ORIGINAL ARTICLE

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 4 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 measured 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 line[1-3]. 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 arches[4]. Orthodontic treatment can alter the width, length and height of the arch; therefore, it is very important to understand the dimensions of the dental arch[5]. 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. Ponts index is the most commonly used method of measuring the inter-molar widths[6]. Tajik and Mushtaq 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 sub-divisions Class-II division-II, Class-II division-I, Class-I and subdivision of Class II and Class III[7].

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 stability[8]. 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 treatment[9]. 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 malocclusion[10]. 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 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 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 calliper 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 49(24.5%). The most common age is 15 for women and 18 for men.

Table-1: shows the patients mean age

	N	Minimum	Maximum	Mean	St. Deviation
Age	200	14	28	18.24	2.80
Valid	200				

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

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Arch Width T1	200	38.00	55.00	46.014	2.58
Arch Width T2	200	42.00	57.10	48.201	2.70

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

	Mean	Std. Deviation
Mean inter-molar arches width males	43.7	2.2
Mean inter-molar arches width females	46.2	2.8

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.

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

	Mean	Std. Deviation
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 width 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

	N	Correlation
Arch width of T1 & T2	200	0.970

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[11-12]. 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[13-14]. Alhajrasi and Omar institute that men usually have bigger arches than women. The greater width of the molar arch in Class II Division-I malocclusion patients in our study can be attributed to racial differences, but differences in measurement method may also subsidise to differences in arch width[15-16].

The height and crown width were not significantly correlated with the various groups of arch length, arch circumference, and maxillary and mandibular arch width[17]. Machida and Tsujino k determined the arch width in longitudinal changes from childhood to adolescent. The maxillary 1st molar width increased gradually till the age of 15 with no substantial changes after that. The mandibular 1st molars width remains nearly constant during the study. In earlier researches, teeth models of class II division-II teeth had larger than average mandibular and maxillary inter-canine distances and had normal inter-molar distances. These researches have inadequate sample size, which makes their legitimacy questionable. There were no differences in the mean dimensions of the mandibular and maxillary dental arches and the width of the alveolar between the, class II division-II, class II division-I and the normal occlusion[18-19].

Shapiro measured the inter-canine and inter-molar width of 90 cases ten years after retention and the results were compared at the conclusion of the treatment and after treatment[20-21]. He concluded that the inter canine width of the mandible strongly tended to return to pre-treatment size in all groups, i.e., with and without extraction. In contrast, Walter found that by examining the plaster models of 103 North American Caucasian patients between 6-36 of age, 1-14 years after retaining devices removal, the dental arch can be lengthened or widened permanently[22-23].

This study has a limitation that we did not assess the width of the inter-molar arch during the post-retention and post-treatment time to determine this study results stability. Further research must be premeditated to evaluate these changes. In addition, variations in the width of the inter-molar arch in extractions also require additional research.

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. Though the rise in inter-molar width is significant, more research is needed to assess the amount of expansion with the use of heavy wire in extraction and non extraction cases and the stability of this expansion after treatment.

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