Cephalometric Evaluation Of Condylar Head Characteristics In Skeletal Open Bite And Deep Bite Cases.

Abhilasha Goyal[*], R H Kamble[**], Sunita Shrivastav[***], Eshan Awasthi [****]

[*] Sr.Consultant, Walk in International Medical and Dental Centre, New Delhi

[**]Prof & Head, Department of Orthodontics, Sharad Pawar Dental College ,Wardha.

[***] Professor, Department of Orthodontics, Sharad Pawar Dental College ,Wardha.

[****] Sr.Consultant , Awasthi Multispeciality Dental Care, Raigarh.

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***Abstract*- Objective** : To evaluate condylar head characteristics in skeletal open bite and deep bite cases. **Material and Method**: The sample consisted of 60 lateral cephalograms of post pubertal patients who were divided on the basis of cephalometric analysis into three groups : skeletal open bite, skeletal deep bite and normal growth pattern. The selected lateral cephalograms were assessed for condylar head inclination, condylar head height and condylar head width for all the three groups. ANOVA, Least significance difference test were done. **Results**: The skeletal deep bite group showed more anteriorly angulated condyles as compared to skeletal open bite and normal growth pattern groups. The condylar head width was smallest in skeletal open bite group and largest in skeletal deep bite group. No significant difference was found in condylar head height in all the three groups assessed. **Conclusion:** There exists a variation in the condylar morphology in the various skeletal malocclusions examined. The individuals with Skeletal deep bite had a tendency towards having more anteriorly angulated condyles. Also the width of condylar head of individuals with skeletal open bite is smaller than skeletal deep bite cases.

I. Introduction

Orthodontists have been particularly interested in facial growth and development because of the dental and skeletal abnormalities that may result facial growth which proceeds along a vector composed of amounts of horizontal and vertical growth. Although the whole dentofacial complex contributes to the development of facial pattern, the role of mandibular growth has especially intrigued practitioners due to its variability and relative unpredictability.

The orthodontists should combine the mandibular development and function to correctly diagnose a problem and formulate a treatment plan.

As the mandible articulates with the cranium, it is paramount that proportionate growth be achieved between anterior and posterior facial heights or resultant clockwise or counterclockwise mandibular rotation may occur **(Fig.1)**. Extreme cases of increased vertical growth and clockwise rotation will result in the hypodivergent, steep mandibular plane facial .This type of malocclusion continues to present itself as one of the most challenging orthodontic treatment situations. [1]

Schendel et al.[2] examined facial dysmorphology of patients exhibiting excessive vertical growth and developed the term long face syndrome. This term includes those patients who have typically been referred to with the following words: extreme clockwise mandibular rotation, high angle type, adenoid faces, idiopathic long face, total maxillary alveolar hyperplasia, and vertical maxillary excess.[3,4] Opdebeeck and Bell [5] defined patients with reduced vertical facial growth as exhibiting a “short face syndrome.” These patients have been described as having a vertical maxillary deficiency, idiopathic short face, extreme counter-clockwise mandibular rotation, low angle as well as a skeletal deep-bite.[3,4,6]

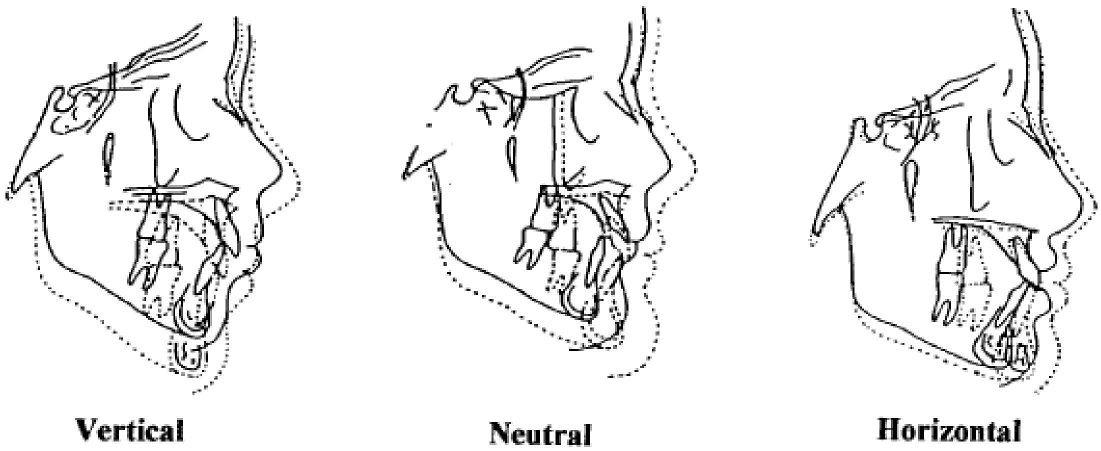


Fig 1. Lateral cephalometric illustrations representing vertical, neutral, and horizontal facial growth patterns.

Schudy[7,8] examined 270 individuals between the ages of 11 and 14 years to assess correlations between various cephalometric measurements, facial height, and facial morphology. He reported the occlusal to mandibular plane angle and S-N to mandibular plane angle were excellent indicators of facial type and that growth of the mandible was a principle determining factor of facial morphology. Bjork[9,10] noted the importance of mandibular growth and rotation in facial development. This resulted in numerous longitudinal implant studies that revealed that the amount of mandibular growth and rotation has a direct effect on vertical facial proportions or esthetics. He concluded that a counterclockwise rotating mandible could be associated with reduced or normal facial proportions and a clockwise rotating mandible could be associated with increased concavity of the lower mandibular border, increased osseous apposition inferior to the symphysis and facial features of the long face type.

To this end, it has been the aim of numerous researchers to study growth and development of the dentofacial complex to predict facial and treatment outcomes. This information would be vital in applying the most efficient orthodontic treatment modalities to enhance and modify the final functional and *esthetic* result. As a result, this has led to the quest to corroborate the role of mandibular growth and establish parameters to successfully predict mandibular growth direction and treatment outcomes.
Therefore , the purpose of this retrospective study was to evaluate the condylar head in different growth patterns.

II. MATERIAL AND METHODS:

This retrospective study was conducted at a tertiary hospital i.e, Sharad Pawar Dental College & Hospital, Wardha, Maharashtra .

Sample Selection:

The study group consisted of total 60 patients which comprises of 20 skeletal deep bite and 20 skeletal open bite cases and 20 normal growth pattern.

Selection criteria:

1. Control group – normal growth pattern
2. Experimental group:-
   - Skeletal open bite and deep bite.
   - Age range of 18 to 40 years for both males and females.
   - No previous history of growth modification.
   - No history of trauma during childhood (birth injury).
   - No history of TMJ dysfunction or infection during childhood.

Symptoms of temporomandibular disorders will not be considered in selecting these subjects, because most such disorders are related to disc positioning, and the purpose of this study is to evaluate the skeletal structures of the TMJ.

III. METHOD:

Lateral cephalograms from previous records present in Department of Orthodontics were taken for all the sample.

The images were obtained with the patients in maximum dental intercuspation and the head positioned so that the Frankfort horizontal plane is parallel to the floor.

Facial growth in the vertical, horizontal or normal direction, was determined by satisfying a minimum of three of the five cephalometric measurements listed in **Table 1 and Fig. 2** ; using Vistadent software, by the same observer. To minimize the error in measurement the values for all parameters were reassessed after a 15 day interval by the same observer.

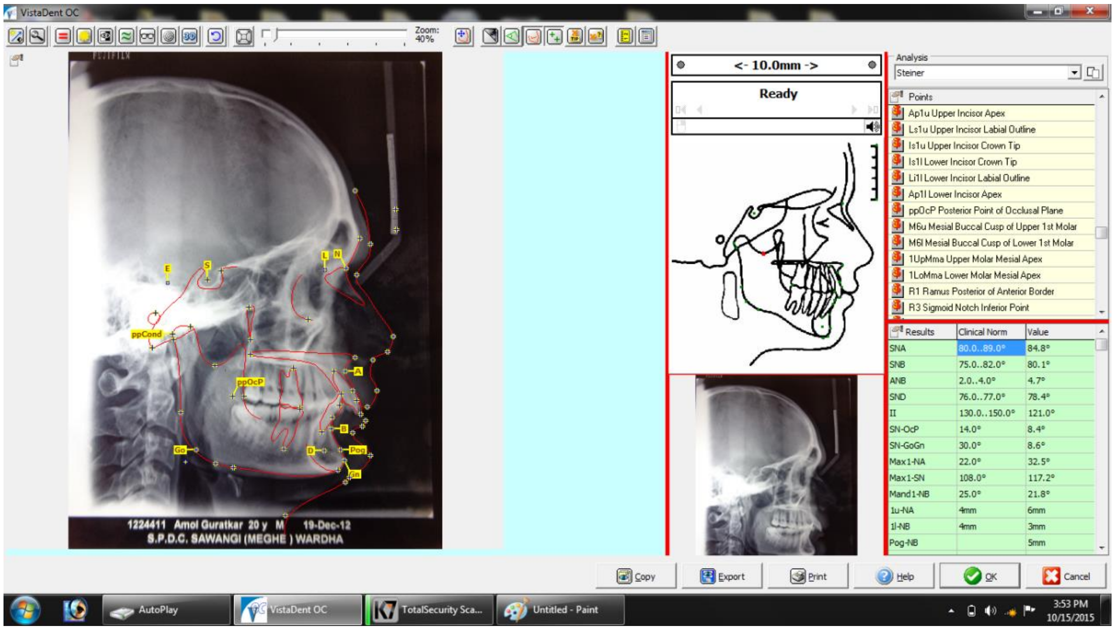


Fig.2

Table 1:

	Skeletal open bite	**Normal growth pattern**	**Skeletal deep bite**
Y Axis (SN to GN)	68° or >	64° - 68°	64° or <
MP Angle (SN to Go-Me)	34° or >	30° - 34°	30° or <
Facial axis (Ba-N to Pt-Gn)	87° or <	87°- 93°	93° or >
PFH:AFH ratio (S-Go:N-Me)	62° or <	62°- 65°	65° or >
Sum total (N-S-Ar,S-Ar-Go,Ar-Go-Me)	403° or >	394°-403°	394° or <

Each cephalogram was assessed manually for following parameters:

1. Condylar head inclination
2. Condylar head height.
3. Condylar head width

1. Condylar head inclination with respect to ramus :

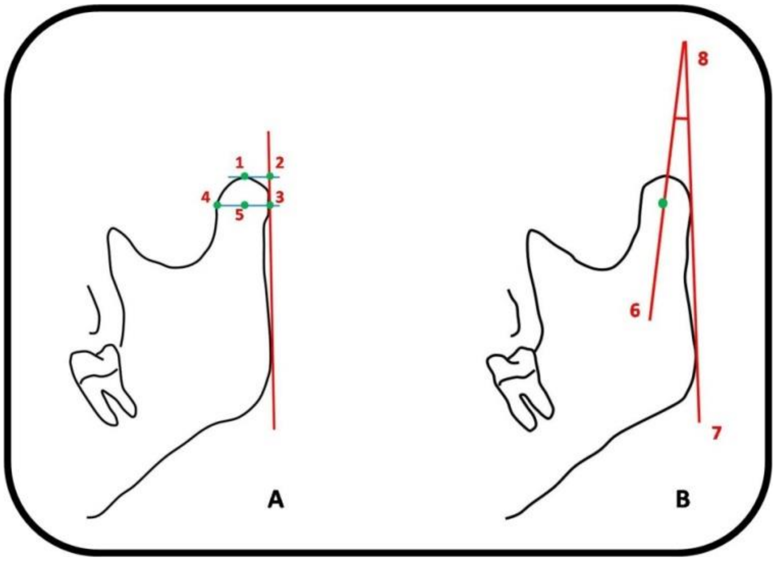
This measurement was completed according to the format described by Sug-Joon Ahn et al (Fig.3)

2. Condylar head height:

Line connecting points 2 and 3, as shown in (Fig.3).

3. Condylar head width:

Maximum width of condylar head anteroposteriorly , as shown in (Fig.3).



(Fig. 3)

A, Landmarks and reference planes, and B, measurements used in this study : **1**; most superior point of condylar head; **2**; point intersecting perpendicular projection of point 1 and ramus tangent; **3**; outermost point of condylar head; **4**; point intersecting perpendicular projection of point 3 and inner condylar outline; **5**; midpoint between points 3 and 4 ; **6**; line connecting points 1 and 5 (condylar axis) ; **7**; ramus tangent ; **8**; angle between condylar axis and ramus tangent **(condylar head angle**) ; **9;** line connecting 3 and 4 **(condylar head width)** ; **10**; line connecting 2 and 3 **(condylar head height)**

IV. STATISTICAL ANALYSIS:

Descriptive statistics for all variables were studied. Group differences were tested with one-way ANOVA and Multiple Comparison Least Significant Difference test.

V. RESULTS:

Table 2: Descriptive statistics, ANOVA, and Least Significance Difference Test for all three groups

	Variables	Mean (SD)	p value (ANOVA)	p(1,2)	p(1,3)	p(2,3)
Normal growth pattern	**Condylar head inclination**	9(1.45)	0.001	0.001^b	0.001^b	0.001^b
	Height of condyle	7.5(1.23)	0.058	0.11^b	0.11^b	0.02^b
	Width of condyle	11(1.55)	0.002	0.004^b	0.013^b	0.001^b
Skeletal open bite	**Condylar head inclination**	4(1.16)				
	Height of condyle	8.10(1.20)				
	Width of condyle	9.7(1.12)				

skeletal deep bite	**Condylar head inclination**	15(1.45)
	Height of condyle	7.2(1.10)
	Width of condyle	12.1(1.33)

SD- standard deviation, [b] Least Significance Difference test, $p<0.05$.

Statistical description of the condylar head inclination, height of condyle and width of condyle according to skeletal pattern are give**n in Table 2.**

On evaluation of condylar head inclination One Way Anova test revealed statistically significant values (p value=0.001*) between the groups and within the groups. Significant findings were obtained when Group 1 was compared to Group 2 and Group 3 (p value=0.001). Also, when Group 2 was compared to Group 3 the values were statistically significant with (p value=0.001).

For the height of condyle, One Way Anova test revealed statistically insignificant values. However, when Group 2 and Group 3 were compared, the values were statistically significant (p value=0.02).

On evaluation of width of condyle One Way Anova test revealed statistically significant values (p value=0.002*) between the groups and within the groups. Significant findings were obtained when Group 1 was compared to Group 2 (p value= 0.004) and Group 3 (p value=0.013). Also, when Group 2 was compared to Group 3 the values were statistically significant with (p value=0.001).

VI. DISCUSSION:

The condyle has a special multidirectional capacity for the growth and adaptive remodeling in selective response to varied mandibular displacement movement and rotations.[12] Facial proportions are determined by the interplay between anterior and posterior vertical and anteroposterior increments. Balance between condylar growth and the dentoalveolar processes act as an equalizing factor in producing normal occlusion and stable facial structures.[7,8]

Condylar head inclination with respect to ramus in all three groups was evaluated. The skeletal deep bite group showed significantly more anteriorly angulated condyles as compared to those of skeletal open bite and control group**.** This shows altered glenoid fossa in the experimental group. The control group had increased anterior condylar angulation as compared to skeletal open bite group but less as compared to skeletal deep bite group.

The correlations obtained between condylar head inclination and facial morphology are consistent with results previously reported in early literature.[9,10] Posterior rotation of the condyles has been shown to dominate in individuals with the classic long face syndrome, and anterior inclination of the condylar head can be associated with counter-clockwise mandibular rotators.[13]

Findings of this study can be explained by the research done by Gail Burke et al[1] who evaluated the correlation between the skeletal growth pattern and condyle glenoid fossa relation using preorthodontic lateral cephalograms and tomograms of 136 preadolescent Class II patients. He stated that patients with vertical facial morphologic characteristics displayed posteriorly angled condyles whereas anteriorly angled condyles were significantly correlated to the patients with a horizontal facial morphology.

Similar findings were obtained by Elias G. Katsavrias[15] who studied the shapes of the condyle and the glenoid fossa in patients with Class II Division 1, Class II Division 2, and Class III malocclusions. Axially corrected tomograms of 189 patients were used (109 Class II Division 1, 47 Class II Division 2, and 33 Class III). The Class III group had a more elongated and anteriorly inclined condylar head with a wider and shallow fossa.

The condylar head height showed statistically significant results only when skeletal open bite and skeletal deep bite groups were compared.

On comparison of condylar head width in all three groups, statistically significant results were found. The condylar head width was found to be statistically larger in skeletal deep bite group followed by control group and skeletal open bite group, respectively.

Proliferation of condylar cartilage and endochondral ossification of the condyle occurs via a complex of biomechanical interactions. The magnitude, direction and duration of the resultant condylar growth may be influenced by genetic determinants as well as intrinsic and extrinsic control factors.[1] Copray[14] stated that adaptability of the condylar cartilage cells to mechanical stimuli and pressure from the functional environment determine the ultimate condylar shape and set up the boundaries of condylar growth.

VII. CONCLUSIONS:

Individuals with skeletal deep bite displayed anteriorly angulated condyles and increased width of condyle, whereas individuals with skeletal open bite displayed decreased angulation of condylar head and decreased width of condylar head.

No significant difference was found in condylar head height measurements in all three groups.

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AUTHORS

First Author – Abhilasha Goyal, Sr.Consultant, Walk in International Medical and Dental Centre, New Delhi
Second Author – R H Kamble , Prof & Head, Department of Orthodontics, Sharad Pawar Dental College ,Wardha.
Third Author – Sunita Shrivastav, Professor, Department of Orthodontics, Sharad Pawar Dental College ,Wardha.
Fourth Author – Eshan Awasthi, Sr.Consultant , Awasthi Multispeciality Dental Care, Raigarh.