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Comparison of arch width changes in maxilla using two different types of closing loops

Kulsum Guroo and Mohammad Mushtaq

Abstract
Objective: To compare the changes in the arch width in maxilla using two different closing loops for space closure.
Materials and method: 30 patients with class II div 1 malocclusion treated with first bicuspid extraction were randomly divided into two groups. In Group I tear drop shaped closing loop was given. In Group II closed vertical loop was given for space closure. The duration of the study was four months. Study models were taken at the start (T_0) and end of study period (T_4). The intercanine and intermolar arch width measurements were measured using a digital caliper. Paired samples t-test was used to evaluate the treatment changes within each group. To compare the changes between groups, unpaired t-test was performed.
Results: A statistically significant decrease was seen in the intercanine width in group I. No differences were observed in intermolar width in both the groups.
Conclusion: Using different types of loops for space closure in extraction cases have different effect on intercanine width, whereas it does not have any difference in affecting the intermolar width.

Keywords: Arch width, intercanine width, intermolar width, closing loop, extraction cases

Introduction
The transverse or vertical arch malrelationships like crowding and local irregularities are common causes of malocclusions and are usually treated by extraction or nonextraction in the permanent dentition. Considerable controversy still surrounds the question of whether better long-term results are achieved by extraction or by non-extraction therapy. It is well established that increases in dental arch length and width during orthodontic treatment tend to return toward pretreatment values after retention [1-4]. some clinicians criticize extraction treatment by saying that it results in narrower dental arches when compared with nonextraction therapy [5]. Some researchers have documented that arch dimensional changes occur both with the orthodontic treatment after the extraction of teeth and with the nonextraction therapy [6, 7]. The maintenance of the pretreatment values for intercanine and intermolar distances was suggested as the key to posttreatment stability because these values were believed to represent a position of muscular balance for the patient [8, 9].
Although the literature has provided information regarding the effects of extraction and nonextraction therapy on arch width, an attempt was made in this study to compare the changes in the arch width in extraction cases treated with two different closing loops.

Materials and methods
The study consisted of thirty patients, which were randomly divided into two groups. Group I received tear drop shaped loop and Group II received closed vertical shaped loop for space closure mechanics (Figure 1). The duration of the study was four months.

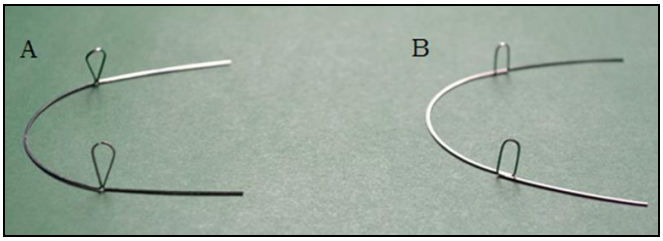

Fig 1: A) Tear drop shaped loop. B) Closed vertical loop

The *Inclusion criteria* were as follows: (1) Patients with Class II division 1 malocclusion, undergoing routine orthodontic treatment with 0.018 MBT- fixed appliances by extraction of upper first premolar were selected as participants. (2) Patients in between the age group of 15-25 years. (3) At the start of treatment, all patients were in the permanent dentition without any missing permanent teeth or congenitally absent teeth. (4) None of the patients had any type of adjunctive appliance such as a Quad Helix, a functional appliance, or a rapid palatal expander used as part of their orthodontic treatment.

Exclusion criteria included: Teeth with root resorption, congenitally missing teeth, dilacerated roots, periodontal pathologies or any systemic disorders that contraindicate orthodontic treatment.

Study models were collected at the beginning (T_0) and the end of study period after four months (T_4). 0.016×0.022 SS wire was used for the fabrication of loops. The dimensions of loops were standardized, with the dimension of 8mm height and 4mm width. The loops were activated 1mm per month in both the groups.

The intercanine and intermolar widths of the maxillary arches were measured using a digital caliper. The widths of the anterior and posterior parts of the maxillary dental arch were measured at the canine and the first molar regions from the most labial aspect of the buccal surfaces of those teeth, as described by Gianelly [5].

All statistical analyses were performed using the SPSS software package (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago) to analyze the data. For each variable, the arithmetic mean and standard deviation were calculated. Paired samples t-test was used to evaluate the treatment changes within each group. To compare the changes observed in both groups, independent samples t-test was performed. Study models were selected randomly and were remeasured by the same examiner. Random error was calculated using Dahlberg's formula [10]. Method error of the measurements ranged from 0.25 mm to 0.45 mm.

Results

The mean and standard deviation of intercanine width in group I and group II at T0 and T4 are shown in Table 1. The intercanine width in tear drop loop (group I) reduced significantly (p = 0.026), whereas in close vertical loop (group II) no significant changes were seen.

The comparative changes in intercanine width between the means of group I and group II from T0 to T4 are given in Table 2. The intercanine width reduced more in tear drop loop group with 2.0 mm (0.73), as compared with close vertical loop group in which 1.4 mm (0.65) of reduction was seen. These changes were statistically significant.

The mean and standard deviation of intermolar width in group I and group II at T0 and T4 are shown in Table 3. No significant changes were seen in both the groups.

The comparative changes in intermolar width between the means of group I and group II from T0 to T4 are given in Table 4. No significant changes were seen in intermolar width from T_0 to T_4 in both the groups.

The results are shown graphically using a bar diagram in Fig 2, 3 and 4.

Table 1: Intercanine width at T_0 and T_4 in Group I And Group II.

Intercanine width (mm)	Pre-Study (T_0) Mean (S.D)	Post-Study (T_4) Mean (S.D)	Paired t test	p value, significance
Tear drop loop (group I)	37.8 (2.01)	35.83 (2.09)	2.385	P = 0.026*
Close vertical loop (group II)	39.6 (1.94)	38.20 (2.38)	1.640	p = 0.115

p>0.05- not significant *p<0.05- significant **p<0.001-highly significant

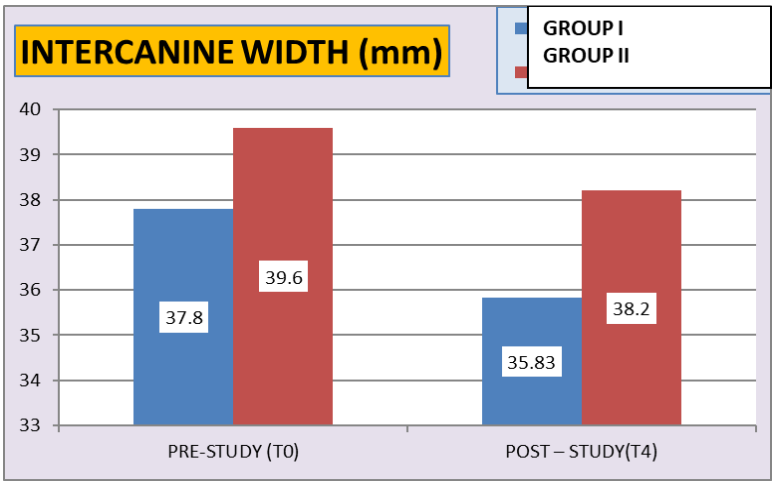

Fig 2: Intercanine width in Group I and Group II at T_0 and T_4.

Table 2: Comparison of intercanine width in Group I and Group II.

	Tear Drop Loop (Group I) $T_0 - T_4$	Close Vertical Loop (Group II) $T_0 - T_4$	Unpaired t test	p value, significance
Intercanine	Mean (S.D)	MEAN (S.D)		
width (mm)	2.0 (0.73)	1.4 (0.65)	t = 1.900	p = 0.0041*

p>0.05- not significant *p<0.05- significant **p<0.001-highly significant

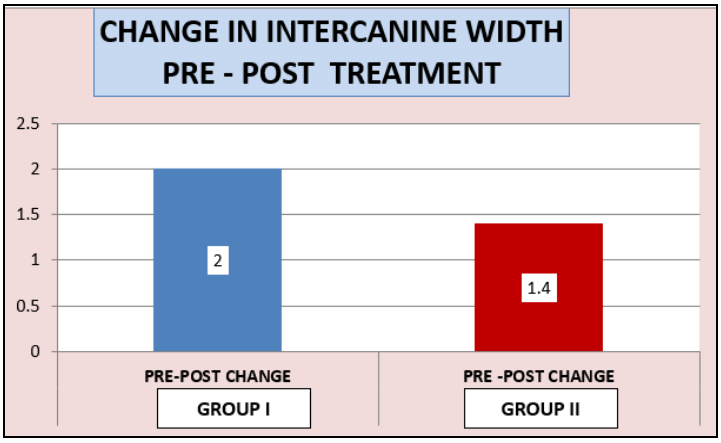

Fig 3: Comparison of intercanine width change in Group I and Group II from T_0 to T_4.

Table 3: Intermolar width at T_0 and T_4 in Group I and Group II.

Intermolar width (mm)	Pre-Study (T_0) Mean (S.D)	Post-Study (T_4) Mean (S.D)	Paired t test	p value, significance
Group I	42.79 (1.87)	41.75 (2.20)	1.248	P = 0.225
Group II	44.66 (2.57)	43.62 (2.86)	0.937	p = 0.359

p>0.05- not significant *p<0.05- significant **p<0.001-highly significant

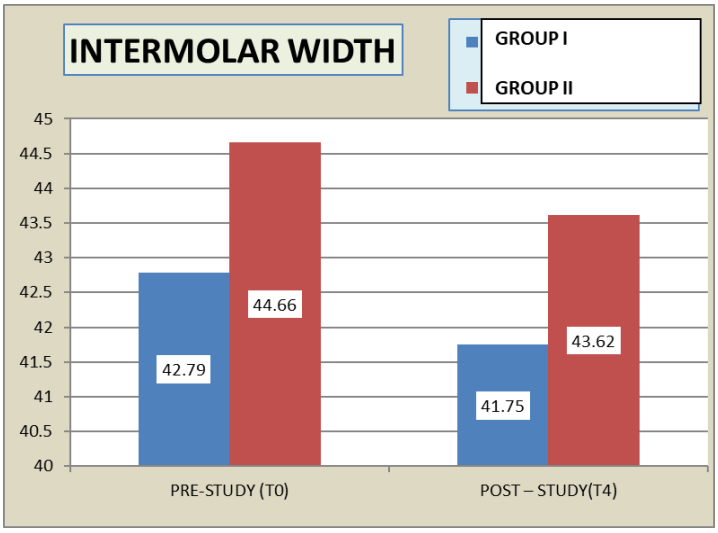

Fig 4: Intermolar width in Group I and Group II at T_0 and T_4.

Table 4: Comparison of intermolar width in Group I and Group II

	Group I $T_0 – T_4$ Mean (S.D)	Group II $T_0 – T_4$ Mean (S.D)	Unpaired t test	p value, significance
Intermolar width (mm)	1.04 (0.78)	1.04 (0.98)	t = 0.0	p = 1.000

p>0.05- not significant *p<0.05- significant **p<0.001-highly significant

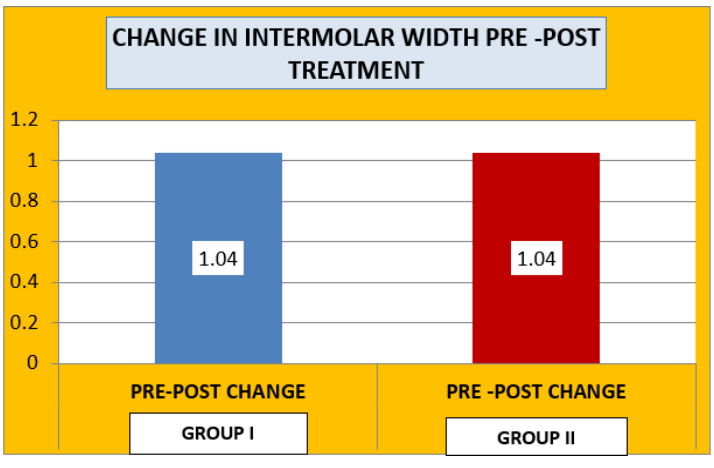

Fig 5: Comparison of intermolar width change in Group I & Group II from T_0 to T_4.

Discussion

It is well accepted that, during orthodontic treatment involving the extraction of teeth, arch dimensional changes occur and that these dimensions continue to change after active treatment [6, 7, 11, 12, 13].

This investigation was done to study the arch width changes in the extraction cases treated with two different closing loops viz Tear drop shaped loop and close vertical loop in the maxillary arch. Patients with class II division 1 malocclusion treated with maxillary first bicuspid extraction were taken in the study. Age was standardized such that the effects of growth and development on arch width were not of concern.

The data of this study revealed that the intercanine width in the maxillary arch reduced in both the groups. The decrease seen in group treated with tear drop shaped loop was statistically significant whereas non-significant in the group treated with closed vertical loop.

The intermolar width did not show any significant changes in both the groups.

Previous studies done by Bishara [14], Paquette *et al.* [11], reported narrower arches after extraction. In the study of Boley *et al.*, [15] the interarch changes of four premolar extraction cases were evaluated. According to their findings, maxillary intercanine widths increased one mm and the corresponding mandibular arch width increased 1.7 mm during treatment. Maxillary and mandibular intermolar widths decreased 1.7 and 2.1 mm, respectively.

In our study, the intermolar widths of both the groups were same after treatment i.e no significant changes were seen, this finding supports the view of Johnson and Smith [16] who stated that arch width at any particular location is maintained or slightly increased after extraction.

In our study, the intercanine width showed no significant change in the close vertical loop group in comparison to tear drop loop during the study. This could also be due to the different design of the loops used, since the design of the close vertical loop has a transverse step between the vertical legs which helps in maintaining the inter-canine width. On the other hand there is no transverse step in the tear drop loop design because of which there is reduction in intercanine width during the retraction.

Long term studies evaluating relapse have shown that expanding intercanine width from original dimension is unstable and also that an expanded intercanine width tend to return to its original position [17, 18]. Therefore it should be kept in mind during the treatment, not to alter the intercanine width.

Conclusion

The conclusions of this study are

- The different loop designs have different effect on the intercanine width.
- The intermolar width however does not show any change with different closing loops used.

However, future studies with various malocclusion groups, treatment mechanics, larger sample size and long-term changes in arch dimensions will be useful to study.

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