Inter-arch tooth size discrepancy for Sulaimani population with class II malocclusion

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ABSTRACT

Background The present study aimed to investigate the correlation between anterior and overall tooth size discrepancies for Class II (division 1 and division 2) malocclusion in Sulaimani population, assessing the mesiodistal width of 12 permanent teeth upper and lower from right first permanent molar to the other and explore the possible significant gender differences.

Materials and Methods The sample was collected from patient attending orthodontic clinic in the college of dentistry, Sulaimani University aged 14 - 25 years old, the materials consisted of stone casts of the dentition of 53 patients (males and females) , 30 of them class II division 1 (15 male and 15 female) and the remaining 23 casts were class II division 2 (12 male, 11 female) who presented with complete eruption of permanent mandibular incisors, canines, premolars and first molars, as well as maxillary canines, premolars and first molars.

Results The overall and anterior ratios were consistently larger in males than in females but statistically non significant also there were no significant differences in comparison between class II div.1 and class II div.2 concerning both overall and anterior ratios.

Conclusion Intermaxillary tooth size ratios may vary in different malocclusion types and may, to some degree, contribute to the severity of a malocclusion and an appropriate relationship of the mesiodistal widths of the maxillary and mandibular teeth favors optimal post-treatment results. So these results improved that the Bolton analysis is important and should be considered when diagnosing, planning, and predicting prognosis in clinical orthodontics.

Key Words: Tooth size discrepancy, Bolton ratio, Sulaimani population.

INTRODUCTION

Orthodontic treatment comprises different phases with unique characteristics and challenges. The orthodontic “finishing” phase is recognized for the multitude of details necessary to achieve an excellent result. In some cases, the finishing phase is very difficult, requiring the production of complicated biomechanical forces to reach a satisfactory orthodontic solution. Early pioneers of orthodontics realized the importance of the harmonious relationship between the teeth in the same arch and between arches. This phase of the orthodontic problem had been studied quantitatively by different investigators (1-5). The crown size of the teeth especially the mesiodistal width is one of the significant attribute of the normal occlusion and it is also important to study the dental characteristics of the population so as to trace the on going process of evolutionary trend (6). A specific dimension relationships must exist between the maxillary and mandibular teeth to ensure proper interdigitation, overbite, and overjet and because that the patients with interarch tooth size discrepancies require either removal or addition of tooth structure to open or close spaces in the opposite arch, it is important to determine the amount and location of tooth size discrepancy before starting treatment (7). In contrast to the progress that has been made in recent decades in the field of orthodontic treatment, especially in fixed appliances, diagnostic aspects have not undergone such extensive development. Essential diagnostic elements such as tooth-size harmony and cephalometric analysis have not been the focus of research, and this has led to few studies being published in this field (5). Orthodontists have used several methods to detect interarch tooth size discrepancies in patients presenting for orthodontic treatment. Most methods, including Kesling’s diagnostic setup (8), Neff’s anterior coefficient (9) are not commonly used. The Bolton analysis (1-2) based on the ratios between the mesiodistal tooth diameter sums of the mandibular and the maxillary dentitions, remains the most recognized and widely used method for detecting interarch tooth size discrepancies (10-12). The Bolton analysis is considered to be a good indicator for evaluating the degree of intermaxillary tooth-size harmony, but the
possibility of ethnic variation of these values should be examined. Thus, the aim of this study was to calculate both the anterior and overall ratios of mandibular and maxillary tooth sizes for a kurdish sample of class II malocclusion and to compare these ratios with the data from the Bolton and Arabic studies (16,17). Discovery during the finishing stages could lead to embarrassing delays in the completion of treatment, or even worse, to a compromised result. Therefore, the ability to analyze the proportionality of the maxillary and mandibular teeth is an important diagnostic tool and one that would be best used at the initial diagnostic stage. Bolton, (1958) published his work on interpreting MD tooth size diameter and their effect on occlusion, Bolton selected 55 cases with excellent occlusion, 44 cases had been treated orthodontically (non extraction). He concluded that an overall ratio of 91.3 and an anterior ratio of 77.2 were necessary for proper coordination of the maxillary and mandibular teeth. Dahlberg, (13) in early 20th century explained the role of genes and their possible effect on dental characters where genes were responsible for the occurrence of a certain dental trait in a population and its absence in another population. He pointed out that because genes are not freely exchanged between populations (due to geographic, language, religious, and other social reasons) the frequencies and manifestations of dental characters are not the same in between various ethnic groups. Potter et al. (14) believed that the inheritance of mesiodistal diameter and dental occlusion is according to polygenic system where the action of many genes together with environmental factors will give the final result (phenotype) of the dental trait. Doris et al. (15) found that: 1-Tooth morphology is under rigid genetic control. 2-The genes that determine whether or not the morphologic traits will be expressed are independent of each other. Other studies were directed towards the effect of environmental factors on dental characters like: Bailit, (16) found that the environmental factors clearly influence tooth size, but little is known about specific environmental conditions that are associated with the size of the tooth. Some data suggest that children of lower socioeconomic class have smaller teeth but the evidence is not very convincing. The evidence on other factors such as climate, systemic diseases and nutrition are equally ambiguous. If these environmental associations indeed exist, they must be of relatively small magnitude. Hikmat and Farhan, (17) an augmented environmental observed effect on dental occlusion in general as growth and development proceeded from the primary to the mixed dentition stage. Nevertheless, non genetic environmental factors play an important role in the prenatal period as well. Among these the maternal effects have a major part. Some investigators (18-21) have noted a secular trend toward an increase in tooth size with succeeding generations, their data showed that primitive civilization exhibited a significant degree of wear or attrition, probably the result of more vigorous mastication of harder food stuff than is commonly associated with modern man. Therefore, they found that teeth dimensions of sons were greater than those for girls. Classification of Malocclusion The classification of static, morphologic occlusion and malocclusion has been of interest to dentistry for at least a century because this classification plays several important roles (22). 1- classification aids in the diagnosis and treatment planning of malocclusions by orienting the clinician to the type and the magnitude of the problems and possible mechanical solutions to the problems. 2- classification facilitates communication between specialists. Angle, (1899) described three groups: 1) Class I Or Neutrocclusion: The mesiobuccal cusp of the upper first molar occludes with the mesiobuccal groove of the lower first molar, in practice discrepancies of up to half a cusp width either way also included in this category. 2) Class II Or Distocclusion: The mesiobuccal cusp of the lower first molar occludes distal to class I position, this is also known as post normal relationship. 3) Class III Or Mesiocclusion: The mesiobuccal cusp of the lower first occludes mesial to class I position, this is also known as prenormal relationship. MATERIALS AND METHODS The sample of the study was collected from patient attending orthodontic clinic in the college of dentistry, Sulaimani University aged 14 – 25 years old. Each of them were seated in upright position and examined extraorally to identify the skeletal relation according to Foster method and then intraorally to identify the molar relation according to Angle’s classification, they should be class II malocclusion (extraorally and intraorally) otherwise it was excluded. After examining more than 200 patients 53 cases were selected, The materials consisted of stone casts of the dentition of 53 patients (males and females), 30 of them class II division 1 (15 male and 15 female) and the remaining 23 casts were class II
division 2 (12 male, 11 female) who presented with complete eruption of permanent mandibular incisors, canines, premolars and first molars, as well as maxillary canines, premolars and first molars, presented with no proximal caries or fillings, morphological anomalies, missing teeth, proximal or occlusal abrasion, or bruxism. The mesiodistal width of a tooth was obtained by measuring the greatest distance between contact points on the proximal surfaces. A pointed Digital Vernier Caliper (0.02 mm accuracy) will be inserted from the buccal surface with instrument held at right angle to the long axis of the crown. The teeth measured are the mandibular permanent central and lateral incisors, the maxillary and mandibular permanent canines, the maxillary and mandibular premolars and maxillary and mandibular 1st permanent teeth. The following measurements have been undertaken: The MD width of the 12 maxillary teeth (first molar to first molar) were totaled and compared with the sum derived by the same procedure carried out on the 12 mandibular teeth, the ratio derived between the two is the percentage relationship of mandibular arch length to maxillary arch length. The same procedure was carried out to analyze the six anterior teeth from canine – canine according to Bolton analysis as followed:

\[ \text{Overall ratio} = \frac{\text{Sum mandibular [12]}}{\text{Sum maxillary [12]}} \times 100 \]
\[ \text{Anterior ratio} = \frac{\text{Sum mandibular [6]}}{\text{Sum maxillary [6]}} \times 100 \]

Statistical analysis of the collected data was performed using SPSS software version 12.

RESULTS

Table 1 shows means, standard deviation, minimum, maximum and ranges for tooth size analysis for both ratios for males and females separately for both types of class II malocclusion. And reveal there were no significant differences between male and female ratios (anterior and overall ratios) for both types of malocclusions (division 1 and division 2), table 2 shows the means, standard deviations and ranges for tooth size ratio observed for combined males and females’ sample, so that mean anterior ratio for class II division 1 was 78.594, and overall ratio was 92.106, again there were no significant differences in both ratios.

DISCUSSION

The overall and anterior ratios were consistently larger in males than in females regardless of race, but not significant and this come in accordance with Nie and Lin, found that when tooth size ratios were compared, there were no significant differences between class II division I and class II division 2, also they suggest that the tooth size discrepancy between maxillary and mandibular teeth may be one of the important factors in the cause of malocclusions, especially in class II and class III malocclusions.

Smith et al, concluded that there were significant differences in the overall and anterior ratios between whites, blacks, and Hispanics suggest that population specific standards are necessary for clinical assessment.

Our result is in contrast to Smith et al; found significant gender differences for both ratios. This difference may be attributed to the difference in the ethnic group, age group variation and sample size. Crosby and Alexander found that there were no significant differences among class II division 1, and class II division 2 while another study done on Croatian subject reveal that there were significant gender difference in anterior ratio.

Salem reported a larger anterior and overall ratio for the both types of class II malocclusion in an Arab sample in Baghdad city since, anterior and overall ratio for class II div.1 was 78.04 and 92.08 while for class II div.2 was 78.743 and 91.603. Finally, Intermaxillary tooth size ratios may vary in different malocclusion types and may, to some degree, contribute to the severity of a malocclusion and an appropriate relationship of the mesiodistal widths of the maxillary and mandibular teeth favors optimal post-treatment results. So these results improved that the Bolton analysis is important and should be considered when diagnosing, planning, and predicting prognosis in clinical orthodontics.

REFERENCES

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Table 1: Descriptive statistics of the tooth size ratio in both males and females in class II division 1 and class II division 2 groups.

<table>
<thead>
<tr>
<th>Tooth Ratio</th>
<th>Sex</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Ratio</td>
<td>Cl II div.1</td>
<td>Male</td>
<td>91.453</td>
<td>1.714</td>
<td>89.029</td>
<td>93.305</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>91.322</td>
<td>1.28</td>
<td>89.553</td>
<td>93.683</td>
</tr>
<tr>
<td></td>
<td>Cl II div.2</td>
<td>Male</td>
<td>91.274</td>
<td>1.584</td>
<td>89.348</td>
<td>93.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>91.44</td>
<td>1.38</td>
<td>89.64</td>
<td>94.29</td>
</tr>
<tr>
<td>Anterior Ratio</td>
<td>Cl II div.1</td>
<td>Male</td>
<td>78.49</td>
<td>1.685</td>
<td>76.19</td>
<td>81.379</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>77.207</td>
<td>3.149</td>
<td>72.474</td>
<td>81.962</td>
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<tr>
<td></td>
<td>Cl II div.2</td>
<td>Male</td>
<td>78.152</td>
<td>1.86</td>
<td>75.36</td>
<td>80.348</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>78.35</td>
<td>2.46</td>
<td>73.8</td>
<td>81.2</td>
</tr>
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</table>

Table 2: Tooth size ratio for combined males and females in class II division 1 and class II division 2 groups.

<table>
<thead>
<tr>
<th>Tooth Ratio</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>t-test</th>
<th>P value</th>
</tr>
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<td>Overall Ratio</td>
<td>Cl II div.1</td>
<td>91.387</td>
<td>1.487</td>
<td>89.029</td>
<td>93.683</td>
<td>4.654</td>
<td>0.078</td>
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<td></td>
<td>Cl II div.2</td>
<td>91.35</td>
<td>1.462</td>
<td>89.348</td>
<td>94.29</td>
<td>4.942</td>
<td>0.661</td>
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<tr>
<td>Anterior Ratio</td>
<td>Cl II div.1</td>
<td>77.848</td>
<td>2.566</td>
<td>72.464</td>
<td>81.962</td>
<td>9.498</td>
<td>0.078</td>
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<td>Cl II div.2</td>
<td>78.249</td>
<td>2.11</td>
<td>73.8</td>
<td>81.2</td>
<td>7.4</td>
<td>0.661</td>
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</table>

All the measurements are statistically not significant at p> 0.05

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Table 3: Comparison of the tooth size ratio between males and females in class II division 1 and class II division 2 groups.

<table>
<thead>
<tr>
<th>Malocclusion type</th>
<th>Tooth Ratio</th>
<th>Male Mean</th>
<th>S.D.</th>
<th>Female Mean</th>
<th>S.D.</th>
<th>T-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II division 1</td>
<td>Overall Ratio</td>
<td>91.453</td>
<td>1.714</td>
<td>91.322</td>
<td>1.28</td>
<td>0.233</td>
<td>0.817</td>
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<td></td>
<td>Anterior Ratio</td>
<td>78.49</td>
<td>1.685</td>
<td>77.207</td>
<td>3.149</td>
<td>1.361</td>
<td>0.184</td>
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<tr>
<td>Class II division 2</td>
<td>Overall ratio</td>
<td>91.274</td>
<td>1.584</td>
<td>91.44</td>
<td>1.38</td>
<td>0.306</td>
<td>0.761</td>
</tr>
<tr>
<td></td>
<td>Anterior ratio</td>
<td>78.152</td>
<td>1.86</td>
<td>78.35</td>
<td>2.46</td>
<td>0.241</td>
<td>0.810</td>
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</table>

* All the measurements are statistically not significant at p > 0.05