

## Diagnostic Significance of Glenoid Fossa Position: A Cephalometric Study

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### Abstract:

**Background:** Diagnostic importance of glenoid fossa needs to be realized. A malocclusion can present itself with various features and a proper treatment demands an accurate diagnosis. Variability in location of glenoid fossa can play an important role in various malocclusions, hence keeping this thing in mind this study was aimed at finding whether a relation exists between glenoid fossa position and malocclusion in a sagittal direction.

**Materials and methods:** Cephalograms of 90 subjects were assessed manually and various parameters describing the location of glenoid fossa were assessed. These parameters were statistically assessed with different malocclusion groups and it was ascertained whether a relation exists between the two or not. Besides maxillary and mandibular position in a sagittal direction were assessed separately with glenoid fossa position.

**Results:** No significant difference was observed in glenoid fossa position in various malocclusion groups. Mandibular position did vary significantly with a unit change in glenoid fossa position when assessed separately.

**Conclusion:** Although the relation between glenoid fossa position and malocclusion was not found to be significant in this study, but role of glenoid fossa in orthodontic diagnosis cannot be undermined. Determining whether a malocclusion is due to variability in jaw size or due to difference in position of glenoid fossa aims at employing proper treatment mechanics and thereby much predictable and stable results.

**Keywords:** Glenoid fossa, malocclusion, cephalometrics, articular eminence inclination

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### I. Introduction

The main aim of orthodontics is achievement of a balanced facial profile. A balanced facial profile is a result of a harmonious association between hard and soft tissues of craniofacial region<sup>[1]</sup>. This balance can be presented by nature in a number of ways, either the hard and soft tissues are in ideal position or there can be some kind of compensation in hard tissue or soft tissue to achieve some kind of balance<sup>[1]</sup>. Unmasking of various compensations is an essential part of orthodontic science. Malocclusion has various components, and the contribution of each component can be variable<sup>[2]</sup>. This variability does pose a challenge to the Orthodontist to properly diagnose and treat a malocclusion. Hence emphasis is being laid on **component approach** of orthodontic diagnosis and treatment planning. Articulation of mandible to rest craniofacial skeleton does play an important role in determining the spatial orientation of jaws and hence the malocclusion. This articulation is at the glenoid fossa and hence position of glenoid fossa determines the position of mandible with respect to rest of craniofacial skeleton. There is evidence in literature regarding the influence of position, shape of glenoid fossa on other skeletal structures in various dimensions<sup>[1,3,4]</sup>. Also there is recognized role of orthodontic treatment on glenoid fossa position and morphology<sup>[5-9]</sup>, forming the basis of treatment of developing Class II or Class III malocclusion. Glenoid fossa holds a significant position in craniofacial region and hence keeping the above mentioned fact in view this study is aimed at determining the diagnostic significance of position of glenoid fossa and its association with craniofacial morphology.

### II. Materials And Methods

The study was carried out on the patients received in the Out-Patient Department of the Department of Orthodontics & Dentofacial Orthopaedics, Government Dental College & Hospital, and Srinagar. The sample for this study consisted of 90 subjects which included 30 males and 60 females. Those subjects between the age



**AE plane:** Articulating surface of glenoid fossa <sup>[20]</sup>.

**Clival plane:** A line drawn tangent to the clivus <sup>[20]</sup>.

**2.3: Definition of variables:**

**ANB:** This represents the difference between SNA & SNB angles <sup>18</sup> and determines the anteroposterior relationship of the maxillary and mandibular bases.

**2.4 Variables defining glenoid fossa morphology:**

1. **AE-SN angle :** Angle between the articulating surface of the glenoid fossa and the sella nasion plane<sup>20</sup>
2. **AE-CP angle :** Angle between the articulating surface of the glenoid fossa and the clival plane<sup>20</sup>
3. **X1:** Linear measurement between point articulare and Y- axis.
4. **X2:** Linear measurement between point condylion and Y- axis.

**2.5 Variables defining mandibular morphology:**

5. **Maxillary position (MxP):** Linear measurement between point A and Y- axis.
6. **Mandibular position (Md1P, Md2P):** Linear measurement between point B and Y- axis, point Pog and Y- axis.

**2.5 ANB was used to divide the sample into three groups:**

**Class I :** ANB; (1-4)<sup>0</sup>

**Class II:** ANB; (> 4)<sup>0</sup>

**Class III:** ANB (< 1)<sup>0</sup>

32 subjects were found to be in Class I group, 31 in Class II group, and 27 in Class III group.

**2.6 Statistical Analysis:**

Statistics consisted of descriptive statistics including mean and standard deviations for each variable in all the three skeletal classes were calculated. All the groups were subjected to one way ANOVA test to assess the significance of association between various variables and three malocclusion groups.

In the statistical evaluation, the following levels of significance were used:

P > 0.05 Non-significant

0.05 ≥ P > 0.01\* Significant

0.01 ≥ P > 0.001\*\* Highly significant

P ≤ 0.001\*\*\* Very highly significant

**III. Results**

**Table 1:** Descriptive statistics of all the parameters:

S.No.	Parameter	Class I Mean	Sd	Class Ii Mean	Sd	Class Iii Mean	Sd
1.	X1(Mm)	19.51	2.52	20.56	2.48	19.01	3.95
2.	X2(Mm)	16.63	3.39	17.64	4.01	16.22	3.99
3.	Maxillary Position(A- Y Axis : Mm)	63.33	2.03	64.36	3.03	63.03	2.85
4(A).	Mandibular Position(B- Yaxis;Mm)	53.21	4.64	54.36	3.95	53.01	3.86
4(B).	Mandibular Position(Pog- Yaxis;Mm)	55.62	3.43	54.78	3.22	57.08	3.64
5.	Ae-Sn( <sup>0</sup> )	53.32	2.54	53.69	2.53	53.42	2.63
6.	Ae-Cp( <sup>0</sup> )	73.11	4.02	72.99	3.98	73.40	4.11
7.	Anb( <sup>0</sup> )	2.9	1.83	6.3	2.21	0.87	1.11

**Table 2:** Descriptive statistics and ANOVA for positional variables of glenoid fossa

PARAMETER	CLASS I	SD	CLASS II	SD	CLASS III	SD	ANOVA
X1	19.51	2.52	20.56	2.48	19.01	3.95	0.137
X2	16.63	3.39	17.64	4.01	16.22	3.99	0.338
AE-SN	53.32	2.54	53.69	2.53	53.42	2.63	0.841
AE-CP	73.11	4.02	72.99	3.98	73.40	4.11	0.925

**Table 3:** Assumed change in morphological variables with a unit change in positional variables of glenoid fossa with ANOVA

PARAMETER	CLASS I	CLASS II	CLASS III	ANOVA
Max P with unit change in X1	66.57	67.49	66.34	0.214
Max P with unit change in X2	67.13	68.00	66.91	0.251
Man 1 P with unit change in X1	55.93	55.58	57.21	0.308
Man 1 P with unit change in X2	56.40	56.01	57.71	0.282

Man 2 P with unit change in X1	58.47	57.44	60.08	0.016
Man 2 P with unit change in X2	58.96	57.88	60.59	0.013

Table 1 shows the mean and standard deviation of all the variables observed in three malocclusion groups. Table 2 shows both linear and angular variables that describe the position of glenoid fossa. It is observed that glenoid fossa is posteriorly positioned in Class II malocclusion although the difference between all the three classes is not statistically significant. In order to study the effect of change of position of glenoid fossa on anteroposterior position of maxilla and mandible separately, relationship was observed between a unit change in positional variables and associated change in position of jaws individually. It was observed that a significant relation existed with respect to mandibular position only.

#### IV. Discussion

Role of glenoid fossa in shaping the craniofacial morphology needs to be recognized. Significance of glenoid fossa position in orthodontic diagnosis and treatment planning should be taken into account. Literature does show a relation between glenoid fossa position and different malocclusions<sup>[1,3]</sup>. In this study Articulare and Condylion were used to describe position of glenoid fossa in terms of linear parameters and articulating surface of glenoid fossa in relation to angular parameters. Other studies have used Articulare<sup>[21-24]</sup>, Conylion<sup>[25]</sup> and articulating surface of glenoid fossa<sup>[20]</sup> to study the relation of glenoid fossa position on malocclusion. In this study cranial base line was chosen as a reference line due to its stability<sup>[11,12,13]</sup>. Other authors have chosen different reference lines like SN line<sup>1</sup>, SBL line<sup>[25]</sup>. Point T was chosen in this study as posterior wall and floor of sella turcica remodel with growth<sup>[11]</sup>. In order to widen the spectrum of this study, morphological parameters like position of mandible and maxilla were also included and related to an assumed unit change in variables describing glenoid fossa position. Also in this study, parameters in only one direction, that is, anteroposterior direction were taken in order to allow for a clearer understanding between the two. This study also incorporates parameters showing articular eminence inclination and its relation with malocclusion.

This study shows that glenoid fossa is located posteriorly in Class II malocclusion, followed by Class I, than Class III. But this difference is not significant. This is in disagreement with other studies which do show a significant relation between malocclusion and glenoid fossa<sup>[1,3,26]</sup>. This finding can explain the fact that a Class II malocclusion even in presence of a well formed mandible can be due to a posteriorly positioned glenoid fossa and similarly a Class III malocclusion in case of average sized mandible due to an anteriorly positioned glenoid fossa. Regarding inclination of articular eminence inclination, it was observed in this study that it did not differ significantly in three groups. Although there are various studies relating the inclination of articular eminence to shape of mandible<sup>[7,27]</sup>, this study did not relate the two. This study observed that maxillary position did not alter with change in glenoid fossa position but mandibular position did alter significantly with change in glenoid fossa position. This means that if only position of mandible is studied with respect to glenoid fossa position, it does change significantly with it, but when a malocclusion group taking into account position of both maxilla and mandible, position of glenoid fossa does not differ significantly in different malocclusion groups in a sagittal plane. This points to the fact that influence of various factors on malocclusion can be different when studied in combination or in isolation.

Thus it can be understood that a malocclusion can be either due to abnormal jaw size or position of glenoid fossa which ultimately does have a significant impact on diagnosis and treatment planning.

#### 4.1 Clinical implications:

Changes in glenoid fossa position with accompanying change in jaws forms the basis of correcting developing Class II and Class III malocclusion. There is varying evidence in literature both supporting and refuting this relation. Also treatment mechanics can be employed with particular emphasis on force direction according to direction of growth.

#### 4.2 Limitations and future directions:

This study is based on a two dimensional study of a three dimensional structure. Also the contours of glenoid fossa can be obscured by superimposition of other structures. So studies based on three dimensional radiography like computed tomography should be conducted. Also factors like age and sex should be considered.

## V. Conclusion

1. The position of glenoid fossa does not vary significantly in different malocclusion groups in a sagittal plane.
2. The position of maxilla did not differ with respect to change in glenoid fossa position whereas position of mandible did vary significantly when the two were studied separately.

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