

# Maxillary dental arch width changes by extraction and non-extraction orthodontic treatment among angle's class I malocclusion patients

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## ABSTRACT:

This study examined the pretreatment and post treatment dental arch width changes between the extraction and non-extraction cases in Angle's class I patients. Sixty pre-treatment and post-treatment dental casts from 30 extractions and 30 non-extractions participants were selected for the study. The inter-canine and inter-molar maxillary arch width was measured by Vernier gauge caliper. Unpaired t-test was performed to evaluate the arch width changes between extraction and non-extraction groups. The results showed that inter-molar and inter-canine maxillary arch widths in non-extraction group were slightly higher than the extraction group in both pre- and post-treatment, but the differences were not statistically significant. In conclusion, the extraction and non-extraction techniques used in orthodontic treatment did not change the inter-canine and inter-molar arch width.

**KEY WORDS:** Maxillary arch width change, extraction case, non-extraction case, inter-canine width, inter-molar width.

## INTRODUCTION

Assessment of the dental arch change before and after orthodontic treatment is useful for the clinician to understand the changes in the treatment as well as retention planning. Vertical or transverse arch mal-relationships that includes crowding, local irregularities and spacing were responsible for class I malocclusions that can be treated by the extraction or non extraction in the permanent dentition. Myser et. al.<sup>1</sup> found that inter-molar width respond differently in extraction and non-extraction orthodontically treated cases and Uhde et. al.<sup>2</sup> reported that the mean inter-canine widths increase in the maxillary and mandibular arch with treatment in all types of malocclusion and decreased after treatment toward the original values. Furthermore, there is a little effect of the types of treatment on the net change in inter-canine arch width.<sup>3</sup> It is therefore considered as an important factor for determining the success and stability of orthodontic treatment. Stability and esthetics are greatly influenced by arch width change in both extraction and non-extraction orthodontic treatment and the arch width change in canine and molar region after orthodontic treatment causes instability.<sup>4</sup> Therefore, the width changes in canine and molar region following orthodontic treatment in both extraction and non-extraction groups in class I patients are necessary to get an idea about stability of the treatment.

The preservation of inter-canine and inter-molar distances is also needed for maintaining the post treatment stability because they stand for a position of muscular balance for the patient.<sup>5,6</sup> Furthermore, It has been suggested that in the extraction cases, the canines can be move to the buccal side if they are move distally into the extraction sites and thereby they occupy a wider part of the arch.<sup>7</sup> Furthermore, the stability of expansion in the canine region usually between the extraction and non-extraction cases.<sup>8,9,10</sup> Although the above literatures have provided informations regarding the effects

of extraction and non-extraction therapy, the finding on the amount of inter-arch changes of class I extraction and non-extraction therapy display variation. This can be attributed to the different treatment modalities, malocclusion type and sample sizes. However, it is needed to perform homogenous study in the terms of malocclusion type and treatment mechanics. Therefore, the purpose of the study is to compare the dental arch width changes in Angle's class I malocclusion cases following extraction and non-extraction orthodontic treatment.

## MATERIALS AND METHODS

A total of thirty extracted and 30 non-extracted cast model which were prepared from 60 orthodontic patients were included in this descriptive cross sectional study. Among the patients, 8 were males and 22 females and the mean ages were 17.73 years (Age range: 13 to 30 years) for the extraction group and 21.67 years (Age range: 20 to 34 years) for non-extraction group. The inclusion criteria were as follows: dental casts of the patients having class I malocclusion, pretreatment dental casts having all permanent teeth without any congenitally missing teeth or any missing permanent teeth, post-treatment dental casts of four premolar extraction cases and non-extraction cases, none of the patient's casts had Quad Helix, a functional appliance, or a rapid palatal expander use as part of their orthodontic treatment.

Treatment procedure:

All patients were treated at Bangabandhu Sheikh Mujib Medical University by fixed edgewise appliance. Each patient was treated with stainless steel 0.018 x 0.025 inch Roth brackets and according to standardized moderate anchorage control. Non-extraction case, firstly leveling and alignment, then incisors apposition by elastic chain. The en-mass incisors retraction using 0.017 x 0.025 inch rectangular arch wire containing tear-drop loops activated 1 mm in every 3 weeks. In extraction of four first premolars cases, individual sliding of canine using round stainless steel wire 0.016 inch for canine retraction. It was done by using elastic chain which was changed in every 3 weeks. Then, the en-mass incisors retraction using 0.017 x 0.025 inch rectangular arch wire containing tear-drop loops activated 1 mm in every 3 weeks, in this regimen of activation produce initial force of 150 gm per side. The arch wire activate with tip back bend mesial to the first molars. After finishing and completion of the treatment, another study cast was taken for each sample or patient. So, pre and post treatment study casts were achieved. A Vernier gauge caliper was used to measure the inter-molar and inter-canine widths on the upper and lower dental casts. The transverse distance between the mesio-buccal cusp tips of the right and left first molars and cusp tips of the right and left canines were measured in order to determine the inter-molar, inter-canine width (figure 1), which is originally based on a

previous study (Figure 1).<sup>11</sup> All the measurements were conducted by same person. Double testing of the same sample was done by the researcher herself.

The statistical analysis was performed using the SPSS software package (Statistical Package for Social Science, version 22.0). Data were analyzed by unpaired t-test and a value of  $p < 0.05$  was considered as statistically significant.

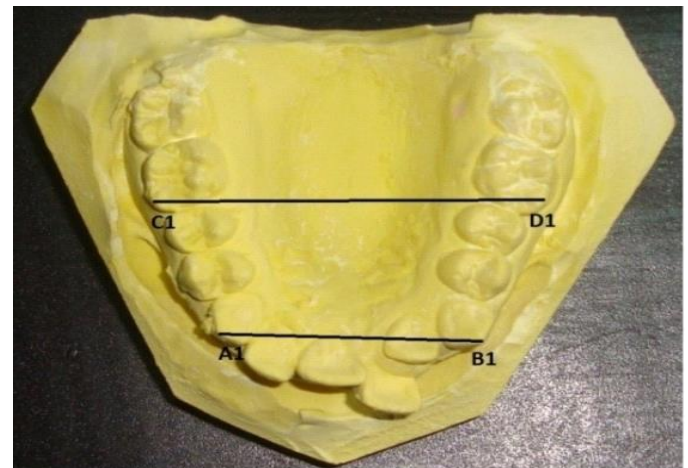
## RESULTS

Table 1 showed the comparison of the inter-canine and inter-molar arch width in both extraction and non-extraction groups. The maxillary inter-molar and inter-canine arch width was high in non-extraction group when comparing to extraction group, but the differences were not statistically significant.

**Table-1: Comparison between non-extraction and extraction group paired 't' test (n=30 in each group)**

Maxillary Arch	Arch width Parameter	Extraction (n=30)	Non-extraction (n=30)	p value
Pre-treatment	Inter-canine	34.40±3.59	35.16±3.49	<b>0.082</b>
	Inter-molar	51.14±2.73	53.11±2.90	<b>0.066</b>
Post-treatment	Inter-canine	35.81±4.28	35.26±3.24	0.267
	Inter-molar	48.89±3.82	53.80±2.83	0.179

Figure 1. Methods for measuring the maxillary arch width



A1 B1 = Inter canine arch width Upper cast.  
C1 D1 = Inter molar arch width Upper cast.

## DISCUSSION

Orthodontic treatment to enhance patient's facial esthetics, functional efficiency and structural balance by means of extraction of teeth or non-extraction has been a controversial aspect since many years. Previous studies have reported that arch width were changes both during and after the orthodontic treatment.<sup>12,13</sup> However, the present study showed that the arch width (both inter-canine and inter-molar) were almost similar between preoperative and post-operative assessment in both extraction and non-extraction

groups. These findings were correlated with some of the previous studies.<sup>14,15,16</sup> Although, at the end of the treatment, maxillary inter-molar and inter-canine width were increased, but they were statistically non significant which was also supported by a previous study.<sup>17</sup> Furthermore, a previous study on changes in the form and dimension of dental arches resulting from extraction and non-extraction orthodontic treatment found that inter-canine arch width was increased in both groups and the inter-molar width decreased in both groups.<sup>18</sup> Moreover, another study that compared the inter-canine arch width between extraction and non-extraction treatment groups and found that during the post treatment there was an increase in inter-canine width both in extraction and non extraction group.<sup>19</sup> But in the present study, it was seen that, the maxillary inter-canine and inter-molar arch width were increased in both groups but the differences were not statistically significant. This is also supported by McNamara (2000).<sup>20</sup> The differences of the present study with that of previous studies might be due to the retraction of canines and molar into the wider space of the arch and variations in the use of arch wire, which was established by DeKock.<sup>21</sup> Therefore, it can be considered that the retention of finished orthodontic treatment is the great challenge for orthodontist. To maintain a proper stability in post treatment phase, it is important to maintain the arch width according to the arch form. The study findings will give some important information for the further active treatment plan and retention protocol.

### CONCLUSION

The extraction and non-extraction techniques used in orthodontic treatment did not change the inter-canine and inter-molar arch width.

### CONFLICT OF INTEREST:

Authors declare no conflict of interest.

### ETHICAL ISSUE

The research protocol was approved by the committee and permission for the study was taken from the Institutional Review Board (5618/2014) of Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka-1000.

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