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# Cephalometric evaluation of glenoid fossa position in Class II skeletal malocclusion and study of the effects of compensations on skeletal jaw pattern in Kashmir population.

Dr. Syed Sameer Hussain[1], Dr. Syed Zameer Khurshaid [2]
[1](*Post-graduate scholar, department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Srinagar, J&K, India)*
[2](*Associate Professor, Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Srinagar, J&K, India)*

***Abstract:***
***Background:*** *Various skeletal malocclusions in sagittal plane have been related to the position of glenoid fossa in anterioposterior dimension. Different dental and skeletal abnormalities interact with each other to cause different malocclusions of various areas of the dentofacial region.A posteriorly or anteriorly placed glenoid fossa may predispose the mandible to be placed in the distal or mesial position, thus increasing the tendency towards a Class II or Class III skeletal malocclusion. This study is conducted to compare the glenoid fossa position in subjects presenting with skeletal Class II malocclusion due to retrognathic mandible and skeletally Class I malocclusion.* ***Methods:*** *The sample consisted of lateral cephalograms of 60 subjects( Class I=30, Class II=30). Cephalometric tracings were done and various measurements taken. The Sample was differentiated into 2 classes using ANB angle, Wits appraisal and Beta angle. The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 for analysis.* ***Results:*** *Glenoid fossa was positioned distal and posteriorly in Class II malocclusion in comparison to Class I malocclusion. There was no significant difference in vertical positioning of glenoid fossa in two classes.* ***Conclusion:*** *A distally and posteriorly placed glenoid fossa is an important diagnostic feature of Class II skeletal malocclusion with retrognathic mandible.*

***Key words:*** *Glenoid fossa, sagittal skeletal malocclusion, anterioposterior jaw relation.*

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## I. Introduction:

Malocclusions are the result of various combinations of underlying dental and skeletal conflicts that involve several different components of the craniofacial region (**Moyers, 1988)**[1]. Since the relationship of the mandible to the cranial base influences both sagittal and vertical facial disharmonies, the position of the glenoid fossa in relation to surrounding skeletal structures as well as the various cranial base parameters deserves to be included in the analysis of the skeletal features of the individual patient **(Hopkin et al. 1968; Droel and Isaacson, 1972)**[2,3].

The scientific contributions in this regard have indicated that the relative position of the glenoid fossa, i.e, of the attachment of the mandible to the cranium, can affect the dentoskeletal features of malocclusions **(Hopkin et al., 1968; Droel and Isaacson,1972, Baccetti et al., 1998)**[2-4]. Experimental and clinical studies have shown changes in the region of the glenoid fossa concurrent with the improvement or correction of dentoskeletal disharmonies **(Woodside et al. 1987, Paulsen et al. 1997, Pancherz et al. 1998, Katsavrias et al. 2003**)[5-8].

Angle's Class II Division 1 malocclusion is a frequently seen dentoskeletal disharmony which constitutes a marked percentage of patients treated worldwide by an Orthodontist. A thorough knowledge of the skeletal and dental components that contribute to Angle's Class II Division 1 malocclusion is essential because these elements may influence the approach to treatment. The success of the treatment of Angle's Class II malocclusion depends on the variations in the direction, timing, and duration of the development in the facial areas. Hence, these variations in the craniofacial components need to be meticulously interpreted for a successful Orthodontic diagnosis and to produce an appropriate treatment plan with a suitable retention regime.

## II. Material and Methods

The sample consisted of lateral cephalograms of 60 subjects( Class I=30, Class II=30). Cephalometric tracings were done and various measurements taken. The Sample was differentiated into classes using ANB angle, Wits appraisal and Beta angle as described in Table no. 1.

| **Parameter** | **Class I** | **Class II** |
|---|---|---|
| **1.ANB** | 2-4degrees | >4degrees |
| **2.Wits**<br>Male<br>Female | <br>-1mm<br>0mm | <br>>-1mm<br>>0mm |
| **3.Beta angle** | 27-35degrees | <27 degrees |

Usually all the three parameters should be used to help arrive at a more accurate diagnosis of anteroposterior skeletal relationship. The cases where inferences from all these parameters did not match, were not included in the study.

**(I)Glenoid fossa position** was measured from 3 stable landmarks sella on Frankfort horizontal plane, pterygomaxillary fissure(Ptm) on Frankfort horizontal plane and Frontomaxillarynasal suture point.

| **A.ANTEROPOSTERIOR MEASUREMENTS.** | |
|---|---|
| (i)**GF-S on FH** | Distance between the perpendicular projections of glenoid fossa ,GF ( most superior and posterior point on the bony contour of the GF, facing Condylion ,Co) and Sella, |
| (ii)**GF-Ptm on FH** | Distance between the perpendicular projection of GF and Ptm onto FH. |
| (iii)**GF – FMN** | Distance between GF and FMN Suture**.** |
| **B. VERTICAL MEASUREMENTS.** | |
| (i) **Fs-FOP:** | It's the perpendicular distance from point fossa summit(Fs) to the functional occlusal plane(FOP). |
| (ii) **Fs-Stable basicranium line(SBL) angle** | angle between the Fs-FOP and SBL. This angle defined the relationship between glenoid fossa and the functional occlusal plane. |

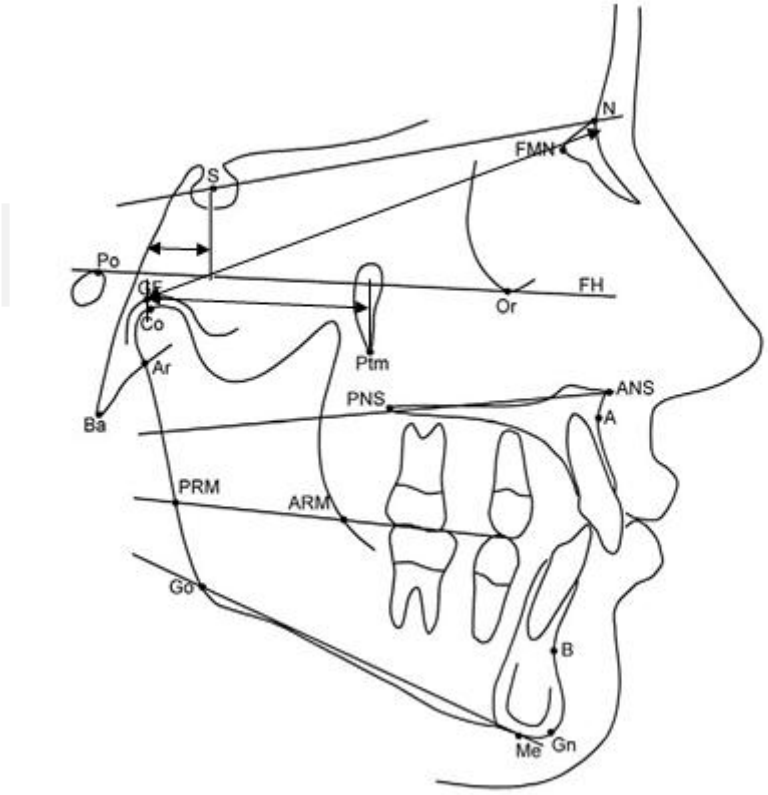


**Figure 2:**Showing perpendiculars dropped from GFtoFHP, S to FHP and Ptm to FHP.

**(II)Glenoid fossa position that can have linear and angular compensations** like

| | | |
|---|---|---|
| **1.** | **Ramus height(linear),** | Distance between gonion(Go) and articulare(Ar). |
| **2.** | **Articular angle(angular)** | angle formed between points Sella(S), Articulare(Ar) and Gonion(Go) |

were also measured and compared.

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 for analysis.

## III. Results

Table 2 shows the age distributrion of the 2 groups.

**Table 2: Age distribution of malocculusion groups**

| Class | N | Mean | SD | Range | P-value |
|---|---|---|---|---|---|
| Class I | 30 | 17.6 | 2.30 | 15-25 | 0.556 |
| Class II | 30 | 17.1 | 3.76 | 16-27 | |

Table 2 shows that the age group used in Class I and Class II were 15-25 and 16-27 years respectively with mean age of 17.6 and 17.1 respectively. The difference between the classes on the basis of age was statistically non-significant(P-value=0.556) indicating that there was no effect of age on different parameters.

**Gender distribution in the three classes given in the table and bar diagram below:**

| Gender | Class I | | Class II | |
|---|---|---|---|---|
| | No. | %age | No. | %age |
| Male | 10 | 33.3 | 14 | 46.7 |
| Female | 20 | 66.7 | 16 | 53.3 |
| Total | 30 | 100 | 30 | 100 |

Chi-square=2.52; P-value=0.284

Table 3 shows the gender distribution of various malocclusion groups. The gender distribution was comparable in the two classes (P-value=0.284), indicating that the gender distribution has no statistically significant effect in two classes.

| Cephalometric variable | Class I | | Class II | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| GF-S on FH (mm) | 13.6 | 2.78 | 15.5 | 2.13 |
| GF-Ptm on FH (mm) | 28.9 | 2.80 | 29.4 | 2.47 |
| GF-FMN (mm) | 76.8 | 3.60 | 78.6 | 3.61 |
| FS-FOP (mm) | 33.3 | 4.72 | 33.5 | 6.06 |
| FS-SBL angle (Degree) | 99.3 | 5.68 | 102.8 | 7.00 |
| Articular angle (degree) | 140.9 | 6.69 | 142.0 | 5.82 |
| Ramal height (mm) | 39.0 | 3.07 | 38.0 | 3.57 |

From the table the mean value of parameters GF-S on FH, GF-Ptm on FH and GF-FMN were higher in Class II group than Class I group. However, the value of FS-FOP was more or less the same in two groups. This indicates that the glenoid fossa was positioned posteriorly with repect to sella(S), ptergomaxillary fissure and the frontomaxillonasal points in Class II when compared to Class I controls.

## IV. Discussion:

The relationship of the mandible to the cranial base influences both sagittal and vertical skeletal facial balance. The position of glenoid fossa is likely to play an important role in different craniofacial patterns. The problems arising from anteroposterior malrelationship of jaws has been mainly attributed to changes in its size, form and position **(Hopkin *et al.*).**[2] Some articles in the literature relate the glenoid fossa position to various malocclusions. **Hopkin, Houston and James**[2] reported that the glenoid fossa position anteroposteriorly was related to dental malocclusions. In an article on mandibular rotations, **Bjork**[9] noted that the vertical placement

of the glenoid fossa was a theoretical factor in the rotation of the mandible. The literature provides only limited data about the diagnostic significance of glenoid fossa position in determining the type of malocclusion. On the contrary many experimental and clinical contributions have demonstrated the effect of orthodontic or orthopedic therapies on glenoid fossa position and morphology **(Pancherz et al. 1998 [6], Argonin et al.[10] 1987, Woodside et al.[5] 1987, Paulsen et al.[8] 1995).** The purpose of this study is to assess the glenoid fossa position and condylar-ramal morphology in different sagittal skeletal patterns, and to study the effect of skeletal compensations related to the glenoid fossa position.

**SAMPLE:**

The sample of this research was selected on the basis of certain criteria to serve the purpose of deriving the proper result regarding the position of glenoid fossa in relation to different skeletal patterns. In the current study, a sample of 60 subjects ( Class I= 30, Class II= 30)were selected with age group of 15-30 years who reported to the department of Orthodontics and Dentofacial Orthopedics, Government Dental College and Hospital, Srinagar, Jammu and Kashmir and belonged ethnically to Kashmir division.

**The position of glenoid fossa in sagittal plane**:

In the present study, the position of the glenoid fossa was evaluated according to its distance from Sella, Pterygomaxillary suture (both on Franfort horizontal plane) and from Frontomaxillonasal suture.

**(i)GF-S on FHP:** This parameter was suggested by **Wylie[11]** in 1947. It measures the distance of glenoid fossa from the vertical projection of sella on Frankfort horizontal plane. The mean value was 13.6 ±2.78mm in Class I, 15.5 ±2.13mm for Class II. This means that the value was higher in Class II.The values were close to the mean values found by Innocenti et al. (Class I= 12±2.2mm; Class III=11.5±2.4mm).The similar landmark was used by **Droel and Isaacson(1972)[3]** and **Baccetti et al.(1997,2008,2009)[4,12,13]** who found the similar results as was found in this study. This suggests that the glenoid fossa is posteriorly placed in Class II subjects with respect to point Sella when projected on Frankfort horizontal plane when compared to Class I control group.

**(ii)GF-Ptm on FHP:**It measures the distance of glenoid fossa from the vertical projection of pterygomaxillary fissure on FHP.The value was higher in Class II(mean=29.4±2.47mm), however on comparison with Class I(mean=28.9±2.8mm) it was not statistically significant(p value =0.556). The values are close to those found by Innocenti et al. (2009), and Droel and Isaacson,(1972).

**(iii)GF-FMN:** measures the linear distance between point FMN amd glenoid fossa. The value mean value was higher for Class II(78.6±3.62mm).

The average distance in Class II group was 1.8mm higher than Class I. The difference between the groups was statistically significant. The values were in agreement with the studies of **Baccetti et al.[12] and Droel and Isaacson[4]**. Baccetti found a difference of 3.5mm between Class II and Class I while **Droel and Isaacson** found the difference of approximately 2.5mm. **Innocenti et al**. found the average distance from the glenoid fossa to the FMN suture to be 2mm shorter for Class III group than the control (Class I) group which is close to the values found in this study(1.6mm).

According to Guintini et al[13] this distance is much more sensitive parameter to evaluate the relative position of glenoid fossa than first 2 parameters. This is probably because GF-FMN has a geometric and anatomical correspondence with the angulation between the anterior and posterior portions of the cranial base.

From the above 3 sagittal parameters it is evident that the glenoid fossa was in a distal position in Class II in comparison to Class I control group.

**Position of glenoid fossa in vertical plane:**

**(i) FS-FOP:** This paramaeter measures the vertical position of the summit of glenoid fossa in relation to the Functional occlusal plane (FOP).The mean value of distance between FS and FOP was not different significantly in 2 groups.

**(ii) FS-SBL angle:** It is the angular measurement between FS-FOP and SBL.

The angle was larger in Class II malocclusion in comparison to Class I control.

The above two parameters were used by **Braun et al**.[14] in their study entitled "**the relationship of glenoid fossa to the functional occlusal plane**". In their study they found that FS-FOP was larger in Class III males than Class II males. Also FS-SBL angle was more acute in Class III males than Class II males. The mean value of FS- SBL in the study of Braun et al. was less than the mean values in our study. The possible explanation for the same is the use of different reference plane in their study. Braun et al. used a Stable Basicranium Line that is -7 degrees to the SN plane (SN-7degrees).

CLINICAL CONSIDERATIONS:

- Probably the main value of assessing the fossa position is in treatment planning. The fossa position is one of the components of vertical and horizontal malocclusions. The location can generally be considered a good indicator of a certain type of malocclusion **(Droel and Isaacson)[3]**.

- The current study also has a scope in the diagnosis of functional Class II malocclusion cases. In this type of Class II malocclusion there is a characteristic posterior shift of the mandible from postrural rest to occlusion. From initial contact to full occlusion, condylar action is both rotary and translatory up and backward (posterior shift).[15] As discussed by Guintini et al.[12]in these cases the distal position of the glenoid fossa may entail a diagnostic importance for two aspects i.e, a "structural" aspect due to the influence of the fossa position on sagittal skeletal relationships, and a "functional" aspect. The distal position allows for movements of the mandibular condyle in a superior and posterior direction during the switch from rest position to maximal intercuspation.[12]
- A final important consideration is that in cases in which the fossa position deviates markedly and there are not much compensations already present, it may well be expected that overcompensation will be necessary in another facial area to achieve a good orthodontic correction. This has to be considered during the treatment planning process of a case.

## V. Conclusions:

1. The glenoid fossa was distally placed in Class II group when compared to the Class I control group. GF-FMN was a more sensitive and better indicator of glenoid fossa position than the other two parameters in Kashmir population. A distally and posteriorly placed glenoid fossa is an important diagnostic feature of Class II skeletal malocclusion with retrognathic mandible.
2. There was no significant difference in the vertical positioning of the glenoid fossa in Class I and Class II malocclusion.
3. In some cases of Class I and Class II the effect of compensations was clearly discernible.
4. It is necessary to conduct more extensive and deeper studies in search for evidence which confirm the findings of this research, and thus determine the standards that apply to our population.

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