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Original Research

Comparison of anchorage loss following initial leveling and aligning using ROTH and MBT Prescription – A clinical prospective study

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Abstract:

Background: To evaluate the amount and percentage of anchor loss after initial leveling and aligning using a ROTH and MBT prescription.

Materials & Methods: Pre and post alignment lateral cephalograms & dental casts of 10 ROTH & 10 MBT patients.

Results: In the study, it was found that the amount of anchor loss is greater in the ROTH group than the MBT group. This could be due to the increased anterior tip in the ROTH prescription, compared to MBT. The total anterior tip in ROTH is 27^0 and in MBT is 20^0. The additional tip of 7^0 in ROTH prescription itself would have resulted in forward thrust of the anteriors.

Conclusion: The use of laceback and cinchbacks creates a statistically and clinically significant increase in the anchorage loss specifically when the posterior anchorage is not enhanced. In this study TPA was not used but studies have shown that passive TPA has almost no effect on the clinician's need to preserve anchorage in the correction of malocclusion. On the other hand, the TPA is an excellent way to prevent molar rotation and maintain the original vertical and transverse dimension when desired.

Key Words: Aligning, anchorage loss, leveling, MBT, ROTH

Introduction

Irrespective of the generation of appliances used over the past millennium, one of the most difficult aspects of all these appliances and mechanics is to control anchorage. It is imperative that all tooth movements be carried out successfully during initial aligning and leveling. Inspite of numerous devices to control anchorage, anchor loss still appears to be a potential side effect of preadjusted edgewise appliance system. Although anchor loss is attributed to be multifactorial, it is essential to idealize the biomechanical advantages of the prescriptions that are used in the day-to-day practice.

Therefore, the present study is intended to compare the anchor loss following initial alignment using "ROTH" prescription and "MBT" prescription.

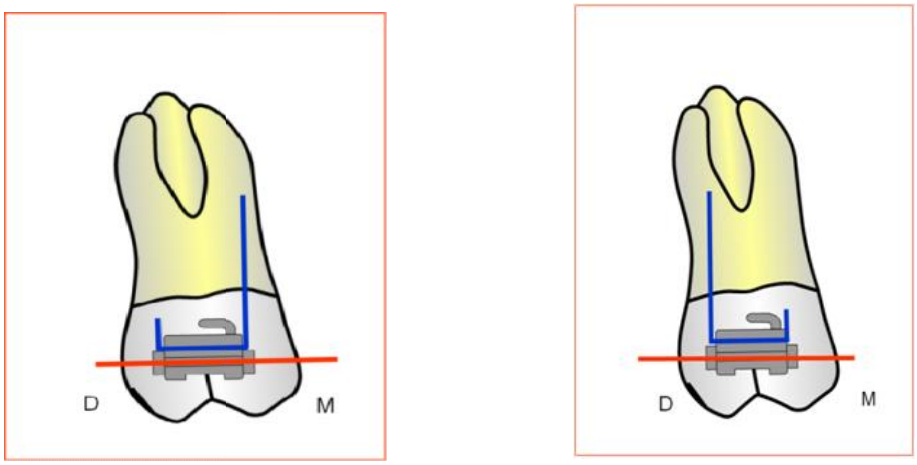
Materials and Methods

Pre-treatment and post-alignment lateral cephalograms and models of 10 patients treated with ROTH and 10 patients treated with MBT mechanotherapy at the Dept. of Orthodontics, BDCH, Davangere were obtained. Criteria's for selecting the patients was a) Class I skeletal pattern with mild to moderate crowding and average growth pattern. b) No anchorage devices are used except for traditional lacebacks and cinch backs. c) Patients underwent extraction of first bicuspids only.

Analysis of Lateral Cephalograms

To differentiate between the right and left molars on the lateral cephalogram, a 0.017" x 0.025" SS wire was shaped in the form of an "L" with 0.7cm of vertical length and 1 cm of horizontal length. On the right side the horizontal portion was inserted from the mesial side of the accessory buccal tube and cinched behind the tube (RMS). On the left side the wire was inserted from the distal surface of the accessory buccal tube and cinched mesially (LMS) to differentiate the right and left molars on the lateral cephalogram (Figure 1).

First SN line and occlusal plane (OP) is drawn and then a perpendicular line is drawn from the occlusal plane to the Sella turcica point known as occlusal plane perpendicular (OPp). The right metal stub and left metal stub is marked on the cephalogram. The linear horizontal distance is measured from occlusal plane perpendicular (OPp) and



Upper right 1st Molar Upper Left 1st Molar

Figure 1: Method of Metallic Stub placement for Cephalometric evaluation ound length graph.

right metallic stub (C1) of right molar and to the left metallic stub of left molar (C2) (Figure 2). Alignment was considered to be complete when a 0.019" x 0.025" SS wire is engaged for a period of 6 weeks without any active force. This was recorded as the post-alignment stage and a cephalogram was taken for comparison in the study.

This was repeated in both pre-treatment and post-alignment cephalograms to evaluate the amount of anchor loss. The values of pre-treatment are subtracted with the post-alignment for both right and left sides and mean anchorage loss is calculated for the whole upper arch. Anchorage loss was than compared between ROTH and MBT groups.

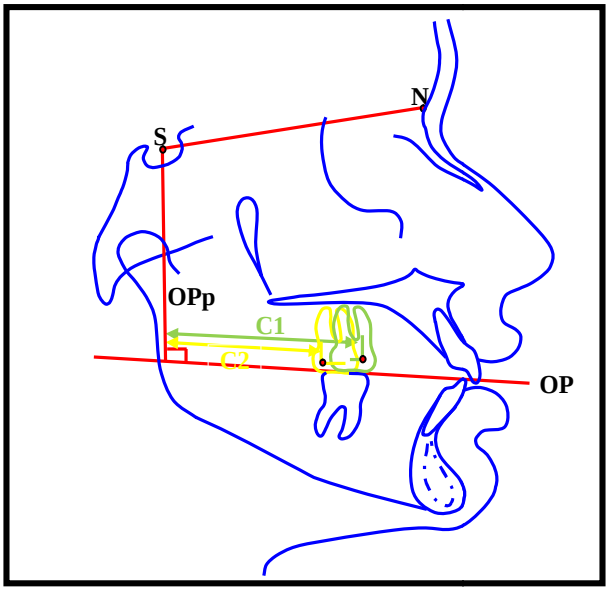


Figure 2: Linear Parameters for Hard Tissue Evaluation on Lateral Cephalogram.

Analysis of Dental Cast:

A line drawn through anterior raphe point and posterior raphe point was used to construct a median reference line (MRL). Perpendicular lines were constructed from the mesial contact point of right (URM-MRL) and left (ULM-MRL) upper first molars to the median reference line. The medial point of the 3rd rugae were marked on both the right (Rr) and left (Lr) side. The linear distance is measured between the third right medial rugae (Rr) to a line drawn perpendicular to the mesial contact point of right upper 1st molar intersecting at median reference line (dR). The Linear distance is measured between the third left medial rugae (Lr) to a line drawn perpendicular to the mesial contact point of left upper 1st molar intersecting at median reference line (dL)(Figure 3). The values of pre-treatment are subtracted with the post-alignment for both right and left sides and mean anchorage loss is calculated for the whole upper arch. Anchorage loss was then compared between ROTH and MBT groups.

Results

The comparison of anchor loss was done by two methods, cephalometrically and by study cast analysis method for both MBT and ROTH techniques.

In the ROTH group on the right side both the cephalometric and model analysis showed 2.9 mm of mean anchorage loss whereas on the left side in cephalometric showed 3.4 mm and model showed 3.1 mm of mean anchorage loss (Table 1 and 2).

In the MBT group on the right side both the cephalometric and model analysis showed 1.8 mm of mean anchorage loss whereas on the left side the cephalometric analysis showed 2 mm and model analysis showed 2.1 mm of mean anchorage loss(Table 3 and 4).

The mean anchor loss in the upper arch is calculated by the difference between pre-treatment and post-alignment value for both the right and left sides for both ROTH and MBT (Table 5 and Graph 1).

a) ***Cephalometric analysis:***

The mean anchor loss in the ROTH group was 3.15 mm with standard deviation of 1.29 mm and in the MBT group was 1.90 mm with a standard deviation of 1.10 mm. The p value is less than 0.05 and showed significant (Unpaired t-test). These values show that anchor loss was more in the ROTH group when compared with MBT.

b) Model analysis:

The mean anchor loss in the ROTH group was 3.00 mm with a standard deviation of 1.08 mm and in the MBT group was 1.95 mm with a standard deviation of 1.09 mm. A p value of less than 0.05 was found and was found to be significant (Unpaired t-test). These values show that anchor loss was more in the ROTH group when compared with MBT.

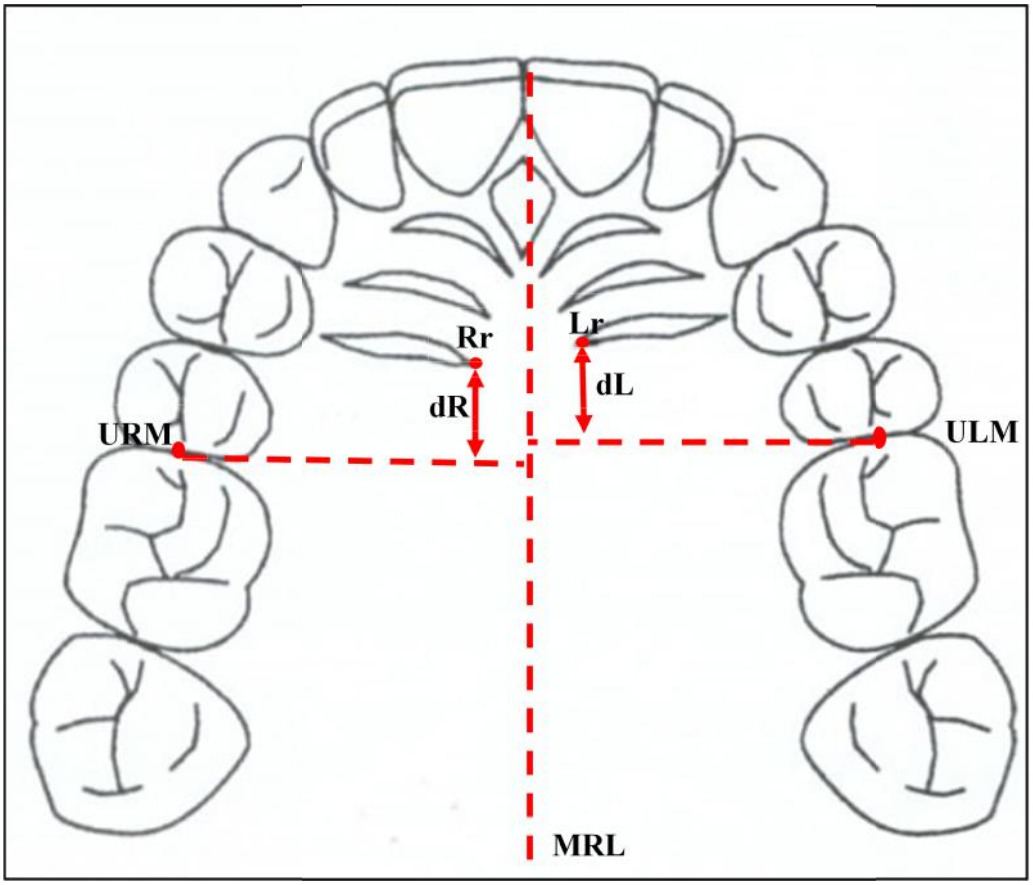


Figure 3: Linear Parameters for Dental Cast Evaluation Parameters.

Discussion:

The importance of taking third palatal rugae as a stable landmark was to accurately evaluate the anteroposterior molar and incisor movements. This is based on the studies done by Bailey LT et al,[1] Almeida MA et al,[2] and Hoggan BR.[3]

In the present study, it was found that the amount of anchor loss is greater in the ROTH group than the MBT group. This could be due to the increased anterior tip in the ROTH prescription, compared to MBT. The total anterior tip in ROTH is 27^0 and in MBT is 20^0. The additional tip of 7^0 in ROTH prescription itself would have resulted in forward thrust of the anteriors as aligning proceeded from 0.0175" Coax wire to 0.019" X 0.025" SS wire without an active force. This is evident in the study done by Roth RH [4] and McLaughlin RP. [5]

As the anteriors tend to express the built in tip sequentially the tendency of the anteriors to procline is more

Table 1: Roth Group Comparison between Pre-Teatment and Post-Alignment

Analysis	Sides	Pre-treatment		Post-alignment		Mean Difference	P* Value, Sig
		Mean	SD	Mean	SD		
Ceph Analysis	Right	52.10mm	4.98mm	55.00mm	5.64mm	2.9mm	P<0.001 HS
	Left	45.30mm	6.20mm	48.70mm	6.91mm	3.4mm	P<0.001 HS
Model Analysis	Right	13.10mm	2.60mm	10.20mm	2.86mm	-2.9mm	P<0.001 HS
	Left	13.30mm	2.36mm	10.20mm	2.74mm	-3.1mm	P<0.001 HS

*Paired t-test

Table 2: Roth Group Comparison between Right and Left Sides

Analysis	Right side		Left side		P* Value, Sig
	Mean	SD	Mean	SD	
Ceph Analysis	2.90mm	1.29mm	3.40mm	1.43mm	P>0.05 NS
Model Analysis	2.90mm	1.62mm	3.10mm	1.15mm	P>0.05 NS

*Paired t-test

Table 3: MBT group comparison between Pre-treatment and Post-alignment

Analysis	Sides	Pre-treatment		Post-alignment		Mean Difference	P* Value, Sig
		Mean	SD	Mean	SD		
Ceph Analysis	Right	58.7mm	3.02mm	60.5mm	3.7mm	1.8mm	P<0.001HS
	Left	50.3mm	3.37mm	52.3mm	3.69mm	2mm	P<0.001 HS
Model Analysis	Right	13.3mm	3.8mm	11.5mm	3.56mm	-1.8mm	P<0.001 HS
	Left	13.5mm	4.62mm	11.4mm	4.2mm	-2.1mm	P<0.001 HS

*Paired t-test

Table 4: MBT group comparison between right and left

Analysis	Right side		Left side		P* Value, Sig
	Mean	SD	Mean	SD	
Ceph Analysis	1.80mm	1.32mm	2.00mm	1.05mm	P>0.05 NS
Model Analysis	1.80mm	1.14mm	2.10mm	1.10mm	P>0.05 NS

*Paired t-test

Table 5: Comparison between ROTH and MBT groups

Analysis	ROTH		MBT		P* Value, Sig
	Mean	SD	Mean	SD	
Ceph Analysis	3.15mm	1.29mm	1.90mm	1.10mm	P<0.05 S
Model Analysis	3.00mm	1.08mm	1.95mm	1.09mm	P<0.05 S

*Paired t-test

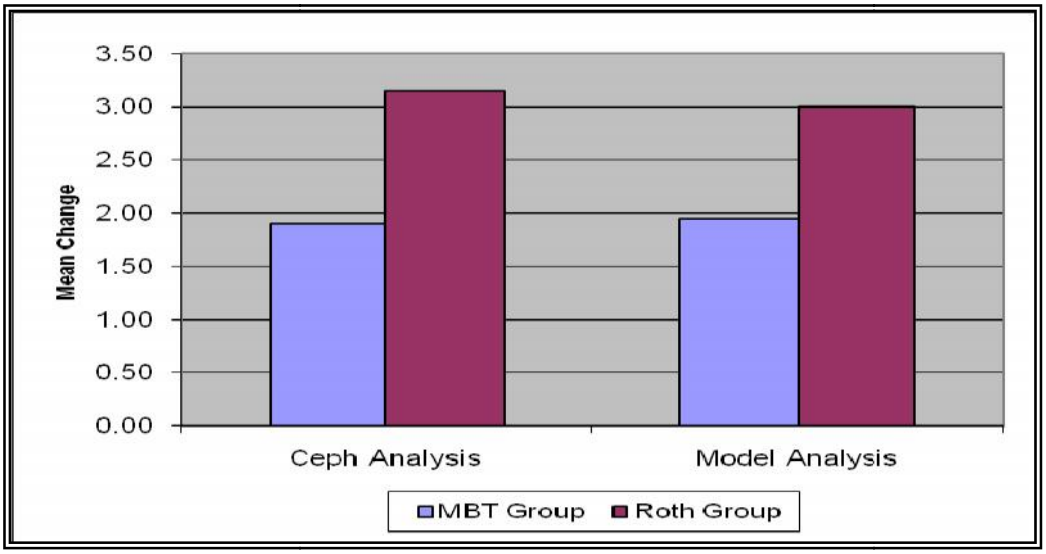
pronounced in the ROTH prescription than MBT. This would have resulted in dragging the whole posterior segment forwards, thereby depicting increased anchor loss comparatively. Anchor loss is more critical in the upper arch than the lower arch due to the fact that,

1. Upper anterior teeth are larger than lower anterior teeth.
2. Increased built in tip of upper anteriors,
3. Greater mesial inclination of the upper molar than the lower molar which facilitates upper molar to move mesially more readily than the lower molar Roth RH.[6]

This is in support with the study done by McLaughlin RP.[7] Another influencing factor in the control of anchorage is the density of the supportive bone around the teeth. It is suggested that teeth move more easily in spongiosa than teeth which are placed in dense cortical bone. Since the maxilla is more cancellous in nature, anchor loss is likely to

be more compared to that of the mandible which shows more cortication. This is in support with the study done by Dr. Robert Murray Ricketts.[8]

simultaneously allow root uprighting minimizing the proclination of anterior teeth. This led to three effective schools of thought, i.e.,



Graph 1: Comparison between ROTH and MBT groups

The preadjusted edgewise appliance system adopted few control measures like bonding brackets on the center of clinical crown, lacebacks, bendbacks, curve of spee, and full sized arch wire irrespective of the mechanics employed. The present study employed the use of lacebacks and cinchbacks in both the prescriptions to minimize and control the potential side effects of the appliance system. Researcher's state that bending the archwire immediately distal to the last banded molar teeth minimizes the forward tipping of the incisors. This is in support with the study done by McLaughlin RP.[7,9] However, it was found that the force exerted due to the additional built in tip was transmitted to the posterior segment also, taxing the posterior anchorage. Therefore, anchor loss was seen in both Roth and MBT techniques, but more vividly in the Roth prescription.

Irrespective of the prescription, the tendency of the anteriors to flare was evident in the initial stages due to the canine expressing the highest tip compared to the laterals and central incisors. Earlier attempts were made to control this by using elastic forces connecting anterior and posterior segments. This resulted in roller-coaster effect and bite deepening. The elastics were therefore replaced with 0.010" SS ligatures from the posterior segment to the cuspids called Lacebacks. The purpose of lacebacks was to prevent the canine from tipping forward and

1. Although the use of the Lacebacks prevented the anterior proclination, it encouraged posterior mesialization taxing anchorage. This is in accordance with study done by Robinson SN.[10]
2. Lacebacks are not effective in controlling the anterior anchorage and further molar mesialization is evident with or without Lacebacks. This is supported by study done by Irvine R et al.[11]
3. Lacebacks were effective in controlling the anterior anchorage and no significant posterior anchor loss was observed with (or) without lacebacks. This is in support with the study done by Usmani T et al.[12]

In the present study, lacebacks were employed in both the treatment methods and some amount of anchor loss was seen in both the groups. Comparatively, ROTH group showed more anchor loss than MBT. This is in accordance with Robinson SN,[10] suggesting reinforcement of anchorage in the posterior segment.

The problem of conserving anchorage remains universal regardless of orthodontic technique used. Hence different types of anchorage control devices like TPA, implants, InstaNance, and holding arches were introduced to control the anchorage. McLaughlin RP[9,7] in his article recommended the use of transpalatal arch as the secondary method of anchorage control in the upper posterior segment. In our study no anchorage devices like

transpalatal arch (TPA), Nance holding arch, Lip bumpers, implants, or extroral anchorage devices were used. The results showed that some amount of anchor loss was seen in both the groups but it was more evident in the ROTH group. This is supported by studies done by Yukio Kojima,[13] and Zablocki Heather L.[14] concluded from all available evidence that the TPA has almost no effect on the clinician's need to preserve anchorage in the correction of malocclusion. On the other hand, the TPA is an excellent way to prevent molar rotation and maintain the original transverse dimension when desired.

Conclusion:

The purpose of the study was to determine anchor loss in ROTH or MBT prescription during initial stages of treatment. The results showed that anchor loss was more in ROTH group when compared with MBT group during initial leveling and aligning. This anchor loss can be attributed to many causes like the increased tip in the anterior segment in ROTH prescription compared to MBT that might have resulted in the forward thrust of the incisors to move labially. The use of laceback and cinchbacks creates a statistically and clinically significant increase in the anchorage loss specifically when the posterior anchorage is not enhanced. In this study TPA was not used but studies have shown that passive TPA has almost no effect on the clinician's need to preserve anchorage in the correction of malocclusion. On the other hand, the TPA is an excellent way to prevent molar rotation and maintain the original vertical and transverse dimension when desired.

References

1. Bailey LT, Esmailnejad A, Almeida MA. Stability of the palatal rugae as landmarks for analysis of dental casts in extraction and non extraction cases. Angle Orthod 1996; 66(1):73-8.
2. Almeida MA, Phillips C, Kula K, Tulloch C. Stability of the palatal rugae as landmarks for analysis of dental casts. Angle Orthod 1995;65(1):43-8.
3. Hoggan BR, Sadowsky C. The use of palatal rugae for the assessment of anteroposterior tooth movements. Am J Orthod Dentofacial Orthop 2001;119(5):482-8.
4. Roth RH. Five year clinical evaluation of the Andrews straight-wire appliance. J Clin Orthod 1976;10:836-50.
5. McLaughlin RP, Bennett JC, Trevisi HJ. Systemized Orthodontic treatment Mechanics, 1st ed. St. Louis:CV Mosby; 2001.
6. Roth RH. The straight wire appliance - 17 years later. J Clin Orthod 1987;21:632-42.
7. McLaughlin RP, Bennet JC. The transition from standard edge wise to pre-adjusted appliance systems. J Clin Orthod 1989;23:142-53.
8. Ricketts RM. Bioprogressive Therapy. Denver, Colorado:Rocky Mountain; 1979.
9. McLaughlin RP, Bennett JC. Anchorage control during leveling and aligning with a preadjusted appliance system. J Clin Orthod 1991;25:687-96.
10. Robinson SN. An evaluation of the changes in lower incisor position during the initial stages of clinical treatment using a preadjusted edgewise appliance (Master's thesis). London, UK:University of London; 1989.
11. Irvine R, Power S, McDonald F. The effectiveness of laceback ligatures: a randomized controlled clinical trial. J Orthod 2004;31:303-11.
12. Usmani T, O'Brien KD, Worthington HV, Derwent S, Fox D, Harrison S, Sandler PJ, Mandall NA. A randomized clinical trial to compare the effectiveness of canine lacebacks with reference to canine tip. J Orthod 2002;29(4):281-6.
13. Kojima Y, Fukui H. Effects of transpalatal arch on molar movement produced by mesial force: a finite element simulation. Am J Orthod Dentofacial Orthop 2008;134(3):335-6.
14. Zablocki HL, McNamara JA Jr, Franchi L, Baccetti T. Effect of the transpalatal arch during extraction treatment. Am J Orthod Dentofacial Orthop 2008;133(6):852-60.