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Comparison of Torque Control and Anchorage Loss Using Two Different Pre-Adjusted Edgewisebracket Systems

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***Abstract**: Predictable and controlled tooth movement is the goal of every orthodontist.Fixed appliance therapyis one of the treatment options for malocclusion During the aligning stage, the increased inter bracket span leads to faster and efficient alignment but at the same could be a disadvantage during the space closure because of the reduced arch wire bracket contact area that would lead to reduced control of the torque of the anteriors. The unique design of the mini uni-twin that incorporates an increased inter bracket span of the single width bracket but at the same has the rotational control of a double width bracket. Objectives: To compare the torque control and anchorage loss using double width brackets and mini uni twin brackets in Roth prescription. Method: Comparative study with 20 subjects (10 in each group) with Angle's Class I dento-alveolar malocclusion were randomly selected for the study. Results: The anchorage loss was comparatively similar in both. The torque control of incisor during retraction was better in double width brackets when compared to Mini Uni Twin brackets. The latter may be efficient during alignment and leveling but comparatively less efficient for torque control during the retraction of anterior teeth.*

***Key Words:**Torque control, anchorage loss, double width bracket, mini uni twin bracket*

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I. Introduction

Malocclusion is a misalignment or incorrect relation between the teeth of two dental arches when the jaw closes. It is the 3rd most common dental disease and was classified by Edward H.Angle. Angle's class I malocclusion is demonstrated to be the most established among children and adolescents, so it receives more attention[1, 2]and the treatment varies. Fixed appliance therapy is one of the treatment options for malocclusion. There has been a constant endeavor to improve the efficiency in every stage of fixed appliance therapy. The interbracket span plays an important role in determining efficient biomechanics[3, 4].

Invitro studies could lead to a greater understanding and finite element method (FEM) studies have given an even greater in-depth understanding but as every clinical parameter cannot be replicated, clinical studies have a greater role in understanding the advantages and deficiencies in any new clinical innovation[5]. Hence it was decided to verify the efficacy of the Mini Uni Twin brackets with respect to double width brackets on their torque control and at the same time verify if there was any difference on anchorage loss.

II. Materials & Methods

A prospective comparative study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, Meenakshi Ammal Dental College and Hospital, Tamil Nadu, India for a period of two years.A total of 20 subjects of either sex, between the age groups of 14 -20 years with Angle's Class I dento-alveolar malocclusions were randomly selected for the study .They were divided into 2 groups consisting of 10 each.Subjects satisfied the following criterias were included, having an average mandibular plane angle, no retroclination,requiring a minimum of 4mm space closure after decrowding in the anterior segment, devoid of any pernicious oral habits, with good oral hygiene and without any malformation in the anterior teeth and teeth not requiring intrusion or extrusion. Cases with broken bands and or attachments during the course of this study were excluded.

ARMAMENTARIUM

3M Unitek Gemini series in Roth bracket system with 0.018 slots,3M Unitek Mini Uni Twin series in Roth bracket system with 0.018 slots,3M Unitek Upper 17 X 25 SS wire with a tear drop loop, template having a standardized alpha and beta bends, Spark plug feeler gauge and Metallic scale and divider.

METHODOLOGY

Twenty patients were selected with extraction of all first premolars and divided into Group A who were bonded with double width brackets (Gemini series) and Group B who was bonded Mini Uni Twin brackets in 0.018" slot Roth system. After aligning and leveling, all subjects were placed with 0.017" X 0.025" SS wire incorporated with a tear drop loop with standardized alpha and beta bends. Retraction was carried out using loop mechanics. The assessment of the anchor loss and torque control of incisor was done by using lateral cephalometric radiographs taken before retraction and after retraction.

All lateral cephalograms were traced by the same investigator twice and the averages of both the values were taken into consideration. Landmarks and reference planes used for this study were illustrated in (Table 1). For the assessment of torque control and anchor loss five variables were taken into consideration. Cephalometric readings of these variables were taken and tabulated (Table 2) .

The pre treatment and post treatment observations were recorded in the structured proforma. Statistical analysis was done using SPSS. Means and standard deviations were estimated from the samples for each study group. Comparison of mean values between Group A and B were estimated using Student's paired t-test.

III. Result

The study was carried out to compare anchor loss and torque control using two different bracket systems, Group A consisted of patients whose teeth were bonded with double width brackets while in group B teeth with Mini Uni Twin brackets. Retraction was carried out using a 0.017 X 0.025" rectangular stainless steel wire with a tear drop loop and standardized alpha and beta moments for all the patients. The brackets systems were compared by assessing the lateral cephalogram before and after space closure.

The comparison of torque of incisors between Group A and Group B indicated a loss of torque in Group B compared to Group A. (Table 3)

The comparison of anchor loss between Group A and Group B after retraction, ($P2_1$) change in group A was -1.4 $\pm$ 0.5 and for Group B, -1.3 + 0.5. The $P2_2$ change in group A was -1.4 $\pm$ 0.5 and for Group B, -0.8 $\pm$ 0.9. This showed a mild mesial movement of molars indicating anchor loss in both the Groups. (Table 4)

The mean value change of U1-PP during pre treatment and post treatment in group A was 2.5 $\pm$ 0.8. This indicated a torque loss of incisors. The comparison of mean value U1E-hor during pre treatment and post treatment within group A showed a mean change of 4.6 $\pm$ 1.5.The mean U1A-hor during pre treatment and post treatment showed a mean change of 3.8 $\pm$ 1.5. This indicated a distal movement of the incisors. The mean U6M-hor during pre treatment and during post treatment showed a mean change of -1.4 $\pm$ 0.5 .The mean change of U6A-hor pre treatment and during post treatment was-1.4 $\pm$ 0.5.This indicated a mild mesial movement of the molars (anchor loss) .(Table 5)

The comparison of mean value change of U1-PP between pre treatment and post treatment within Group B was 6.2 $\pm$ 1.0.This indicated more amount of torque loss of the incisors .The mean change of U1E-hor during pre treatment and post treatment was 4.8 $\pm$ 0.6 and of U1A-hor was 1.8 $\pm$ 1.4. This indicated distal movement of the incisors. The mean change of U6M-hor between pre treatment and post treatment was -1.3 $\pm$ 0.5 .The mean change U6A-hor among pre treatment and post treatment was -0.8 $\pm$ 0.9. This indicated a mild mesial movement of the molars. (Table 6)

IV. Discussion

An important aspect of orthodontic treatment is maximizing the tooth movement that is desired, while minimizing undesirable side effects. In pre adjusted edgewise appliance therapy, anchorage and torque are two distinct entities which influence the treatment outcome. Different bracket series have got their own characteristic features which will affect the anchorage and torque during treatment. The inter bracket span plays an important role in determining efficient biomechanics [6].

The anchorage is the nature and degree of resistance to displacement offered by an anatomic unit for the purpose of affecting tooth movement". Anchorage control throughout the orthodontic treatment is essential for uncompromised results and is being taxed twice with a two step retraction, as opposed to once with en masse retraction, pointing out that the posterior segment is unaware of knowing how many teeth are being retracted and merely responds according to the force system involved [7].

The torque is the force that enables the orthodontist to control the axial inclination of the teeth and to place them in the harmonizing positions that are so desirable for nicely finished results[8]. It is an acknowledged fact that the pre adjusted edgewise system is not efficient in expressing torque. Hence it is of paramount importance to prevent torque loss during retraction. The slop between the archwire, the material of the archwire and the area of contact of the archwire with the bracket slot, all, influence the amount of torque loss[8, 9, 10].

The inter bracket width changes throughout treatment as the tooth moves and varies around the arches. There are two types of brackets that are routinely used, they are the single width and the double width brackets[11, 12, 13, 14]. The Mini Uni Twin was neither a prescription nor a technique rather an amalgamation

between the single width and the double width bracket. The bracket had the skeleton framework of a twin bracket, but the precision or working part of the bracket that was located in the center of the framework was no wider than a single bracket. The slot then widens considerably as it moved toward the edges of the twin bracket tie wings, and this feature allows the archwire to flex considerably, yet stay within the confines of the twin bracket. There was no interference with the archwire from rotational tie wings. The bracket could be tied like a typical twin bracket and rotated with the same efficiency of a twin bracket. The width of the mini uni twin bracket was 2.50 mm but the width of the precision or the working part is no greater than 1.10 mm[15,16]. To avoid any problems of standardization the Roth prescription was selected in both the bracket types. To avoid any errors in standardization of bonding, it was done by the same operator and the brackets where placed in the center of the clinical crown[17].

Torque Control

The mean value of change for $P2_1$in group A was 2.5$\pm$ 0.8 while as group B showed a change of 6.2 $\pm$ 1.0 This indicated a loss of torque in both Group A and Group B which was statistically significant however Group A showed much lesser amount of torque loss compared to Group B. This was further substantiated by recording the position of incisal edge (U1E-hor) and the position of the root apex (U1A-hor) of the incisors during retraction in Group A and Group B. In Group A, U1E-hor change was (4.6$\pm$ 1.5) and U1A-hor change was recorded as 3.8$\pm$ 1.5 where as in Group B, U1E-hor was recorded as (4.8$\pm$ 0.6) and the U1A-hor was (1.8 $\pm$ 1.4).This confirmed more amount of distal movement of root apex of upper incisors in Group A compared to Group B thereby confirming that Group A showed more of a bodily retraction as compared to Group B. This torque loss occurred inspite of using a 17x25" SS wire with a gable bend of 10^0alpha and 25^0 beta in a 0.018' slot. A further loss of torque would have occurred if a 16x22" SS wire was used for retraction of the incisors which is one of the commonly used wires for retraction mechanics. (Fig1)

Anchor Loss

The mean value of change in $P2_1$ in group A was (-1.4 $\pm$ 0.5) while in group B was (-1.3 $\pm$ 0.5). The mean $P2_2$ change value in group A of (-1.4 $\pm$ 0.5) and group B of (-0.8 $\pm$ 0.9) .This indicated a mesial movement of molars in both the Groups. In case of maximum anchorage, where en mass retraction is indicated, mesial movement of the molar is not common. As the molar tooth is the anchor component, the reactionary forces acting on it would bring about a mesial movement of the molars. (Fig 2)

V. Conclusion

This clinical study was conducted to compare the standard double width brackets and the Mini Uni Twin brackets for their efficiency regarding anchorage loss and torque control**.** The anchorage loss is comparatively similar in Mini Uni Twin brackets and double width brackets, The torque control of incisor during retraction was better in double width brackets when compared to Mini Uni Twin brackets. The Mini Uni Twin brackets may be efficient during alignment and levelling but comparatively are less efficient for torque control during the retraction of anterior teeth.

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Tables and Figures

Table 1 **Landmarks and reference planes**	
Nasion	(N)
Sella	(S)
Orbitale	(Or)
Porion	(Po)
Anterior nasal spine	(ANS)
Posterior nasal spine	(PNS)
Pterygoid point	(Pt point)
Upper incisor edge	(U1E)
Upper incisor root apex	(U1A)
Center of Max. 1st molar crown on occlusal surface	(U6C)
Most mesial point of mesial surface of Max. 1st molar crown	(U6M)
Mesiobuccal root apex of Max. 1st molar	(U6A)
Vertical reference plane through Pt point (tangent to palatal plane)	(PTV)

Table 2 **Variables for the sagital assessment**		
1.	U1 to PP:	Long axis of the upper incisor to palatal plane
2.	U1E-Hor:	The horizontal distance from U1E to PTV
3.	U1A-Hor:	The horizontal distance from U1A to PTV
4.	U6M-Hor:	The horizontal distance from U6M to PTV
5.	U6A-Hor:	The distance from U6A to PTV

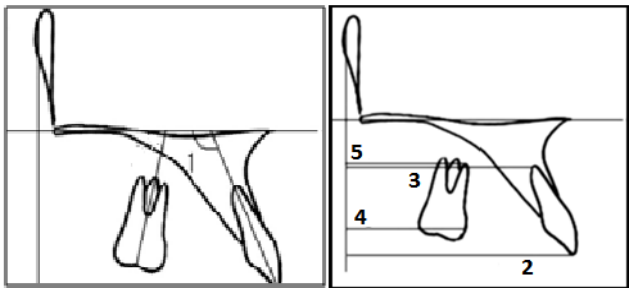


Table 3 **Torque of incisors**				
Variable	**Group A**	**Group B**	**p - Value***	**Significance**
	Mean + S.D	**Mean + S.D**		
P2-pre	119.7 ± 6.5	123.4 ± 6.0	0.20	N.S
P2-post	117.2 + 6.4	117.2 + 5.8	1.00	N.S
P2- Change	2.5 + 0.8	6.2 + 1.0	<0.0001	**S**

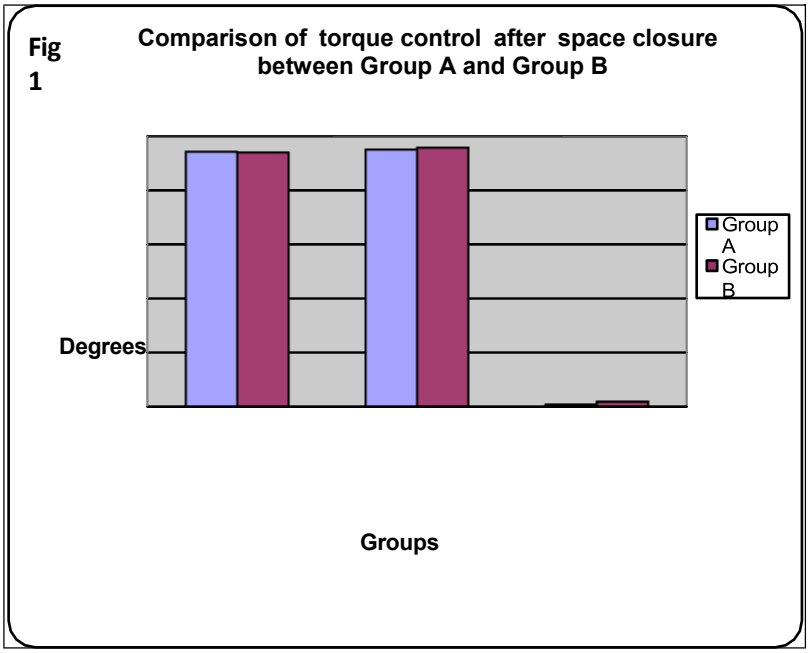
P2 - Inclination of the upper incisor

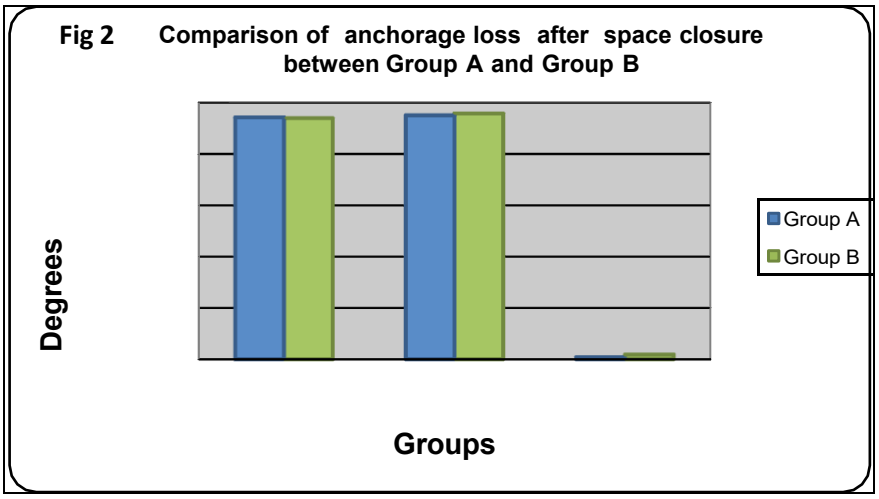
Table 4 Anchor Loss				
Variable	**Group A**	**Group B**	**P – Value**	**Significance**
	Mean ± S.D	**Mean ± S.D**		
$P2_1$-pre	33.3 ± 5.3	31.8 ± 2.0	0.42	N.S
$P2_1$-post	34.7 ± 5.1	33.1 ± 1.8	0.37	N.S
$P2_1$- Change	-1.4 ± 0.5	-1.3 ± 0.5	0.68	N.S
$P2_2$-pre	33.2 ± 3.7	32.5 ± 1.7	0.60	N.S
$P2_2$-post	34.6 ± 3.6	33.4 ± 1.5	0.32	N.S
$P2_2$- Change	-1.4 ± 0.5	-0.8 ± 0.9	0.08	NS

$P2_1$ - Occlusal molar distance from pterygoid vertical
$P2_2$ - Apical molar distance from pterygoid vertical

Table 5 Comparison of Mean values between Pre-Rx and Post-Rx for Group A					
Variable	**Pre-Rx**	**Post-Rx**	**Change Mean ± S.D**	**P-Value**	**Significance**
	Mean ± S.D	**Mean ± S.D**			
U1-PP	119.7 ± 6.5	117 ± 6.4	2.5 ± 0.8	<0.0001	S
U1E-hor	64.1 ± 7.4	59.4 ±6.7	4.6 ± 1.5	<0.0001	S
U1A-hor	50.4 ± 4.8	46.9 ±4.4	3.8 ± 1.5	<0.0001	S
U6M-hor	33.3 ± 5.3	34.7 ±5.1	-1.4± 0.5	<0.0001	S
U6A-hor	33.2 ± 3.7	34.6 ±3.6	-1.4 ± 0.5	<0.0001	S

Table 6 Comparison of Mean values between Pre-Rx and Post-Rx for Group B					
Variable	**Pre-Rx**	**Post-Rx**	**Change Mean ± S.D**	**P-Value**	**Significance**
	Mean ± S.D	**Mean ± S.D**			
U1-PP	123.4 ± 6.0	117.2 ± 5.8	6.2 ± 1.0	<0.0001	S
U1E-hor	64.7 ± 4.0	60.0 ± 4.1	4.8 ± 0.6	<0.0001	S
U1A-hor	50.7 ± 4.1	49.0 ± 4.5	1.8 ± 1.4	<0.004	S
U6M-hor	31.8 ± 2.0	33.1 ± 1.8	-1.3± 0.5	<0.0001	S
U6A-hor	32.5 ± 1.7	33.4 ± 1.5	-0.8 ± 0.9	<0.02	S





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