Palatal dimensions in different occlusal relationships

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ABSTRACT
Background: This study aimed to compare the palatal dimensions in different occlusal relationships and to find out the genders difference in each relationship.

Materials and methods: The sample consisted of 60 sets of dental casts for 60 dental students and patients attending the Orthodontic Department in the College of Dentistry, University of Baghdad. These casts divided into three groups according to the Angle’s classification: Class I group: included casts of subjects had Class I normal occlusion and consisted of 10 males and 10 females. Class II Division 1 group: included casts of subjects had Class II Division 1 malocclusion and consisted of 10 males and 10 females. Class III group: included casts of subjects with Class III malocclusion and consisted of 10 males and 10 females. The palatal dimensions were measured using digital vernier and palatometer. Descriptive statistics were performed to each gender and to both genders in each class. Inferential statistics included independent sample t-test to find out the presence of genders difference and ANOVA then LSD tests to show the classes differences in each gender and in the total sample.

Results and Conclusions: The results showed that Class I and II males had the largest palatal dimensions than females while Class III females had the largest palatal dimensions than males. Class I subjects had the largest palatal width and depth while Class II subjects had the largest palatal length. Class I males and Class III females had the largest palatal width than other classes. Class III females and Class II males had the largest palatal depth than other classes.

Key words: palatal dimension, occlusal relationships.

INTRODUCTION
The palate, due to its morphology and position, is one of the key anatomical structures in determining the type of skeletal pattern (1) and, most importantly, the palate can be influenced by orthodontic treatment procedures (2).

Many studies have been done to compare the palatal dimensions between Class I and Class II malocclusion (3,5), normal occlusion and different malocclusion (6), normal subjects and subjects with Turner's syndrome (7), normal subjects and subjects with Down's syndrome (8,9), thalassemic patients and normal subjects (10), monozygotic and dizygotic twins (11,12) and subjects with open bite, deep bite and normal occlusion (13). On the other hand, two studied were conducted to established the palatal index and compare it in primary, mixed and permanent dentitions (14,15).

As a part of the study of dental arch dimensions in Class I occlusion, the palatal dimensions were established and genders differences were found out in many studies (16-19).

Other authors tried to find out the relation between the width, depth and circumference of the dental arch in normal occlusion (20,21), while the study of Al-Mulla and Al-Bashir (22) was the specific Iraqi study that investigated the palatal dimensions.

This study aimed to compare the palatal dimensions in different occlusal relationships and to find out the genders difference in each relationship.

MATERIALS AND METHODS
Sample
The sample included 60 sets of dental casts for 60 Iraqi Arab subjects selected from the students and patients of College of Dentistry, University of Baghdad.

Sample criteria
1. All subjects had complete permanent dentition regardless the third molars.
2. The age ranged between 18-28 years.
3. No attrition or abrasion in all teeth.
4. Healthy gingival tissue with no gingivitis or periodontitis or any gum recession.
5. Mild or no crowding or spacing in all dental classes.
6. No rotation in all of the teeth.
7. Intact tooth structure, no fracture, caries, trauma or heavy restoration.
8. No history of significant medical disease or trauma.
9. No previous orthodontic, prosthetic or surgical treatment was recorded.

The sample was divided into 3 groups according to the Angle’s classification (23,24):
1. Class I group: included casts of subjects had Class I normal occlusion and consisted of 10 males and 10 females.

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2. Class II Division 1 group: included casts of subjects with Class II Division 1 malocclusion and consisted of 10 males and 10 females.

3. Class III group: included casts of subjects with Class III malocclusion and consisted of 10 males and 10 females.

**Equipment**

1. Dental mirrors.
2. Dental probes.
4. Antiseptic solution (Dettol).
5. Cotton.
6. Perforated plastic trays.
7. Rubber bowl.
8. Wide bladed plastic spatula.
10. Irreversible hydrocolloid impression material (Alginmax, Italy).
11. Dental stone (Elite Model thixotropic, Italy).
13. Rubber mold base.
15. Sharp lead pencil.
16. Rulers.
17. Digital vernier (Serial No.: 7156682; sensitivity: 0.01 mm. Mitutoyo Digimatic, Japan).
18. Dental vernier (Serial No.:042-751-00; sensitivity: 0.1 mm. Dentaurum, Germany).
19. Palatometer (Siber Hegner and Co. Ag, Zürich. It permits reading to the nearest 0.1 mm.).

**Methods**

**History and clinical examination**

Each subject was asked to seat comfortably on the dental chair and asked information about the name, age, origin, medical history, the history of facial trauma and orthodontic treatment. Then they were asked to look forward horizontally (Frankfort plane parallel to the floor) for clinical examination (extra-orally and intra-orally) to check their fulfillment of the required sample selection.

All the subjects were classified according to the Angle’s classification (23,24) as follows:

**Class I.** It is malocclusion in which the lower first permanent molar is within one half-cusp width of its correct relationship to the upper first permanent molar. This arch relationship is sometimes known as ‘neutro-occlusion’.

**Class II Division 1:** The lower arch is at least one-half cusp width too far forward in relation to the upper arch, judged by the first permanent molar relationship.

**Class III:** The lower arch is at least one-half cusp width too far forward in relation to the upper arch, judged by the first permanent molar relationship. This arch relationship is sometimes known as ‘dento-occlusion’.

Overjet was measured as the distance parallel to the occlusal plane from the incisal edge of the most labial maxillary central incisor to the labial surface of the opposing mandibular central incisor with the use of vernier (25). Overjet was measured to the nearest millimeter (26) and in case of asymmetry, the larger overjet measurement be recorded (27).

**Dental Cast Production**

Impressions were taken for every subject with Alginate impression material then poured with a prepared amount of stone. After setting of the dental stone, a base of Plaster of Paris was prepared, and then the poured cast was inverted over it. After the final setting of the gypsum, the base was trimmed uniformly by trimmer and made ready for the measuring procedure.

**Measurement of the Palatal Dimensions**

The palatal dimensions were measured according to Riquelme and Green’s (11) method as shown in figure 1.

1. **Width of the Palate:** It was measured with digital vernier as the minimum distance between points A and B of the upper first permanent molars at the cervical aspect of the mesio-palatal cusps at the junction of the tooth and gingival margins.

2. **Length of the Palate:** It was measured with digital vernier from an anterior point C, defined as the intersection of the mid-sagittal plane with a line passing over the widest point of the incisive papilla, to a posterior point D defined as the intersection of the mid-sagittal plane with a plane passing through the most distal points of the upper first permanent molars. This point can be determined by placing one ruler parallel with a plane passing through the most distal points of the upper first permanent molars and the other perpendicular to it touching the palate (6).

3. **Height (Depth) of the Palate:** It was measured from a level coinciding with that of points A and B of the maxillary first permanent molars to the highest point of the palatal vault in the midline using the palatometer.
Statistical Analyses
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
   a) Means.
   b) Standard deviations (S.D.).
   c) Statistical tables.

2. Inferential Statistics
   a) Independent- samples t-test for the comparison between both genders.
   b) ANOVA then LSD tests were used to determine the presence of significant differences between the classes.

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

Non-significant NS P > 0.05
Significant * 0.05 ≥ P > 0.01
Highly significant ** 0.01 ≥ P > 0.001
Very highly significant *** P ≤ 0.001

RESULTS AND DISCUSSION
In Iraq, many studies had been conducted to determine the palatal measurements mostly in Class I occlusion. There is no data regarding Class II and III; so this study was carried out to compare the palatal dimensions in different occlusal relationships. Generally, the present results are difficult to be compared with other studies either due to the difference in the age, the methods of measurements or Class II and III are not included. The palatal dimensions are discussed under three headings:

1. Palatal Width
   Descriptive statistics and gender difference
   The results indicated that in Class I, the males had larger palatal width with a very high significant gender difference; this comes in agreement with Al-Zubair (16) and disagrees with Al-Mulla and Al-Bashir (22) who reported a non-significant genders difference. In Class II, the palatal width of males was larger than females with a non-significant gender difference and just the reverse in Class III where there was slightly larger palatal width in females with a non-significant. This variation may be attributed to the cause of Class II or III and the dentoalveolar compensation that mask the skeletal discrepancies.

   Descriptive statistics and class difference
   The results showed that the palatal width of males of Class I was larger than other classes followed by Class II then Class III with a significant difference as shown by ANOVA test. LSD test indicated that there was a significant difference between Class I and III only. On the other hand, the palatal width of females of Class III was the largest followed by Class II then Class I with a non-significant difference. For the total sample, Class I showed the largest palatal width followed by Class II and III with a non-significant difference.

   Angle (23) stated that, Class II Division 1 malocclusion is characterized by a narrowing of the upper arch, abnormal function of the lips, and some form of nasal obstruction and mouth breathing. This confirmed the present results for males and total sample. In females, the palatal width is slightly larger in Class II than Class I; this may be explained by the variability of the size of the maxilla as the cause of Class II are maxillary excess, mandibular deficiency or both.

   Jones and Oliver (24) stated that, in Class III, in many, but not all, cases the maxillary base is narrow and the mandibular base is wide. The resulting transverse discrepancy is aggravated by the forward position of the mandible relative to the maxilla. As in the case of the dental arches, the skeletal bases diverge posteriorly so that when the lower base is in a forward position, a wider part lies below a given part of the maxilla. In many cases, a buccal inclination of the upper teeth and a lingual inclination of the lower teeth compensate for the transverse discrepancy. However, if this is not sufficient there will be a crossbite. This may explain the increased in the palatal width in Class III females.

2. Palatal Height
   Descriptive statistics and gender difference
   In general, the palatal depth or height was larger in males than females in Class I and II and the reverse in Class III with a non-significant genders difference.

   For Class I occlusion, Al-Zubair (16) reported that the palatal depth was higher significantly in
males, while Al-Mulla and Al-Bashir \(^{(22)}\) found a non-significant gender difference. 

**Descriptive statistics and class difference**

The results indicated that the palatal depth was larger in Class II males followed by Class I then Class III with a non-significant difference. On the other hand, Class III females showed larger palatal depth followed by Class I then Class II. For the total sample, Class I showed the largest palatal depth followed by Class II and Class III with a non-significant difference.

Singh \(^{(28)}\) stated that subjects with Class II Division I had deep palatal vault but may be average and this causes the variability in Class II Division I females.

### 3. Palatal Length

**Descriptive statistics and gender difference**

The results indicated that in Class I and II, the males had larger palatal length with a non-significant gender difference, while in Class III; the females showed larger palatal length also with a non-significant gender difference; this may attributed to the increased in the overjet of the males in Class II and the reverse in Class III (table 2).

**Descriptive statistics and class difference**

The results showed that the palatal length of males and the total sample of Class II were larger than other classes followed by Class I then Class III with a very high significant difference as indicated by ANOVA test. LSD test showed that there was significant difference between Class I and III and very high significant difference between Class II and III. Regarding the females, Class II showed the largest palatal length followed by Class I then III with a non-significant difference.

Angle \(^{(23)}\) stated that Class II Division I malocclusion is characterized by lengthened and protruding upper incisors, abnormal function of the lips, and some form of nasal obstruction and mouth breathing. In the present study, the increase in the palatal length may be attributed to the increased overjet in Class II subjects as point C located behind the upper incisors (table 2). In reverse, Class III subjects had the least palatal length either due to the backward position of the upper incisors relative to the lower or due to maxillary deficiency.

**REFERENCES**


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Orthodontics and Preventive Dentistry, University of Sulaimani, 2006.

Table 1: Descriptive statistics, genders differences and classes' differences

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sex</th>
<th>Descriptive statistics</th>
<th>Classes' differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Class I</td>
<td>Class II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>37.46</td>
<td>2.91</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>32.66</td>
<td>2.12</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>35.06</td>
<td>3.51</td>
</tr>
<tr>
<td></td>
<td>t-test</td>
<td>4.18</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>d.f.</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.001 ***</td>
<td>0.2 (NS)</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>15.14</td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>14.8</td>
<td>2.15</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>14.9</td>
<td>1.78</td>
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<tr>
<td></td>
<td>t-test</td>
<td>0.25</td>
<td>1.69</td>
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<td></td>
<td>d.f.</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.81 (NS)</td>
<td>0.11 (NS)</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>29.09</td>
<td>1.79</td>
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<td>Females</td>
<td>28.85</td>
<td>1.37</td>
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<tr>
<td></td>
<td>Total</td>
<td>28.97</td>
<td>1.55</td>
</tr>
<tr>
<td></td>
<td>t-test</td>
<td>0.35</td>
<td>1.42</td>
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<td>d.f.</td>
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<td>18</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.73 (NS)</td>
<td>0.17 (NS)</td>
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</table>

Table 2: Descriptive statistics of the overjet in both sexes and in different occlusal relations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sex</th>
<th>Class I</th>
<th>Class II</th>
<th>Div. I</th>
<th>Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Overjet (mm.)</td>
<td>Males</td>
<td>2</td>
<td>0.5</td>
<td>5.7</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>2</td>
<td>0.9</td>
<td>5.1</td>
<td>1.8</td>
</tr>
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