A Comparative Study of Intermolar Arch Width before and after Orthodontic Treatment in Alignment Phase among Class II Div-I Patients

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ABSTRACT
For an orthodontist, changes in the width of the arch caused by treatment with fixed appliances are important. Understanding these changes is critical to your physician's planning for treatment.

Aim: The purpose of the study was to compare and determine the width of the inter- molar arch in cases of class II, division 1 before and after six months after fixed orthodontic treatment.

Study Design: A cross-sectional intervention study.

Place and Duration: In the Orthodontics department of Jam Ghulam Qadir Govt. Hospital, Hub Govt of Balochistan and Bhitai Dental and Medical College Mirpurkhas, for six-months duration from July 2021 to December 2021.

Methods: 200 Class II Division 1 malocclusion patients were included by the purposive non- probability technique of sampling. 14 to 28 years was the patients age range. The impressions of the upper arch were made before and six months after orthodontic treatment, and the maxillary inter-molar width was measured. Standard 0.012 Nitinol to 0.019x0.028 arch wires were used. The width of the inter-molar arch was taken as the transverse distance from the central fossa of the 1st molar on one side of the same arch to the central fossa of the 1st molar on the same arch of other side.

Results: 200 Class II Division 1 malocclusion patients were included (120 males and 80 females) with 14-28 years of age range and 18.24 ± 2.8 years of mean age. The mean values of the inter-molar width in the entire sample were 46.01 mm ± 2.58 mm in T1 and 48.201 mm ± 2.70 mm in T2 (Table 2). The mean width of the inter-molar arches in men and women before treatment was 43.7± 2.2 mm and 46.2 ± 2.8 mm. Though, the mean T2 inter-molar arch width after treatment was 47.1 ± 2.3 mm in women and 48.3 ± 2.7 mm in men.

Conclusion: There was an average rise in the width of the inter-molar arch by 1.7 mm before and after treatment, therefore the orthodontist should consider the mechanics of expanding the arch, especially when the treatment plan does not include extractions.

Keywords: width of the inter-molar arch, shape of the arch, malocclusion class II division 1

INTRODUCTION
Scientists have described historically arches in dental practice in simple geometric terms such as parabolas, ellipse and parts of circles connected by modified spheres or straight lines. The supposed ideal teeth arrangement was well-defined geometrically by the angle teeth as the occlusal line1-3. The dimensions of the dental arch are of particular interest to dentists and orthodontists. When defining the correct dental width of arch in people, the inter-molar width (IMW) is an important measure that helps in the treatment planning and diagnosis of orthodontic patients, particularly those necessitating expansion as an alternative to premolars extraction with narrow dental arches4. Orthodontic treatment can alter the width, length and height of the arch; therefore, it is very important to understand the dimensions of the dental arch5. Dental arches have been examined by means of various reference points and measurements, counting but not restricted to inter molar widths, inter premolar and inter canine widths also between fossae or cusps. Pons index is the most commonly used method of measuring the inter-molar widths5. Tajik and Mushiag assessed the mean inter-molar maxillary widths at 34.6 mm, 34.5 mm, 30.9 mm, 34.18 mm and 34.7 mm and the mean inter-canine widths were 24.16 mm, 24.5 mm, 24.6 mm, 23.05 mm and 23.9 mm respectively for the groups of subdivisions Class-II division-II, Class-II division-I, Class-I and subdivision of Class II and Class III5.

The shape and proportions of the dental arches have a significant effect on the planning and diagnosis of orthodontic treatment, and affect the available space, tooth aesthetics and tooth stability6. The change in the size of the arch width includes the entire alveolar process development and insignificant increase in the skeletal width, especially the mandibular arch. Exactly as the teeth erupt, the maxillary alveolar processes diverge; The progression of the mandibular alveolar process is extra parallel. Overall, maxillary growth is much greater and can be more easily altered during treatment6. Knowing the arch dimensions is valuable in anticipating future orthodontic problems, smooth occlusion changes in mixed dentition and in the correct formation of a temporary malocclusion7. For an orthodontist, changes in the width of the arches resulting from treatment with fixed appliances are important. Understanding these variations is of paramount significance for the practitioner in relations of treatment preparation. The purpose of the study was to compare and determine the width of the inter-molar arch in cases of class II, division 1 before and 4 months after fixed orthodontic treatment.

METHODS
This is a cross-sectional study held in the Orthodontics department of Jam Ghulam Qadir Govt. Hospital, Hub Govt of Balochistan and Bhitai Dental and Medical College Mirpurkhas, for six-months duration from July 2021 to December 2021. 200 Class II Division I malocclusion patients were included by the purposive non- probability technique of sampling. 14 to 28 years was the patients age range. The impressions of the upper arch were measured before and six months after orthodontic treatment, and the maxillary inter-molar width was measured. The selected cases did not have an anterior or posterior open bite or history of orthodontic treatment. Extraction was not performed prior to the commencement of orthodontic treatment. Before starting the treatment, measurements of the maxillary arch were made and the maxillary inter-molar width was calculated by means of digital caliper with an accurateness of 0.01 mm. After six months of orthodontic treatment, the procedure was repeated. Standard 0.012 Nitinol to 0.019x0.028 arch wires were used. All evaluations were repeated after 4-weeks by the same investigator to assess the measurement error. The width of the inter-molar arch was taken as the transverse distance from the central fossa of the 1st molar on one side of the same arch to the central fossa of the 1st molar on the same arch of other side. The data obtained was reviewed, edited and verified and analyzed with SPSS 22.0.
Method: For calibration, both researchers performed all assessment were accomplished on 20 dental models and then comparison was done.

RESULTS
200 Class II Division 1 malocclusion patients were included (120 males and 80 females) with 14-28 years of age range and 18.24 ± 2.8 years of mean age. Table 1. The common age group is 15 years (24.5%). The most common age is 15 for women and 18 for men.

Table 1: shows the patients mean age

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>14</td>
<td>28</td>
<td>18.24</td>
<td>2.80</td>
<td></td>
</tr>
</tbody>
</table>

The mean values of the inter-molar width in the entire sample were 46.01 mm ± 2.58 mm in T1 and 48.201 mm ± 2.70 mm in T2 (Table 2). The mean width of the inter-molar arches in men and women before treatment was 43.7 ± 2.2 mm and 46.2 ± 2.8 mm.

Table 2: shows the mean arch widths of T1 and T2

<table>
<thead>
<tr>
<th>Arch Width</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>48.201</td>
<td>2.70</td>
</tr>
<tr>
<td>T2</td>
<td>48.01</td>
<td>2.58</td>
</tr>
</tbody>
</table>

Table 3: shows the Mean inter-molar width pre-treatment

| Mean inter-molar arches width males | 43.7 | 2.2 |
| Mean inter-molar arches width females | 46.2 | 2.8 |

Table 4: shows the Mean inter-molar width post-treatment

| Mean inter-molar arches width males | 48.3 | 2.7 |
| Mean inter-molar arches width females | 47.1 | 2.3 |

It was found that the most common value of the inter-molar arch before treatment was 45 mm in women and 46 mm in men, while the most common value of the inter-molar arch width after treatment was 48 mm in both men and women, both men and women. The paired sample t Test was used to determine before and after treatment intermolar arch widths to evaluate the difference significance. The results exhibited a substantial rise in the width of the arch four months after placement of appliance, value of p=0.00 is considered significant (Table-V).

Table 5: shows the paired sample t-test

<table>
<thead>
<tr>
<th>Arch width of T1 &amp; T2</th>
<th>N</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200</td>
<td>0.970</td>
</tr>
</tbody>
</table>

DISCUSSION
In our study, 18.24 ± 2.8 years was the patients mean age. There were 120 women (60%) and 80 men (40%). The highest age of recurrence was 15 years for women and 18 years for men. The width of the inter-molar arch is usually determined by age. All the subjects were in the stage of permanent dentition, but most patients still had a margin of residual growth, so we certainly cannot do comparison of the inter-molar width of this study with other researches. The mean values of the inter-molar width in the entire sample were 46.01 mm ± 2.58 mm in T1 and 48.201 mm ± 2.70 mm in T2. The mean width of the inter-molar arches in men and women before treatment was 43.7 ± 2.2 mm and 46.2 ± 2.8 mm. Though, the mean T2 inter-molar arch width after treatment was 47.1 ± 2.3 mm in women and 48.3 ± 2.7 mm in men. The most common values for the inter-molar arch width across the sample were 46 mm in T1 and 48 mm in T2. The most common values for the inter-molar arch width across the sample were 45 mm in T1 and 47 mm in T2. In the transitional dentition, a greater increase in the width of the arch occurs in the maxilla than in the mandible. The change in inter-molar width from adolescence to adulthood varies with the longitudinal pattern; while some researchers report increases, others find no substantial variations for men and women, and few show decreases in women.

REFERENCES