Anteroposterior dysplasia indicator (APDI) and Overbite depth indicator (ODI) in a sample of Iraqi adults with different skeletal classes

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ABSTRACT

Background: This study aimed to establish the mean value of Anteroposterior Dysplasia Indicator (APDI), as measurements of the sagittal discrepancy and Overbite Depth Indicator (ODI), as measurement of vertical discrepancy, in a sample of Iraqi adults with different skeletal classes.

Materials and Methods: Ninety dental students, 30 subjects have class I (15 males and 15 females), 30 subjects have class II (15 males and 15 females) and 30 subjects have class III (15 males and 15 females) were chosen for this study. Each student was subjected to clinical examination and digital true lateral cephalometric X-ray. The radiographs were analyzed using AutoCAD 2007. Descriptive statistics obtained for the variables for both genders, independent samples t-test was performed to evaluate the gender difference, and ANOVA then LSD tests were applied to compare the measurement among the skeletal classes.

Results and Conclusions: The mean value of APDI and ODI were established for class I, class II and class III, the APDI and ODI values showed high statistically significant differences among the different skeletal classes for both genders. The mean value of APDI was greater for class III group, and the mean value of the ODI was greater for class II group and it was smaller in class III group.

Keyword: APDI, ODI.

INTRODUCTION

In the radiographic cephalometric analysis, the anteroposterior and the vertical relationship of maxilla to the mandible are the most important diagnostic criterion. However the diagnostic value of singular measurements such as facial angle, A-B plane angle, palatal plane angle and A-B to mandibular plane angle was enhanced by introducing composite angular measurement, (APDI) antero-posterior dysplasia indicator and (ODI) overbite depth indicator (2,3,4,7,8).

The APDI scores the antero- posterior skeletal relationship, while the ODI describes the skeletal tendency toward open bite or deep bite they have been recommended as adjunct to cephalometric differential diagnosis and they were found to better diagnostic parameter for the presence of malocclusion than any other commonly used single cephalometric measurements. The APDI was obtained from three angles, the facial angle, the palatal plane angle and A-B to mandibular plane angle (i.e. the facial angle plus or minus the A-B plane angle and again plus or minus the palatal plane angle). They found that the mean value of APDI in normal occlusion was 81.4 ± 3.79. The ODI is the arithmetic sum of the angle of the A-B plane angle to the mandibular plane angle and the angle of the palatal plane to Frankfort horizontal plane.

This study aimed to establish the mean value of APDI and ODI in a sample of Iraqi adults with different skeletal classes and to test the existence of sexual dimorphism and classes difference.

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MATERIALS AND METHODS

Sample
The sample included 90 dental students and orthodontic patients. The age ranged between 18-25 years, all had complete permanent dentition regardless to the third molars with no history of previous orthodontic treatment, craniofacial disorders, and facial trauma. The sample was classified according to ANB angle (8) into:

1- Skeletal Cl I: 2 ≤ ANB ≤ 4 (15 males and 15 females)
2- Skeletal Cl II: ANB > 4 (15 males and 15 females)
3- Skeletal Cl III: ANB < 2 (15 males and 15 females)

The Instruments
1. Kidney dish
2. Dental mirrors
3. Sterilizer (Memmert, Germany)

The Equipment
1. X-Ray Unit (The Planmeca ProMax X-ray unit)
2. Analyzing Equipment
   a) Pentium IV portable computer.
   b) Analyzing software (AutoCAD 2007).

Method
Each individual was examined clinically and subjected to the digital true lateral cephalometric radiographs. The individual was positioned within the cephalostat with the sagittal plane of the head vertical, the Frankfort plane horizontal, and the teeth were in centric occlusion. Every lateral cephalometric radiograph was analyzed by AutoCAD program 2007 to calculate the angular measurements. Once the picture is imported to the...
AutoCAD program, it will appear in the master sheet on which the points and planes were determined, and then the angular measurements were obtained. The angles were measured directly as they were not affected by magnification.

Cephalometric Landmarks, Planes, and Measurements (Figure 1)

Cephalometric Landmarks

1. Point A (Subspinale): The deepest midline point on the premaxilla between the Anterior Nasal Spine and Prosthion (1).
2. Point B (Supramentale): The deepest midline point on the mandible between Infradentale and Pogonion (1).
3. Point N (Nasion): The most anterior point on the nasofrontal suture in the median plane (6).
4. Point ANS (Anterior Nasal Spine): It is the tip of the bony anterior nasal spine in the median plane (6).
5. Point Pog (Pogonion): It is the most anterior point on the mandible in the midline (1).
6. Point PNS (Posterior Nasal Spine): This is a constructed radiological point, the intersection of a continuation of the anterior wall of the pterygopalatine fossa and the floor of the nose. It marks the dorsal limit of the maxilla (6).
7. Point Or (Orbitale): The lowest point on the inferior rim of the orbit (8).
8. Point Po (Porion): The most superiorly positioned point of the external auditory meatus (8).
9. Point Me (Menton): The most caudal point in the outline of the symphysis, it is regarded as the lowest point of the mandible (6).
10. Point Go (Gonion): A constructed point, the intersection of the lines tangent to the posterior margin of the ascending ramus and the mandibular base (6).

Cephalometric Planes

1. Frankfort plane: A line passing through the points Porion and Orbitale (8).
2. Palatal plane: A plane joining between anterior nasal spine and posterior nasal spine (6).
4. Facial plane: A line from Nasion to Pogonion (1).
5. Mandibular plane: A line passing through the points Menton and Gonion (6).

Cephalometric Measurements

1. A-B plane angle: The angle formed by the intersection of line A-B to the line Nasion- Pogonion. It is a measure of the relation of anterior limit of the apical bases to each other relative to the facial line (1).
2. Palatal plane angle: The angle between Frankfort and palatal planes. When the palatal plane slopes in an upward and forward fashion, the angle is read as negative. When the plane relates to the Frankfort horizontal plane in a downward and forward fashion, it is read as positive (4).
3. Facial angle: The angle between Frankfort and facial planes (1).
4. Anteroposterior dysplasia indicator (APDI): The resultant reading obtained from the facial angle plus or minus the A-B plane angle and again plus or minus the palatal plane angle (4).
5. ANB angle: The angle between lines N-A and N-B. It is measured directly on the radiograph (6).
6. Mandibular plane to A-B plane angle: The angle formed by the mandibular plane and A-B plane (2).
7. Overbite Depth Indicator (ODI): Is the arithmetic sum of the angle of the A-B plane to the mandibular plane and the angle of the palatal plane to Frankfort horizontal plane (Fig. 2), it determines the vertical maxillo-mandibular relationship (2).

Statistical Analysis

All the data of the sample were subjected to computerized statistical analysis using SPSS version 15 (2006) computer program. The statistical analysis included:

1. Descriptive Statistics; included mean, standard deviation, and statistical tables.
2. Inferential Statistics; included:
   " Independent- samples t-test for the comparison between both genders.
   " ANOVA test: for the comparison of the measurements among the classes in each gender.
   " LSD test: used to test the significant P value of ANOVA between every two groups.

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

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<td>Highly Significant</td>
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RESULTS

Descriptive statistics, genders differences and classes' differences are shown in tables 1, 2, 3 respectively.

In subject with class I, generally there is non-significant gender difference for the measured variables except for ANB angle, the AB-MP angle and ODI.

In subject with class II malocclusion there is non-significant gender difference for all the measurement variables.

In subject with class III malocclusion, generally there is non-significant gender difference for the measured variable except for the APDI.

Generally there were very high significant difference for the measured variables between class I, class II and class III for females and males groups except FH-NPog and FH-PP angles there were non-significant difference for these variables.

DISCUSSION

Many researches have been published on the ANB angle as the most commonly used measurement in evaluating the sagittal jaw discrepancy, but many factors could affect the validity of ANB, such as the variation in positions of nasion, point A or B vertically and horizontally which is a normal anatomical occurrence (3).

This study was aimed to determine a composite measurement (APDI) which is a formula obtained from (facial angle ± AB-plane angle ± palatal plane angle) for assessing the anteroposterior jaw relationship and also the ODI which is a composite measurement obtained (AB-MP angle ± palatal plane angle) for assessing the vertical jaw relationship.

Anteroposterior dysplasia indicator

APDI

The mean value of APDI in class I group was 81.36 in male and 80.43 in female; this comes in agreement with Kim and Vieta (2) and Freudenthaler et al. (10).

In class II group, the mean value of APDI was less than that of class I and class III groups because of mandibular deficiency (i.e. the mandible is either small in size or retruded in position relative to the maxilla) this relationship result in a more distal position of points B, Pog and hence a more negative value of AB-NPog angle, together with smaller FH-NPog angle. So the resulting formula (APDI) value would be decreased. FH-PP angle and FH-Npg angle showed non-significant difference among the different skeletal classes.

In class III group, the APDI value showed the highest value. This may be due to mandibular prominence associated with a more anterior position of B and Pog points leading to increase the angle between FH and NPog. However, AB-NPog angle showed no effect upon the increased APDI value, and the FH-PP showed non-significant difference among the different skeletal classes.

Generally the APDI showed very high significant difference among class I, class II and class III groups in both genders attributed to the underlying skeletal features that affect the component of the composite measurement (APDI).

Overbite Depth Indicator ODI

It is the arithmetic sum of the AB plane to mandibular plane angle and the angle of palatal plane to Frankfort horizontal plane; it determines the vertico-maxillo-mandibular relationship.

The mean value of ODI in class I was 72.64 in female and 75.57 in male which is greater than its mean value obtained by Freudenthater et al. (10) which may be due to different ethnic samples.

The mean value of ODI in class II found to be higher than class I and class III, this is due to increased the mean value of AB-MP angle which may be due to maxillary protrusion and/or mandibular retrusion or may be due to shifting the mandibular plane resulting from increased posterior facial height or increased the height of mandibular ramus together with decrease the anterior facial height resulting from vertical deficiency of the nasomaxillary process and/or vertical deficiency of mandibular symphysis, the increased AB-MP angle usually associated with deepbite and a tendency toward a more hypodivergence, However FH-PP angle show non-significant difference among the adult skeletal classes.

The ODI shows the lowest value in class III group this may be due to decrease the value of AB-MP angle (steep mandibular plane) which may be due to maxillary protrusion and/or mandibular retrusion or may be due to shifting the mandibular plane resulting from decreased the posterior facial height together with increased the anterior facial height as a result of vertical maxillary excess or vertical mandibular symphysis excess.

The decreased AB-MP usually indicates an open bite with – tendency toward a more hyperdivergence.

However the FH-PP angle (maxillary inclination) showed to have no effect upon the
decreased ODI, this result agreed with Freudenthaler et al. (10,11). The ODI showed a very high significant difference among class I, class II and class III groups due to the underlying skeletal features affecting the component of the composite measurement (ODI).

Figure 1: Cephalometric tracing showing the angles FH-NPg, FH-PP, AB-MP and AB-NPg, which yield the ODI and APDI

Table 1: Descriptive statistics and genders differences for class I

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Table 3: Descriptive statistics and genders differences for class III

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REFERENCES

5. Kim YH. A comparative cephalometric study of class II division 1 non extraction and extraction cases. Angle Orthod 1979; 49: 77-84.