTION

According to Angle's system, there are three major classes to identify a malocclusion, namely Class-I, Class-II Div-1/Div-2 and Class-III. [1] The Angle's system focuses only on dental malocclusion. The underlying dento-skeletal morphology is not embraced while defining these classes. Out of three major classes, Cl-II Div-1 malocclusion is the most commonly found malocclusion (47.6%) in Gujarati population. [2]

The Cl-II Div-1 malocclusion is found with a range of sagittal and vertical components.[3, 4] The clinical picture of Cl-II Div-1 malocclusion can have vivid underlying dento-skeletal morphology for example it can be due to maxillary prognathism, mandibular retrognathism or combination of both. Or it can be so that the skeletal jaw relation is normal but it is the proclination/ mesial movement of maxillary dentition as the underlying responsible factor. Any of these sagittal jaw/ dental relationship can be found with either, horizontal, vertical or average growth pattern. Thus, the underlying picture can be vivid and varied with many different combinations. This makes it necessary for the orthodontist to extract and locate the underlying problem so as to target the treatment in the right direction for successful and faster results. Knowing the underlying dento-skeletal morphology helps to decide a definite treatment plan to either work on the maxilla/ mandible or both the jaws for growth modification or surgical approach or to focus only on the dentition. The dento-skeletal morphology of Cl-II Div-1 malocclusion has

been extensively investigated in many different population groups like Caucasians, Swedish and Jordanians [5-7]. Some studies have found maxilla to be prognathic, and mandible to be normal in size and position. Other studies found maxilla to be normal and mandible to be retrognathic in size and position [8-10]. Whereas, some authors also found the class II skeletal pattern in Cl- II Div-1 patients to be due to both maxillary prognathism and mandibular retrognathism [11,12]. Such similar studies are lacking in the Gujarati population.

Thus, this study was aimed at assessing the underlying dento-skeletal component of Cl-II Div-1 malocclusion in local Gujarati population using Lateral Cephalogram.

MATERIALS AND METHODS

The lateral cephalogram of subjects in the age group of 20-30 years were selected from the patient pool of the department of Orthodontics, KM Shah Dental College, Sumandeep Vidyapeeth, as per the inclusion and exclusion criteria as mentioned below. A brief history was taken to confirm the Gujarati origin of the patient for two generations.

Inclusion and Exclusion criteria: Both the parents of the participants should be Gujarati without any inter-racial marriage for at least two generations. Presence of Class-II molar relationships with proclined upper anteriors as determined clinically or in the dental cast. Participants should have full complement of permanent teeth except third molars. And there should not be previous history of orthodontic treatment. Participants with crowns or bridges or with any syndrome or anomalies were excluded from the study.

After taking history for Gujarati origin and considering all the inclusion and exclusion criteria, 184 lateral cephalograms were selected. The study was started after obtaining Ethical approval from the Ethical committee of Sumandeep University. Each film was manually traced on acetate paper (0.003 inch thick) using lead pencil 0.5mm by the Principal investigator. Seventeen cephalometric landmarks were located (Fig-1). Eighteen parameters (Fig-2) were measured and tabulated elucidating the underlying dento-skeletal morphology. Out of these, 35 randomly selected lateral cephalograms were traced again after an interval of one week by the same investigator to eliminate the intra observer error. After collection of all the data it was subjected to statistical analysis to get the results and conclude the study.

RESULTS

Table 1 and 2 shows the mean age and gender distribution of the sample. Table-3 depicts the values of Intra-class correlation coefficient found to be more than 0.900 for all the parameters showing high correlation between two observations. Thus, the data collected was reliable. As it can be seen in Table-7, the highest percentage (23.37%) of skeletal and dental combination found in the sample is that of maxillary retrusion, maxillary dental protrusion, mandibular retrusion, and mandibular dental protrusion with horizontal growth pattern. Thus this combination can be conferred as the most commonly found dento-skeletal pattern of Cl-II Div-1 maloccusion in Gujarati population.

DISCUSSION

Each malocclusion can have a varied underlying dento-skeletal pattern and that pattern can also show varied racial differences. It has been found that out of all the three Angle's malocclusions namely Class-I, Class-II Div-1/Div-2 and Class-III, Class-II Div-1 malocclusion is the most commonly found (47.6%) malocclusion in the Gujarati population.[2] The dento-skeletal morphology of Class II Div-1 malocclusion has been extensively investigated since years in different population groups like Caucasians, Swedish and Jordanians. Each population showed a distinct dento-skeletal pattern. [3- 5]

There is no data found in the literature where the components of Class II div-1 malocclusion for Gujarati population have been studied. Thus, in this study, it was intended to investigate the underlying skeletal and dento-alveolar features of Class II Div-1 malocclusion in both, sagittal and vertical plane in a sample of 184 subjects from local Gujarati population.

The analysis of various components of 184 individuals in this study confirms that Cl-II Div-1 malocclusion is not a single entity.The results of this study indicate that mandibular retrognathism (87.5%) is the most commonly occurring skeletal component contributing to Class II Div-1 malocclusion (Table-5). Similar results were found in the studies of Renfore, Gilmore, James McNamara Jr, and Rosenblum. [8,14-16] It is not surprising that the retrognathic mandible is the most commonly found component if viewed according to its developmental character. The growth of mandible is the last event in the entire craniofacial region. It shows its spurt coinciding with the general body spurt. In addition, the cartilage of the mandibular condyle is secondary in origin (Moffett,

Symons, Durkin et al) and biochemically has been shown to be distinct from other growth cartilage of the craniofacial region (Brigham et al). [17-20] This makes it more vulnerable to the environmental influences like habits, malnourishment and diseases, that can retard its growth.

TABLE-1: Showing Mean Age of the Overall Sample

	N	Minimum	Maximum	Mean	S.D
Age(Yrs)	184	20.00	30.00	22.42	2.61

TABLE-2: Showing Gender Distribution of the Sample

Gender	Frequency (N)	Percentage (%)
Female	114	62.0
Male	70	38.0
Total	184	100.0

TABLE-3: Showing Reliability Test (Intra-Class Correlation)

Sr. No.	Variables	ICC
1.	ANB	1.000
2.	SNA	0.999
3.	N on FH to Pt.-A	1.000

4.	Co – Point A	0.999
5.	U1- NA (º)	0.999
6.	U1- NA (mm)	0.999
7.	U1 - Sn	1.000
8.	SNB	0.999
9.	N on FH to Pog	1.000
10.	Co-GN	1.000
11.	L1-NB (º)	0.998
12.	L1-NB (mm)	0.999
13.	L1- MP	1.000
14.	Jarabak Ratio	1.000
15.	Y- Axis	0.998
16.	Facial axis	1.000
17.	U1 to NF	0.999
18.	L1 to MP	0.999

TABLE-4: Showing The Descriptive Statistics of All Cephalometric Parameters In The Overall Sample

Sr. No.	Parameters	N	Minimum	Maximum	Mean	Std. Deviation	95% Confidence Interval	
							Lower Bound	Upper Bound
1.	ANB	184	1.00	10.00	5.65	2.32	5.31	5.98
2.	SNA	184	73.00	92.00	81.67	3.76	81.13	82.22
3.	N on FH to Pt - A	184	.00	6.00	2.75	1.47	2.54	2.96
4.	Co- point A	184	76.00	101.00	90.02	6.09	89.14	90.91
5.	U1- NA (º)	184	0	86	31.25	11.59	29.57	32.93
6.	U1- NA (mm)	184	1	13	7.97	2.90	7.55	8.39
7.	U1-SN	184	85.00	140.00	112.20	9.95	110.75	113.65
8.	SNB	184	65.00	90.00	76.27	4.13	75.67	76.87
9.	N on FH to Pog	184	-13.00	-1.00	-6.73	2.74	-7.13	-6.34
10.	Co-GN	184	75.00	122.00	109.01	8.02	107.84	110.17
11.	L1-NB (º)	184	9	42	29.04	7.24	28.00	30.09
12.	L1-NB (mm)	184	1	14	6.57	2.69	6.18	6.97
13.	L1-MP	184	77.00	120.00	100.39	8.99	99.08	101.70
14.	Jarabak Ratio	184	52.07	86.17	66.43	5.98	65.56	67.30
15.	Y-Axis	184	51.00	75.00	59.73	3.60	59.21	60.25
16.	Facial Axis	184	-14.00	10.00	-0.03	5.21	-0.79	0.73

17.	U1to NF	184	21.00	36.00	29.15	3.82	28.60	29.71
18.	L1 to MP	184	31.00	48.00	41.23	4.75	40.54	41.92

TABLE-5: Percentage findings of dento-skeletal components of Cl-II Div-1 malocclusion

Sr. No.	Dento-skeletal components	Total (N)	Frequency (%)
1.	Mandibular retrognathism	184	161(87.5%)
2.	Maxillary retrognathism	184	104 (56.52%)
3.	Maxillary prognathism	184	56(30.43%)
4.	Maxillary prognathism and mandibular retrognathism	184	37(20.10%)
5.	Horizontal growth pattern	184	118(64.13%)
6.	Average growth pattern	184	33(17.93%)
7.	Vertical growth pattern	184	33(17.93%)
8.	Upper incisor protrusion	184	164(89.13%)
9.	Lower incisor protrusion	184	127(69.02%)
10.	Upper incisor extrusion	184	133 (72.28%)
11.	Lower incisor extrusion	184	113 (61.41%)
12.	Upper and lower incisor extrusion	184	101(54.89%)

TABLE-6: Showing Five Variables Used In Combination Table

Sr. No.	Variable	Retrusive	Neutral	Protrusive
1.	Maxillary Skeletal (SNA) (º)	< 82º	82º	>82º
2.	Maxillary Dental (U1-NA) (º)	< 22º	22º	>22º
3.	Mandibular Skeletal (SNB) (º)	< 80º	80º	>80º
4.	Mandibular Dental (L1- NB) (º)	< 25º	25º	>25º
5.	Vertical Devolopment (Jarabak Ratio) (%)	< 62%	62-65%	>65%

TABLE-7: The Most Frequently Occurring Combination of Variables

Group	N	Percentage	Maxillary skeletal	Maxillary dental	Mandibular skeletal	Mandibular dental	Vertical development
1	43	23.37	Retrognathic	Protrusive	Retrognathic	Protrusive	Horizontal
2	18	9.78	Retrusive	Protrusive	Retrusive	Protrusive	Average
3	14	7.61	Protrusive	Retrusive	Retrusive	Protrusive	Horizontal
4	14	7.61	Retrusive	Protrusive	Retrusive	Protrusive	Vertical
5	13	7.07	Retrusive	Protrusive	Retrusive	Retrusive	Horizontal

6	9	4.89	Retrusive	Retrusive	Retrusive	Protrusive	Vertical
7	7	3.80	Protrusive	Protrusive	Protrusive	Protrusive	Horizontal
8	7	3.80	Neutral	Protrusive	Retrusive	Protrusive	Horizontal

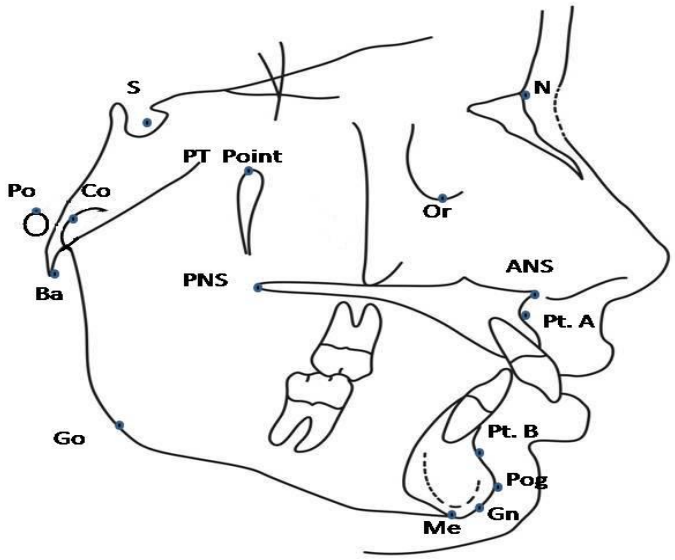

Figure 1: Cephalometric landmarks

Cephalometric landmarks: Sella (S), Nasion (N), PointA, PointB, Anterior nasal spine (ANS), Posterior nasal spine (PNS), Pogonion (Pog), Gnathion (Gn), Menton (Me), Gonion (Go),Condylon (Co), Basion (Ba), Porion (Po), Ptergomaxillary fissure (PTM), Orbitale (Or),Upper incisor crown tip (UICT), and Lower incisor crown tip (LICT).

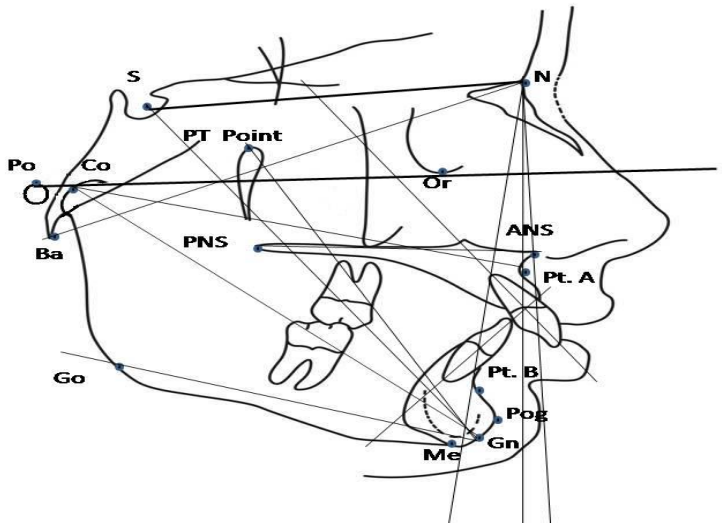

Figure 2: Cephalometric parameters

Cephalometric parameters: ANB(˚), SNA(˚),Pt.-A to N †FH (mm), Co-Pt.A(mm), U1-SN(˚), SNB(˚),Pog to N FH (mm), Co-Gn(mm), L1-NB (˚) (mm), L1-MP(˚), Jarabak Ratio(%), Y-axis(˚), Facial axis(˚), U1 to NF(mm), L1 to MP(mm)

The second most common feature found in Cl-II Div-1 malocclusion in our study (Table-5) is maxillary retrognathism (56.52%). Similar findings were noted in the studies by James McNamara Jr who also found maxillary retrusion in his sample. [8] This is in contrast to the findings of Rosenblum (56.3%) and Al-Khateeb who found maxillary prognathism to be second most common feature in their sample. [7,16] In contrast, in our study, only 30.43% subjects showed maxillary prognathism which is actually thought to be a prominent component in creating Cl-II Div-1 malocclusion.

The combination skeletal component of maxillary prognathism and mandibular retrognathism in this sample was found to be 20.10% (Table-5) as the fourth most common feature contributing to Cl-II Div-1 malocclusion. This finding coincides with the findings of Rosenblum. [16]

The protrusion of maxillary anterior teeth was found to be in 89.13% of subjects (Table-5). This parameter is critically important in creating the picture of Cl-II Div-1 malocclusion. Proclination of upper anterior teeth was also found in the studies of Drelich, Riedel, Rothstein and Al-Khateeb but was not

found to be a contributing factor in the findings of James McNamara Jr. [7,8,21-23]

In the present study, out of total 184 sample, 127 subjects showed proclination of lower anteriors i.e. 69.02% (Table-5), which is a natural compensation for a retrognathic mandible. This finding coincides with the findings of Al- Khateeb. [7]

Cl-II Div-1 malocclusions are always looked upon as having a prognathic maxilla and retrognathic mandible. But the findings of our study reveal a more protrusive maxillary anteriors than prognathic maxillary base as the underlying component creating the picture of this malocclusion. This reduces the severity of the problem from being more dento-alveolar than skeletal, thus, improving the prognosis of the treatment results.

Analyzing the vertical component of Cl-II Div-1 malocclusion, out of 184 subjects, 64.13% subjects were horizontal growers, 17.93% were average growers and similar percentages were vertical growers (Table-5). Thus, the result suggests that most of the subjects with Class II div-1 malocclusion are horizontal growers in Gujarati population which is not in agreement with the study of McNamara Jr in which excessive vertical development was a frequent characteristic in Class II Div-1 malocclusion of his sample.[8]

Analyzing the vertical component of the sample, it was found that the maxillary anterior teeth showed 72.28% of extrusion whereas the mandibular anterior teeth showed 54.34% of extrusion in relation to their respective basal planes (Table-5).

Till now, we considered individual components figuring in Cl-II Div-1 malocclusion. To determine the frequency of occurrence of various combinations of skeletal and dental components underlying the malocclusion, five variables were selected as it can be seen in Table-6. Four sagittal and one vertical component was selected and based upon their normal values, the variable was categorized into retrusive, protrusive and neutral for sagittal dimension whereas horizontal, vertical and average growers for vertical dimension.

The seven most frequently occurring dentoskeletal combinations constituting Cl-II Div-1 malocclusion were statistically calculated and are shown in Table-7. The highest occurring combination (23.37%) found was the one with maxillary retrognathism, maxillary dental protrusion, mandibular retrognathism and mandibular dental protrusion with Horizontal growth pattern. Similar combinations were evaluated in the study by McNamara Jr who found the

highest occurring combination (10%) to be the one with neutral maxilla and maxillary dentition, retrognathic mandible and neutral mandibular dentition with vertical growth pattern in his sample of American children. [8] This confirms the racial differences in the underlying components of Cl-II Div-1 malocclusion proving it to be a vivid entity with varied and multiple dento-skeletal combinations.

CONCLUSION

CL-II Div-1 malocclusion comprises of varied dento-skeletal components. Mandibular retrognathism is the most commonly found skeletal entity (87.5%) underlying the Cl-II Div-1 malocclusion in local Gujarati population. Maxillary retrognathism is the second most commonly found skeletal entity (56.52%). Majority of the sample (64.13%) exhibited Horizontal growth pattern. Maxillary dental protrusion was found to be (89.13%) contributing highest to the increased overjet found in Cl-II Div-1 malocclusion. The increased overjet in Cl-II Div-1 malocclusion in local Gujarati population is not because of maxillary prognathism but due to maxillary dental protrusion, thus improving the prognosis of the results. Upper incisors show higher extrusion (72.28%) than the lower incisors. The most frequently occurring dento-skeletal combination comprising Cl-II Div-1 malocclusion in local Gujarati population is maxillary retrusion, maxillary dental protrusion, mandibular retrusion, mandibular dental protrusion with horizontal growth pattern.

CONFLICTS OF INTEREST- None

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