

Clinical Comparison of 3D Effect of Passive Goshgarian (TPA) and Passive Nance Button Appliance on Permanent Maxillary First Molar

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ABSTRACT

Background: Anchorage control is most important in clinical orthodontics. Both extra-oral and intra-oral anchorage can be used to prevent anchorage loss. The aim of this trial was to evaluate the change in position of first molar in three-dimension i.e inclination, rotation and vertical movement after giving Goshgarian and Nance palatal arch.

Material and Method: 40 Patients were recruited from orthodontic department. The patients were randomly divided into two groups Group A consisted of 20 patients with Nance palatal arch and Group B consisted of 20 patients with Goshgarian arch. Full arch strap up with 0.022 MBT prescription was done and the readings were taken in initial levelling and aligning stage.

Result: The mean differences of Molar inclination in Group A & Group B i.e. Goshgarian (TPA) arch were compared using unpaired t-tests such as (Mann-Whitney test, Levene's Test for Equality of Variance, t-test for Equality of Means) the p values are (p= 0.824, p=0.605, and p=0.794) respectively. The p values are (p=0.000, p=0.000, and p=0.000) respectively, for the mean difference of Molar rotation in Group A and Group B. The p values are (p= 0.688, p=0.688, and p=0.317) respectively which indicated that the results were statistically non-significant for molar vertical movement.

Conclusion: The result of both Nance button and Goshgarian (TPA) arch showed negligible change in molar inclination and molar vertical movement. The Goshgarian arch has better control over molar rotation than Nance palatal arch.

Keywords: Anchorage, TPA, Nance Button.

INTRODUCTION

Anchorage control is one of the most important key for achievement of success in clinical orthodontics. To get the appropriate anchorage, numerous anchorage devices are proposed and used for more than a century.¹ Anchorage is composed of units of

resistance. However, if this proves to be inadequate, it must be supplemented by other anchorage sources, either intraoral, extra oral, or both. Extra oral anchorages such as headgears or facemasks are the most powerful tools but they have a weak point that their effectiveness depends on the patient compliance. Inter-maxillary elastics also have the

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same disadvantage.² However intra oral anchorage devices are more preferred because of good compliance of patient. Intra oral auxiliary anchorage or auxiliary holding appliances are those adjunctive appliances that enhance anchorage by incorporating adjacent soft and hard tissue components, i.e. palatal bar, lip bumper, lingual bar.³

A modified maxillary lingual arch was described by Nance in 1947 and has since been commonly known as the Nance appliance (NA). The NA is simply a maxillary lingual arch that does not contact the anterior teeth, but approximates the anterior palate. The appliance is an effective space maintainer, but soft tissue irritation can be a problem. The acrylic portion can become embedded in the soft tissue if the palatal tissue hypertrophies because of poor oral hygiene or if the appliance is distorted.⁴

To overcome these disadvantages Robert A. Goshgarian in 1972, introduced the Goshgarian arch or transpalatal bar (arch). The TPA consists of a wire soldered to molar bands on either side and runs across the palatal vault, avoiding contact with the soft tissue.^{5,6} Initially in 1st and 2nd generation PEA, due to anterior bracket tip there was main threat to anchorage. To control anchorage, in the 3rd generation pre-adjusted edgewise (MBT™) prescription, the tip value in anterior segment were reduced as compared with earlier generations (1st & 2nd) PEA.⁷ Further, MBT have also recommended the use of lace backs and bend backs, thinner initial arch wires to control the anchorage along with these measures. However, clinicians frequently use intra oral anchorage devices such as TPA or Nance button as anchorage reinforcing devices.⁸ The efficacy of Nance button and TPA as passive anchorage reinforcing appliance have been studied individually, however comparative studies have been lacking. Hence this study was undertaken to evaluate the comparison of effects of passive transpalatal arch & Nance button on maxillary first molar in all three planes during initial levelling & aligning phase of treatment.

AIMS & OBJECTIVES

Aims

To clinically compare the change in position of permanent first molar in three dimensions after

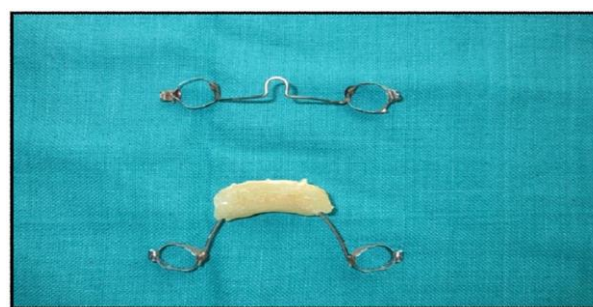
giving passive transpalatal arch and passive Nance button as anchorage reinforcing appliances during initial levelling and aligning phase of treatment.

Objectives

1. To evaluate and compare the change in position of permanent maxillary first molar in three dimensions as follows,
2. Inclination of permanent first molar
3. Rotation of permanent first molar
4. Vertical movement of permanent first molar (intrusion& extrusion)

MATERIALS AND METHODS

The in-vivo study was contrived to analyze the effectiveness of passive Nance Button and passive Goshgarian (TPA) arch as anchorage reinforcing appliance on permanent first molar in the pre-adjusted edgewise appliances during the initial levelling and aligning phase.



In Vivo Study:-

40 patients requiring bilateral symmetrical extraction of first premolar in maxillary arch & diagnosed as critical anchorage case, aged between 18-35 years reporting to the Department of Orthodontics and Dentofacial Orthopedics were selected for study. Patients with badly destructed or missing maxillary 1st molar were excluded from the study.

METHOD

Before treatment, signed consent forms were procured from all the patients. An OPG & alginate impression were recorded prior to first premolar extractions and after 3 months of initial levelling and alignment.

The patients were randomly divided into two groups.

Group A: This group consisted of 20 patients in whom anchorage reinforcing appliance used was passive Nance Button.

Group B: This group consisted of 20 patients in whom anchorage reinforcing appliance used was passive Goshgarian (TPA) arch.

Banding of permanent first molar and brackets placed with upper and lower teeth with 0.016 NiTi wire placed for initial alignment. Patient was discharged with necessary instructions and recalled after 4 weeks.

The following parameters were studied:--

1. 1st permanent maxillary molar inclination.
2. 1st permanent maxillary molar rotation.
3. 1st permanent maxillary molar vertical height.

All these parameters were recorded pre-treatment and after three months of levelling and alignment. An OPG was taken before First Pre-molar extraction and after three month of levelling and aligning phase for determination of maxillary molar inclination and molar vertical movement. Alginate impression was taken for determination of maxillary molar rotation.

After initial levelling and alignment, alginate impressions of the maxillary arch were once again

recorded and cast was poured out of it. All the measurements were done by the same individual to rule out the errors.

Statistical Analysis

The observations obtained in the study were subjected to statistical analysis, so as to get their interpretation. . The following statistical analyses were carried out in this study

- A '*p*' value of less than **0.05** was considered as statistically significant.

Mean values were calculated for the Molar inclination, molar rotation & molar vertical movement for both the groups i.e. Nance and Goshgarian (TPA) arch. Standard deviation was calculated for the Molar inclination, molar rotation & molar vertical movement for both the groups i.e. Nance and Goshgarian (TPA) arch.

- Paired t-test was used for Intra groups comparison i.e. Group A Nance Button and Group B Goshgarian (TPA) arch. Unpaired t-test, Mann Whitney U test, Levene's Test for Equality of Variances was used for the Inter group comparison of mean of Molar inclination, Molar rotation and Molar vertical movement of Nance Button and Goshgarian (TPA) arch.

RESULTS

Table 1: Pre treatment & post treatment values of Molar Inclination, Molar Rotation, Molar Vertical movement after applying Nance Button appliance group (Group A).

Group A	Sample	Mean		SD		SEM		P
		Pre	Post	Pre	Post	Pre	Post	
Molar Inclination	40	86.8000	49.4000	4.07116	3.90791	.64371	.84943	.735
Molar Rotation	40	60.8750	73.0500	4.26186	12.86408	.67386	2.03399	.000
Vertical Rotation	40	48.3250	86.6000	5.64046	5.37229	.89183	.61790	.172

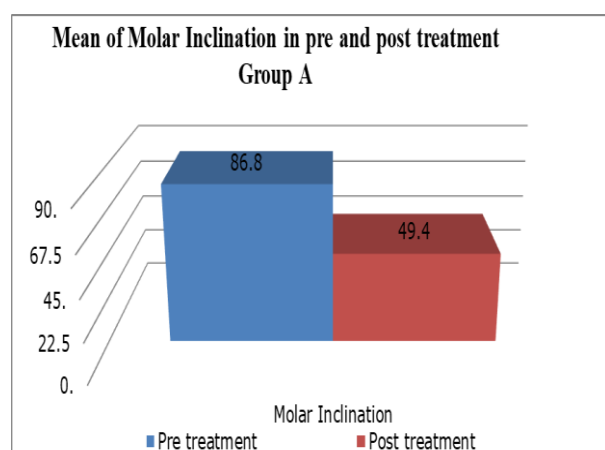
Table 2: Pre treatment & post treatment values of Molar Inclination, Molar Rotation, Molar Vertical movement after applying Goshgarian appliance group (TPA) (Group B).

GroupB	Sample	Mean		SD		SEM		P
		Pre	Post	Pre	Post	Pre	Post	
Molar Inclination	40	88.8250	88.8500	3.76139	3.95196	.59473	.62486	.968
Molar Rotation	40	61.6000	62.1500	5.96915	3.64129	.94381	.57574	.503
Vertical Rotation	40	48.9250	48.9500	6.57652	7.20737	1.03984	1.13958	.972

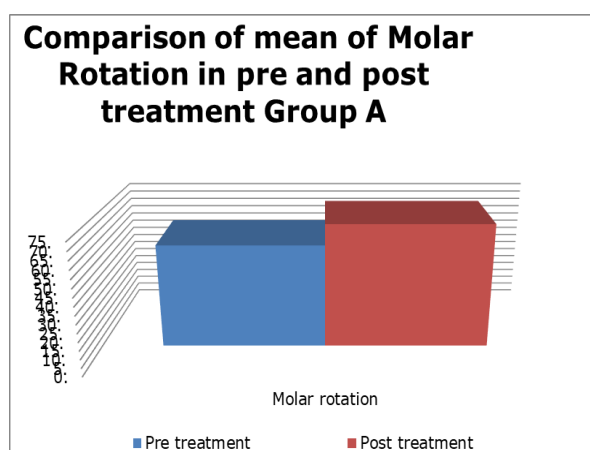
Table 3: Nance Button Appliance group Vs Goshgarian Appliance group (Group A Vs Group B) comparison of mean difference (pre treatment and post treatment mean) values.

Group Statistics						Mann-Whitney test (significance)	Levene's Test for Equality of Variances	t-test for Equality of Means
		N	Mean	Std. Deviation	Std. Error Mean			
Molar inclination	Nance	40	.2000	3.70862	.58638	.824	.605	.794
	Goshgarian	40	-.0250	3.97742	.62889			
Molar rotation	Nance	40	12.1750	11.74928	1.85772	.000	.000	.000
	Goshgarian	40	-.5500	5.14881	.81410			
Molar vertical movement	Nance	40	-1.0750	4.89053	.77326	.688	.688	.317
	Goshgarian	40	-.0250	4.41726	.69843			

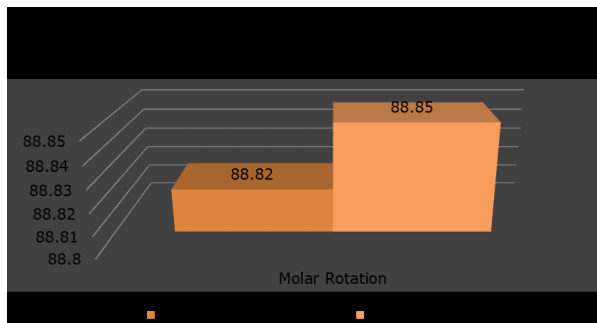
Graph 1: Comparison of mean of molar inclination in pre treatment and post treatment of Nance Button group (Group A)



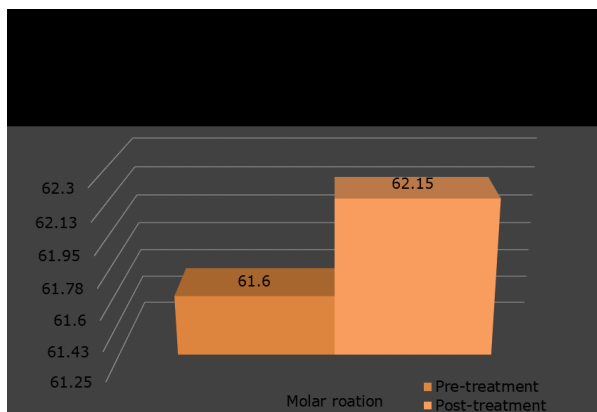
Graph 2. Comparison of mean of molar rotation in pre treatment and post treatment of Nance Button group (Group A)



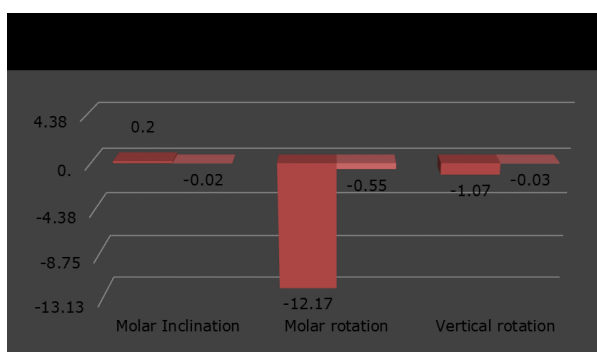
Graph 3: Comparison of mean of molar inclination in pre treatment and post treatment of Goshgarian appliance group (Group B).



Graph 4: Comparison of mean of molar rotation in pre treatment and post treatment of Goshgarian appliance group (Group B).



Graph 5: Nance Button group (Group A) Vs Goshgarian group (Group B) comparison of mean difference of all three parameters: Molar Inclination, Molar Rotation, Molar vertical movement.



DISCUSSION

Anchorage is the resistance to unwanted tooth movement and anchorage loss (AL) is a reciprocal

reaction that could obstruct the success of orthodontic treatment by complicating the anteroposterior correction of the malocclusion and possibly detracting from facial esthetics. A major concern when correcting severe crowding, excessive overjet, and bimaxillary protrusion is control of AL.⁹

To overcome the perceived inadequacies of the original Straight Wire Appliance, McLaughlin, Bennett, and Trevisi introduced the third generation pre-adjusted bracket system with the use of simple figure of eight ligature wires called lacebacks from the most distally banded molar to the cuspid along with light, continuous forces and bend backs. Since lighter forces and thinner wires are used in initial levelling and aligning phase of treatment, tip in the anterior bracket was reduced.⁸ However even after taking all these measures anchor molar may get taxed, hence Nance button and Goshgarian (TPA) Arch are routinely used intra oral anchorage appliances used to reinforce the molar anchorage. Literature search lacks the information regarding the effects of Nance button and Goshgarian (TPA) arch as anchorage reinforcing appliance while using MBT mechanotherapy in initial levelling and aligning phase of treatment.

Hence this study was undertaken to evaluate 3D effects of passive Nance button and Goshgarian (TPA) arch on permanent first molar during initial levelling aligning phase of treatment. A total number of 40 patients were selected, 20 for Nance button and 20 for Goshgarian (TPA) with age group of 18-35 years.

The following parameters were studied:-

1. 1st permanent maxillary molar Inclination
2. 1st permanent maxillary molar Rotation
3. 1st permanent maxillary molar Vertical movement

The measurements of all above parameters were collected, tabulated and subjected to suitable statistical analysis. Intra-group (pre and post treatment) mean value comparison was done using paired t-test. While inter-group (Group A and Group B) comparison was done using Mann-Whitney test, Test for Equality of Variance, t-test for Equality of

Means. A '*p*' value of less than **0.05** was considered as statistically significant.

The results of the study were discussed under the following headings:

1. Comparison of Molar Inclination
2. Comparison of Molar Rotation
3. Comparison of Molar Vertical Movement

I. Comparison of Molar inclination

Intra-group comparison

In our study, in Nance Button group (Group A) we found no statistical difference ($p=0.735$) between the mean values of pre (M/S.D = 86.80° , 4.071° respectively) and post treatment (M/S.D = 49.40° , 03.907° respectively) when compared using paired t-test. Similarly, no significant difference ($p=0.968$) was found between mean values of pre (M/S.D = 88.82° , 03.761° respectively) and post (M/S.D = 88.85° , 3.951° respectively) treatment in (Group B). This showed that both passive Nance button and passive Goshgarian (TPA) had augmented anchorage value sufficiently in antero-posterior dimension. (Table 1, Graph 1 & Table 2, Graph 3).

Inter-group comparison: Nance Button group (Group A) vs Goshgarian group (Group B)

When mean differences of Molar inclination in Group A i.e. Nance Button & Group B i.e. Goshgarian (TPA) arch were compared using unpaired t-tests such as (Mann-Whitney test, Levene's Test for Equality of Variance, t-test for Equality of Means) the *p* values are ($p= 0.824$, $p=0.605$, and $p=0.794$) respectively. The results were compared statistically and found to be Non-significant. This shows that both Nance button and Goshgarian (TPA) arch has same control over mesio-distal inclination of maxillary permanent first molar. (Table 03, Graph 05).

II. Comparison of Molar Rotation

Intra-group comparison

In our study, when mean values of pre- & post treatment values of Molar rotation in Nance Button group (Group A) were compared using paired t-test, it was found ($p= 0.000$) to be statistically significant. Whereas in Goshgarian (TPA) arch (Group B), pre

and post treatment mean values of molar rotation were compared using paired t-test was found ($p=0.503$) to be statistically non significant, indicating Goshgarian (TPA) (Table 3, Graph 5) has better control in augmenting disto-palatal Molar rotation than Nance button (Table 1, Graph 2).

Inter-group comparison: Nance Button group (Group A) vs Goshgarian group (Group B)

When mean differences of Molar rotation in Group A i.e. Nance Button & Group B i.e. Goshgarian (TPA) arch were compared using unpaired t-tests such as (Mann-Whitney test, Levene's Test for Equality of Variance, t-test for Equality of Means) the *p* values are ($p=0.000$, $p=0.000$, and $p=0.000$) respectively, that shows more amount of molar rotation is seen when Nance button is used as anchorage reinforcing appliance as compared to that of Goshgarian (TPA) arch. (Table 03, Graph 05) The findings indicate that Goshgarian arch provides better control on the maxillary 1st molar in the transverse plane than the Nance Button.

III. Comparison of Molar Vertical Movement

Intra-group comparison

In our study, when pre- & post treatment mean values of Molar vertical movement in Nance Button (group A) were compared, minor intrusion in molar was seen. However, using paired t-test it was found ($p= 0.172$) to be statistically non-significant. (Table 1, Graph 1). Similarly, when pre and post treatment mean values of molar vertical movement in Goshgarian (TPA) arch (Group B) are compared, minor intrusion of molar was observed. However, when statistically analyzed using paired t-test ($p=0.972\text{mm}$) it was found to be statistically non-significant denoting negligible change in Molar vertical movement with Goshgarian (TPA) arch. (Table 2, Graph 3)

Inter-group comparison: Nance Button group (Group A) vs Goshgarian group (Group B)

When mean differences of Molar vertical movement in Nance Button group (Group A) & Goshgarian (TPA) arch group (Group B) were compared using unpaired t-tests such as (Mann-Whitney test, Levene's Test for Equality of Variance, t-test for Equality of Means) the *p* values are ($p= 0.688$, $p=0.688$, and $p=0.317$) respectively which indicated

that the results were statistically non significant. This shows that change in molar vertical movement was almost identical with both Nance button and Goshgarian appliance. (Table 03, Graph 05).

CONCLUSION

The in-vivo study was contrived to analyze the effectiveness of passive transpalatal arch and passive nance button as anchorage reinforcing appliance on permanent first molar in the pre-adjusted edgewise appliances during the initial levelling and aligning phase.

The result of both Nance button and Goshgarian (TPA) arch showed negligible change in molar inclination and molar vertical movement. Change in molar rotation was more when Nance Button was used as anchorage reinforcing appliance compared to Goshgarian (TPA). This shows that Goshgarian (TPA) has better control over molar rotation when compared with nance button.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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