A Cephalometric Evaluation of Anterior Deep Bite in Class II Malocclusions

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Abstracts: **Background & objectives:** Vertical malocclusions of the incisor teeth namely, anterior openbite and deep overbite present a challenge to the orthodontic clinicians. Determining the etiology of these is utmost important for further treatment planning and prognosis. Present study was carried out to understand the dentofacial skeletal pattern of the deep overbite in two types of deformities, Angle's Class II Div.l & Class II Div.2 (study group) and comparing them with normal occlusion (control group). **Methods:** Lateral cephalogram of total 60 pts, 20 in each of the above mentioned groups were analysed using 19 linear and 8 angular parameters and results of each group were compared with other two groups and conclusions were drawn. **Result and conclusion:** Larger posterior facial height, lower anterior facial height, lower gonial angle, larger Jaraback's ratio & reduced lower molar height together contribute to horizontal growth pattern. It was concluded that there is more horizontal growth pattern in class II div. 2 cases hence the deepbite is more severe in class II div.2 cases compared to div.1 cases. [Patel R NJIRM 2014; 5(4) :56-60]

Key Words: cephalometrics, Dento-alveolar overbite, skeletal deep bite

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Introduction: The knowledge of size, forms, and patterns of craniofacial skeleton is of paramount importance in diagnosis and treatment planning of a malocclusion as well as for the stability of the obtained results. The two extremes of vertical relationships of the incisor teeth, namely anterior openbite and deep overbite present a challenge to the Orthodontic clinician and investigators. According to T.M. Graber the term "overbite" applies to the distance by which the maxillary incisal margin closes vertically past the mandibular in occlusion. Deep overbites can be divided into those that are dentoalveolar in origin and those that are predominantly skeletal due to the growth patterns of the jaws. The treatment and prognosis of both the type of deep overbite are different. Hence it is very important to study the type of deep bite in any given case. Since deep bite is very commonly found amongst class II cases, this study is an attempt to understand the dentofacial skeletal pattern of the deep overbite in two types of deformities (Angle's Class II div.2 and Angle's Class II div.1)[1,2,3,4].

Material And Method: The sample size for the study consisted of total 60 subjects divided into 3 groups of 20 each, according to different occlusal categories: Group A- Normal occlusion (Control group),Group B- Class II div.1 malocclusion & Group C-Class II div.2 malocclusion (study group). All subjects were attending the Orthodontic clinic of Govt. Dental College & Hospital, Ahmedabad. Selection criteria were as follow:

1) No history of any kind of orthodontic intervention.
2) No history of any accidental injury to face.
3) All permanent teeth up to second permanent molar were present.
4) The age ranged between 13 to I5 yrs.
5) The male female ratio was 1:1.
6) In all the subjects, the molar relations were same on both the sides of arches i.e. no subdivision was present.
7) In all class-2 cases, the lower incisors were almost fully covered by upper incisors clinically.
8) All the subjects were free -from proximal carious lesions and proximal restorations.
9) No overretained deciduous teeth or supernumerary tooth were present.

After the sample selection, lateral cephalometric radiographs of all the 60 subjects were taken using standardized radiographic technique. These were manually traced using 8 angular and 19 linear parameters, twice, to reduce error and findings recorded. The linear and angular parameters measured were as follows[5,6]:

Linear Parameters:

1. S -N (SELLA - NASION): Anteroposterior extent of anterior cranial base formed by line connecting points Sella and Nasion.

2. N-Me: Line connecting the points Nasion and Menton representing the anterior face height.
3. S-Ar: Line connecting points Sella and Articulare, representing posterior extent of cranial base.
4. ANS – Me (LOWER ANTERIOR FACE HEIGHT): Line connecting points Anterior Nasal Spine and Menton, representing the lower anterior facial height.
5. Ar-Go: Line connecting points Articulare and Gonion representing length of the ramus.
6. Go-Me: Line connecting points Menton and Gonion, representing the extent of mandibular base.
7. PALATAL PLANE: Line connecting Anterior Nasal Spine and Posterior Nasal Spine representing palatal plane.
8. OCCLUSAL PLANE: A line connecting the midpoint in the incisor overbite in occlusion and the most distal point of contact between the most posterior molars in occlusion.
9. MANDIBULAR PLANE: A line which is tangential to the lower border of mandible.
10. AFH: Anterior face height, linear distance between point Nasion to point Menton.
11. PFH: Posterior face height, linear distance between point Sella to point Gonion.
12. LFH: Lower face height, linear distance between point Anterior Nasal Spine to point Menton.
13. Cd-Me: Effective mandibular length measured from point Condylion to point Menton.
14. UIH: Upper incisor height-linear perpendicular distance from maxillary central incisor tip to palatal plane.
15. LIM: Lower incisor height-linear distance from the mandibular central incisor tip to the mandibular plane, measured perpendicular to the mandibular plane.
16. UMH: Upper molar height-linear distance between tip of the mesiobuccal cusp of the maxillary first molar and the palatal plane measured perpendicular to the occlusal plane.
17. LMH: Lower molar height-linear distance between the tip of the mesiobuccal cusp of the mandibular first molar and the mandibular plane measured perpendicular to the mandibular plane.
18. UM-AP: Horizontal linear distance of mesiobuccal cusp tip of upper first molar from sella along SN plane.
19. LM-AP: Perpendicular distance from tip of mesiobuccal cusp of lower first permanent molar to a line drawn perpendicular to GoGn plane and tangent to the lingual border of symphysis.

Angular Parameters:

1. N-S-Ar: Saddle angle between the anterior (N-S) and posterior (N-S) and posterior (S-Ar) cranial base.
2. S-Ar-Go: Articulare angle formed between the S-Ar line and the Ar-Go line.
3. Ar-Go-Me: Gonial angle formed between the ramus and the body of mandible base.
4. Go_1 (N-Ar-Go): Upper gonial angle formed by the ascending ramus and the line joining nasion-gonion.
5. Go_2 (N-Go-Me): Lower gonial angle, formed by the body of mandible and the line joining nasion-gonion.
6. GoGn-SN: Angle between GoGn Plane and the SN Line.
7. Pal-SN: Angle between the palatal plane and the SN line.
8. Jaraback's ratio: PFH/AFH RATIO.

Results And Discussion: Treating vertical malocclusion is always a challenge for the orthodontist.[21] According to Graber & Petrovick deep overbite may be caused by the following factors:

1. Skeletal deepbite with a horizontal growth pattern.
2. A lateral tongue thrust or postural position, - frequently can produce an acquired deep overbite. This type of dysfunction produces an infraocclusion of the posterior teeth which in turn leads to a deep overbite.
3. Premature loss of deciduous molars or early loss of permanent posterior teeth can cause an acquired secondary deep overbite, particularly if the contiguous teeth are tipped into the extraction sites. The wearing away of the occlusal surface or tooth abrasion can produce an acquired secondary deep overbite.

Since deep bite is very commonly found amongst class II cases, an attempt to understand the dentofacial skeletal pattern of the deep overbite of the two types of deformities (Angle's Class II div.2

and Angle's Class II div.1) was made. The sample size for the study consisted of total 60 subjects divided into 3 groups of 20 each, according to different Occlusal categories: Group A- Normal occlusion (Control group),Group B- Class II div.1 malocclusion & Group C-Class II malocclusion div.2 (study group). The dentofacial skeletal pattern was compared using 19 linear and 8 angular parameters and the analysed results of each group were compared with other two groups and conclusions were drawn:

Table 1: Showing Mean and S.D of Angular Skeletal Parameters In Various Study Group

SR. NO.	Angular skeletal parameters	NORMAL (A)		CL.II DIV.1 (B)		CL.II DIV.2 (C)	
		MEAN (N=20)	S.D.	MEAN (N=20)	S.D.	MEAN (N=20)	S.D.
1	< N-S-Ar	129.05	4.382	132.15	3.28	128.15	3.759
2	< S – Ar – Go	138.05	6.605	137.04	4.84	141.00	4.823
3	< Ar–Go-Me	120.09	6.077	125.015	4.81	115.45	5.529
4	< Go1	052.45	4.751	055.01	3.51	51.70	4.461
5	< Go2	068.55	4.442	070.04	3.101	63.85	3.391
6	< GoGn-SN	030.02	2.705	031.05	2.910	23.50	3.389
7	< PaL-SN	010.03	2.536	009.04	2.60	8.05	1.820
8	< PAL-GoG	019.09	4.426	022.01	4.689	15.45	3.074
9	< SNA	081.05	2.125	079.33	2.52	83.05	2.154
10	< SNB	079.15	2.907	071.91	2.198	76.25	2.679
11	< ANB	002.04	3.235	007.42	3.861	07.00	3.867
12	< SND	076.08	3.620	069.05	3.772	73.87	3.969

Table 2: Showing Mean and S.D of Linear Skeletal And Dental Parameters

SR. NO.		NORMAL(A)		CL.II DIV.1(B)		CL.II DIV.2(C)	
		MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
1	AFH	117.0	5.82	112.0	5.56	111.4	5.59
2	LAFH	62.05	3.62	58.08	4.64	57.0	3.39
3	PFH	80.07	5.87	72.04	4.39	83.7	6.74
4	JARABAK RATIO	69.45	5.53	45.04	3.51	75.55	3.94
5	Cd-Me	114.35	5.353	103.75	6.504	109.35	4.625
6	NS	71.75	2.048	70.65	2.433	71.4	3.507
7	SAr	36.04	3.076	34.08	2.607	39.75	3.931
8	Ar-Go	49.05	5.784	41.06	3.858	49.2	4.774
9	Go-Me	73.04	2.234	67.75	4.024	72.55	3.051
10	Ui - Ht	24.03	3.972	26.1	1.552	27.5	2.212
11	Li - Ht	43.07	3.645	43.75	3.921	40.65	2.286
12	Um - Ht	22.05	2.874	20.5	1.866	19.7	1.335
13	Lm - Ht	33.25	2.899	34.15	3.790	30.95	3.587
14	Um - AP	34.04	5.154	29.9	1.682	32.7	4.053
15	Lm - AP	15.65	2.277	17.55	1.986	17.8	2.858

The saddle angle (N-S-Ar) was significantly greater in Class II Div.l cases as compared to Class II Div.2 and normal case. Similarly the articular angle was greater for the Class Div.2 cases compared to Class II Div.l and normal cases. Hence this shows that the condyle was posteriorly positioned in Class II Div.2 cases as compared to Class II Div.1 cases. This is in co-relation to the findings of HELMANN7 that in Class II Div.2 the mandible is narrower, greater in height and more anterior.

The total anterior face height (AFH) is smaller in cases of Class II than normal & it is smaller in class II Div.2 than in Class II Div.l cases. The posterior facial height is significantly greater in Class II Div.2 cases as compared to Class II Div 1 and normal cases leading to increase

In the Jarabak's ratio in Class II Div.2 cases than Class II Div.l cases and the normal groups. Increases in posterior facial height and Jarabak's ratio suggest that there is more horizontal growth pattern in Class II Div.2 than in Class-II Div.l and

Table 3: Showing Comparison of Linear Skeletal Measurements between various groups by unpaired't' test control group.

SR. NO.		GROUP A & B N1 + N2 = 40		GROUP A & C N1 + N2 = 40		GROUP B & C N1 + N2 = 40	
		"t" VALUE	SIGNI FICANCE	"t" VALUE	SIGNI FICANCE	"t" VALUE	SIG NI FICA NCE
1	AFH	3.109	**	2.564	-0.570	-0.570	NS
2	LAFH	2.811	**	5.406	1.789	1.789	NS
3	PFH	5.059	**	-1.500	-6.281	-6.281	**
4	JARABAKS RATIO	2.733	**	-4.281	-8.900	-8.900	**
5	Cd-Me	5.627	**	3.160	-3.138	-.138	**
6	NS	1.546	NS	0.165	-1.309	-1.309	NS
7	SAr	1.220	NS	-3.499	-4.693	-4.693	**
8	Ar-Go	5.092	**	0.189	-5.537	-5.537	**
9	Go-Me	4.894	**	0.854	-4.250	-4.250	**

These findings are in co-relation with the findings of HELMANN[7], HEDGES[8] and RENFROE[9].

The lower anterior face height LFH in Class II Div.l and Div.2 cases is smaller than normal. Also it is smaller in Class II Div.2 than in class 11 Div.l cases. This is in correlation with the study of HEDGES[8]. Who says that the lower anterior face height is decreased considerably in class II div2 cases. Thus the decrease in the total anterior face height may be due to decrease in lower -face height.

The lower gonial angle (Go2) is significantly smaller in class II div. 2 cases as compared to class II div.l cases suggesting that there is horizontal growth pattern in class II div. 2 cases. There was no significant difference between upper gonial angle

of Jarabak. These findings co-relate well with BLAIR[12], RENFROE[11], HEDGES[10] & HELLMAN[7,8,9] indicating that the more acute gonial angle in class II div. 2 is due to lack of lower anterior facial height. The GoGn-SN angle is smaller in Class div.2 Cases as compared to Class II div.l cases. There was no significant difference between the GoGn-SN angles of Class II Div.l and normal samples. This angle gives the inclination of the mandible to the anterior cranial base. The mean value for the normal group is 32^{o}. The value of this group in Class II Div.2 cases is 23.5^{0} which suggest that the inclination of the mandible is anterior to the cranial base in Class II Div.2 cases, which adds to the decrease in lower facial height and so deepbite in such cases.

The Pal-SN angle is smaller in Class II div 2 cases than Class II div.1. But there is no significant difference between Class II div.1 cases and normal. The angle Pal-GoGn is smaller in Class II div.2 and is larger in Class II div.I cases than normal. This suggests that the GoGn-SN angle which is smaller in Class-II div.2 cases is due to the anterior inclination of mandible to the cranial base even though the Palatal plane being tipped up anteriorly tries to compensate it. Where as in ClassII div.1 cases the GoGn-SN angle is near normal and Pal-SoGn angle is larger with smaller Pal-SN angle. This suggests that there is ante-inclination of the maxillary base compared to the mandible in Class II div.1 cases.

The effective mandibular length (Cd-Me) is smaller in Class II cases than the normal samples. It is still smaller in Class II Div**.** 1 cases as compared to Class II Div.2 cases. This is in co-relation to the studies of HELLMAN[9], DRELICH, ELSASSER & WYLIE[13], GILMORE[14], MITCHELL[22]. They had concluded that the mandibular length was shorter in Class II Div.1 cases and was posteriorly positioned as compared to the normal to the normal groups.

The length of the anterior cranial base (N-S) has no significant difference between the three groups. The ramus height (Ar-Go) is smaller in Class II Div.1 than in Class II Div.2 and normal cases. This finding is in co-relation to the studies of MITCHELL[15] and HELLMAN[9] who found the mandibular body length, the overall mandibular length and height of the ramus to be significantly smaller in Class 11 Div.l cases. The S-Ar posterior cranial base) length is greater in Class II Div. 2 than Class II Div 1 and normal. The Go-Me (length of body of mandible) is smaller in Class II Div.1 than Div.2 and normal cases. These findings also co-relate with the findings of HELMANN[9] AND MITCHELL[15].

Table 4: Showing Comparison of Linear Dental Measurments Between Various Groups By Unpaired 'T' Test

SR. NO.		GROUP A &		GROUP A & C		GROUP B & C	
		"t" VALUE	SIGNIF ICANCE	"t" VALUE	SIGNIF ICANCE	"t" VALUE	SIGNIF ICANCE
1	Ui - Ht	-0.209	NS	-1.573	NS	-2.317	*
2	Li - Ht	-2.547	*	-3.222	**	-0.492	NS
3	Um - Ht	3.067	**	2.469	*	-1.169	NS
4	Lm - Ht	0.284	NS	-0.872	NS	-1.028	NS
5	Um - AP	3.711	**	1.159	NS	-2.853	**
6	Lm - AP	-2.516	*	-2.386	**	-0.321	NS

The upper incisor height has no significant difference between the three groups. The lower incisor height is greater in Class II groups than normal but there is no significant difference between the ClassII Div.1 than and Class II Div.2 samples. The upper molar height is smaller in Class II cases than the normal ones and the lower molar height is smaller in Class II Div.2 cases as compared to Class II Div.1 cases. This increase in the height of the lower incisors and decrease in height of the upper and lower molars also contribute to the formation of deep bite in the Class II div.2 cases. These findings are in co-relation with findings of SCHWARZ (1961) who states that deepbite is the result of disturbance in the height proportions of incisors and molars. Also JACKSON[16], HOWES, ROGERS, PREM PRAKASH & MARGOLIS[17] and STRANG[18] were of opinion that the deepbite results in supraocclusion of incisors and infraocclusion of molars. Also, SASSOUNI and NANDA[19] state that the vertical chain of the muscles (internal pterygoid, massseter, temporalis) is perpendicular and more anteriorly situated, thus exerting the major force against the molars and keeping them depressed, causing deep bite in Class II Div.2 cases.
The antero-posterior position of the upper first permanant molar is posterior in Class II Div.l, than in Class II Div.2 and normal cases where as the antero-posterior distance of the lower permanant first molar from the symphysis is greater in class II cases than the normal group. This means that the maxillary -first permanant molar is posteriorly placed in Class II Div.l cases where as there is no

significant difference in the position of upper first permanent molar in Class-II div.2 and normal cases. This is in contrast to study by GILMORE[20] which showed that statistically the maxillary first permanent molar is further forward on maxilla in Class-II cases.

On the basis of the analyzed data, it must be clear that a single morphologic feature does not necessarily produce deep bite in Class-II div.l and Class-II div.2 cases, since a structural imbalance in any one area also effects the nature of balance in the other areas. Consequently, a number of separate but interrelated regions tend to augment each other in a cumulative composite manner. In class II malocclusion there exists an imbalance of the intrinsic compensating factors which are present in normal occlusion.

Conclusions: The study of dentoskeletal facial pattern of deep overbite in cases of class II div.1 and 2 malocclusions revealed that- Larger posterior facial height, lower anterior facial height, lower gonial angle, larger Jarabak's ratio, reduced lower molar height together contribute to horizontal growth pattern which is more in class II div. 2 cases hence the deepbite is more severe in class II div.2 cases compared to div.1 cases.

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