OVERJET AS A PREDICTOR OF SAGITTAL SKELETAL RELATIONSHIPS

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ABSTRACT

Skeletal relationships in the sagittal plane do not always correspond with dental relationships. The aim of the study was to evaluate the degree of correlation between a dental parameter (overjet) and a skeletal (ANB) angle.

Eighty nine patients fulfilled the inclusion criteria for the study (22 males and 69 females, aged 12-35). Overjet was measured on casts with a standard ruler. Lateral cephalograph was taken to measure the ANB angle.

The correlation analysis of overjet with ANB angle in the three malocclusion classes showed, that there was a weak correlation of overjet with ANB angle in all three groups of malocclusion with “r” value of 0.257 whereas P value was statistical insignificance (P-value > 0.05).

This study concluded that overjet is not a good predictor for sagittal skeletal relationship and therefore could not be used for better assessment of sagittal jaw relation which is critical in orthodontic diagnosis and treatment planning.

Key Words: Overjet, ANB angle, sagittal skeletal malocclusion.

INTRODUCTION

Correct orthodontic diagnosis requires history of the patient, thorough examination and certain diagnostic tools e.g model, radiographic analysis and photographs.1-3 The aim of Clinical examination is to establish the type and severity of malocclusion and to determine the skeletal or dental origin of the problem. It also helps to determine what diagnostic records might be needed.3,4

OJ is an important linear parameter that can be measured clinically and is used to assess the sagittal relationship of upper and lower dental arches. OJ could be due to skeletal, dental, or a combination of both.5 It is generally accepted that increased OJ is due to a growth deficit of the lower jaw or increase of upper jaw rather than poor positioning of the dental elements but no significant data regarding this has been published as yet.6

At completion of growth, when deciding on surgical or orthodontic intervention, beside the facial profile, OJ is also an important guideline. Generally when the OJ is greater than 10 mm, surgery is a more successful treatment option.5

Cephalometric analysis is an important part of diagnosis in orthodontics, allowing changes associated with growth and orthodontic treatment to be observed. To diagnose and classify a malocclusion, the measured values of cephalometric parameters are compared with standard values. A large number of cephalometric standards have been developed for adult populations and for children in the period of growth and development.7

For accurate measurement of sagittal skeletal relationship, the ANB angle and the Wits appraisal have been considered as the most common cephalometric.5,8 ANB measurement is commonly used to determine sagittal skeletal relationship in routine. It indicates the magnitude of the skeletal jaw discrepancy and is, in a normal well proportionate face, from 10 to 40.9 However ANB angle has certain limitations; with change in the anteroposterior and vertical position of nasion, increased or decreased vertical height of the face10, tipping of SN plane ANB can give incorrect value.
There is variation in ANB angle between patient's centric occlusion and centric relation. Various authors have shown that these angular measurements are geometrically sensitive and can give false measurement, so other linear measurement like witts and OJ should be investigated for sagittal evaluation.

The rationale of this study was to determine whether the sagittal skeletal evaluation through a non-invasive parameter of OJ rather than through cephalometry and to find out whether the previous study performed is applicable in our population or not. If ANB could coincide with the OJ; then this method could be considered as a substitution in cases where radiographic facility is not available, patient not fit for radiation or unaffordable.

**METHODOLOGY**

This cross-sectional study was carried out in the orthodontic department of Khyber College of Dentistry. Eighty nine patients were recruited, out of which 36 were males and 53 were females. Approval from the Ethics Committee was sought and written consent were taken from all the participants. The age range was 12 to 35 years. The inclusion criteria included subjects with permanent dentition. Patients having any asymmetry of jaws, absent or supernumerary teeth, previous extraction of any tooth or patients with past history of orthodontic treatment were excluded from the study.

The molar relationship was assessed according to the mesiobuccal cusp of the upper first permanent molar.

- **Class I:** When the mesiobuccal cusp of permanent upper first molar occludes in the mesio-buccal of the permanent lower first molar.
- **Class II:** When the mesiobuccal cusp of permanent upper first molar occludes mesial to the mesio-buccal groove of the permanent lower first molar.
- **Class III:** When the mesiobuccal cusp of permanent upper first molar occludes distal to the mesio-buccal groove of the permanent lower first molar.

OJ was measured on the study casts with a standard ruler as the horizontal overlap of the most prominent incisor, with cast in occlusion distance from the labial surface of lower central incisor to the incisal edge of the most prominent upper central incisor was recorded.

The lateral cephalograms were taken under standard conditions. The film – focus distance from the median plane of the patient’s head was 150 cm, and the median plane – film distance 10 cm. The cephalograms were taken with the subjects standing and the head positioned in the cephalostat and orientated to the Frankfort horizontal plane with the teeth in maximum intercuspation. All measurements were made by the same investigator. On cephalograph, the ANB angle was measured by drawing two lines from nasion to point A called as NA line and other line from nasion to point B called as NB line. Angle formed between these two lines was taken as ANB angle.

The data were analyzed using SPSS version 19.0. Mean and standard deviation for numerical variable likes OJand ANB were calculated. Pearson correlation test was used to relationships between OJ and ANB. P < 0.05 was considered to be significant.

**RESULTS**

A total of 83 subjects, 36 (40.4%) males and 53 (59.6%) females) were included in the study. Male to female ratio was 1: 0.64. The most common age group was second decade. (Table 1). There is very low correlation between ANB and OJ ($r = 0.257$) and coefficient of determination ($r^2 = 0.066$). Only 6.6% skeletal cases of malocclusion OJ can be for ANB. There is no statistically significant correlation between ANB and OJ. (Table 2)

<table>
<thead>
<tr>
<th>Age group (in years)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20</td>
<td>68</td>
<td>76.22</td>
</tr>
<tr>
<td>21-30</td>
<td>19</td>
<td>21.44</td>
</tr>
<tr>
<td>35</td>
<td>2</td>
<td>2.34</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**TABLE 2: CORRELATIONAL ANALYSIS BETWEEN ANB AND OJ**

<table>
<thead>
<tr>
<th>$r'$</th>
<th>$r^2$</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.257</td>
<td>0.066</td>
<td>3.63775</td>
</tr>
</tbody>
</table>

*Pearson correlation test

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>81.493</td>
<td>1</td>
<td>81.493</td>
<td>6.158</td>
<td>0.015a</td>
</tr>
<tr>
<td>Residual</td>
<td>1151.288</td>
<td>87</td>
<td>13.233</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1232.781</td>
<td>88</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), ANB  b. Dependent Variable: OJ
Table 3 shows the regression model of ANB and OJ which is statistically significant; OJ is predictor of ANB but correlation is very weak. Table 4 and 5 shows that the difference between OJ and ANB is not statistically significant (p=.640) which denotes similarity in ANB and OJ.

**DISCUSSION**

Among the factors which must be evaluated to formulate a correct diagnosis and a suitable treatment plan, the antero-posterior relationship between the maxilla and mandible is a particularly important parameter.\(^\text{12,13}\) Correction of sagittal discrepancy is very important in achieving balanced profile after orthodontic treatment. Various methods (ANB, Witts, OJ, etc) used to measure the antero-posterior relationship of maxilla to mandible.\(^\text{14-17}\)

As proposed by the ABO (American Board of Orthodontist), OJ, in association with other parameters such as overbite, IMPA, presence of open bite or crossbite, or entity of crowding, is a useful indicator in evaluation of the diagnostic complexity.\(^\text{18}\)

The aim of this study was to evaluate by what degree a dental parameter i.e OJ which is measured clinically is able to predict the entity of the skeletal parameter ANB. Therefore, within individual classes of malocclusion, according to Angle’s classification, the average values of these parameters were calculated and their correlations tested the extent to which OJ can determine skeletal relationships in the sagittal plane. OJ is an important measurement in cast analysis. It has been one of the parameters used to investigate the sagittal relationship of the upper and lower dental arch. The cause of an increased or negative OJ could be skeletal, dental, or a combination of both. At completion of growth, when deciding on orthodontic or surgical intervention, in addition to the facial profile, OJ is an important guideline. Generally when the OJ is greater than 10mm, surgery is a more indicated treatment.\(^\text{2,5}\)

The current study, showed that there was weak correlation between OJ and ANB with r=0.257. This was probably due to the fact that OJ is influenced by the inclination of the upper and lower incisors, while ANB is less affected. However, ANB also varies according to the anteroposterior position of the nasion, the inclination of the SN plane, and the inclination of the jaws.\(^\text{19}\) Another factor able to modify the width of ANB, even if the relationship between the jaws remains constant, is the inclination of the Occlusal plane.\(^\text{20}\)

In a previously conducted study by Iwasaki et al\(^\text{21}\) similar results as in current study were observed. They found that OJ is not always a reliable measure of the jaw relationship in the sagittal plane, especially in subjects with Class III malocclusions Another study carried out by Zupancic et al\(^\text{5}\) showed the same results. This study findings demonstrated that for Class I and Class III malocclusions OJ is not a good predictor of skeletal relationships in the sagittal plane. However, according to their study, in Class II division 1 malocclusion subjects, OJ is a statistically significant predictor.\(^\text{5}\) Similar results were found in a study by Jabbar et al\(^\text{3}\) they observed weak correlation between OJ and ANB angle in all three malocclusion groups but found that it is statistically significant only in class III malocclusion.\(^\text{3}\)

**CONCLUSION**

The findings of this study demonstrate that OJ is not a good predictor of malocclusion (Class I, Class II & Class III) for skeletal relationships in the sagittal plane.

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5 Umar Hussain: Data analysis