ORIGINAL RESEARCH PAPER

Volume - 9 | Issue - 6 | June - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EVALUATION OF THE TORQUE CONTROL AND ANCHORAGE LOSS USING MINI UNI TWIN BRACKETS IN ROTH PRESCRIPTION-A CLINICAL STUDY

Dental Science

Anand. R. Krishnan Assistant Professor & MDS in the Department of Orthodontics, Govt. Dental College, Thiruvananthapuram.

Dr P Janardhanam* MDS, Professor, Department of Orthodontics, Meenakshi Ammal Dental College, Chennai. *Corresponding Author

ABSTRACT

As the vehicle for communicating the intended biomechanical regimen to the tooth undergoing treatment, brackets occupy a central place in the orthodontic armamentarium. The interbracket span plays an important role in determining efficient biomechanics. This clinical study was carried out to measure the anchorage loss and torque control using Mini Uni Twin brackets (single width brackets) in an 0.018"ROTH system. 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 bracket system was evaluated by assessing the lateral cephalogram before and after space closure. The Mini Uni Twin brackets were efficient during alignment and levelling but comparatively less efficient for torque control during the retraction of anteriors. More clinical studies need to be performed with increased number of parameters on these Mini Uni Twin brackets, to analyze their efficacy.

KEYWORDS

mini uni twin brackets, torque control, anchorage loss.

INTRODUCTION

In orthodontics, the techniques and the appliances that are used may influence the clinical efficiency and treatment duration. It is to the best interest of both the patient and the clinician to keep the duration of fixed appliance treatment as short as possible, while not compromising the quality of the treatment outcome. Proper buccolingual inclination of both posterior and anterior teeth is essential for providing stability and proper occlusal relationship in orthodontic treatment. Torque of the maxillary incisors is particularly critical in establishing an esthetic smile line, proper anterior guidance, and a solid Class I relationship, because undertorqued anterior teeth can preclude the retraction of the anterior maxillary dentition. Optimal treatment outcomes require effective torque expression, which is sensitive to irregularities in tooth anatomy, the size, morphology, and engagement of the arch wire in the bracket, as well as the position, material properties, and slot size of the bracket.[1-7] As the vehicle for communicating the intended biomechanical regimen to the tooth undergoing treatment, brackets occupy a central place in the orthodontic armamentarium. The interbracket span plays an important role in determining efficient biomechanics.

During the aligning stage, the increased interbracket span leads to faster and efficient alignment but at the same could be a disadvantage during the space closure because of the reduced archwire bracket contact area that would lead to reduced control of the torque of the anteriors during retraction. The unique design of the mini uni-twin that incorporates an increased interbracket span of the single width bracket but at the same time has the rotational control of a double width bracket[7, 8]**.** The performance of orthodontic appliances has been investigated using *in vitro*, *in vivo*, and *ex vivo* study designs. However, among these designs, only the results of *in vivo* clinical studies on humans can be directly extrapolated to everyday clinical orthodontic practice. Hence it was decided to verify the efficacy of the mini uni twin brackets on their torque control and at the same time measure the amount of anchorage loss.

MATERIALS & METHODS

The patient sample was selected from the subjects seeking treatment at the Department of Orthodontics, Meenakshi Ammal Dental College and Hospital, Meenakshi University, Tamil Nadu, India. Patient with Angle's Class I dento-alveolar malocclusions and between the age groups of 14 - 20 years; both males and females were recruited for a prospective study of 2 years duration. Cases having an average mandibular plane angle, without retroclination and requiring a minimum of 4mm space closure after decrowding in the anterior segment were included. All patients underwent first premolar extraction and having the first molar as an anchor unit. Cases devoid of any pernicious oral habits, with good oral hygiene and without any malformation in the anterior teeth were only recruited. Cases requiring intrusion or extrusion and with broken bands and / or attachments during the course of this study were also excluded.

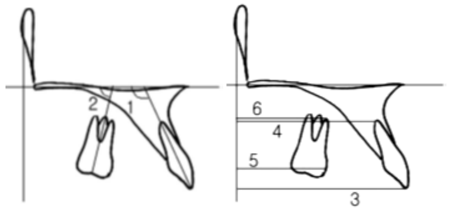
Retraction of the upper anterior segment for space closure was carried out using a 0.017" X 0.025" rectangular stainless steel wire with a tear drop loop and standardized alpha and beta moments for all the patients. Arch wires with Tear drop loop and similar alpha and beta moments were simulated on a template. Anchorage unit included was first molar with TPA. Tear drop loop was activated by 1mm once a month and this was verified with a spark plug feeler gauge. The assessment of the torque control and anchor loss was done by radiographic assessment method. Lateral cephalograms were superimposed according to the method of Pancherz. Lateral cephalometric radiographs were taken before retraction and after retraction. All lateral cephalograms were traced by the same investigator twice and the average of both the values was taken into consideration. Landmarks and reference planes used for this study are illustrated in 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.1

For the assessment of torque control and anchor loss, six variables were taken into consideration. Cephalometric readings of these six variables were taken and tabulated. The variables and their description are as follows;

6 variables for the sagital assessment		
1	U1 to PP:	Long axis of the upper incisor to palatal plane
2	U6 to PP:	Long axis of the upper first molar palatal plane
3	U1E-Hor:	The horizontal distance from U1E to PTV
4	U1A-Hor:	The horizontal distance from U1A to PTV
5	U6M-Hor:	The horizontal distance from U6M to PTV
6	U6A-Hor:	The distance from U6A to PTV



RESULTS

The study was carried out to measure the anchor loss and torque control using Mini Uni Twin brackets (single width brackets) in an 0.018"Roth system. 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 bracket system was evaluated by assessing the lateral cephalogram before and after space closure.

The result thus obtained were recorded and tabulated and statistically analyzed as follows.

Torque of incisors:

Variable	Mean + S.D
P2-pre	123.4 + 6.0
P2-post	117.2 + 5.8
P2- Change	6.2 + 1.0

P2 - Inclination of the upper incisor

Anchor Loss:

Variable	**Mean + S.D**
P21-pre	31.8 + 2.0
P21-post	33.1 + 1.8
P21- Change	-1.3 + 0.5
P22-pre	32.5 + 1.7
P22-post	33.4 + 1.5
P22- Change	-0.8 + 0.9

P21 - Occlusal molar distance from pterygoid vertical

P22 - Apical molar distance from pterygoid vertical

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

The mean U1-PP (inclination of upper incisor) during pre treatment was 123.4 ± 6.0 and post treatment showed a mean value of was 117 ± 5.8. This showed a mean value change of 6.2 ± 1.0.This indicated more amount of torque loss of the incisors. This was statistically significant (P<0.0001)

The mean U1E-hor (Upper incisal edge distance to pterygoid vertical) pre treatment was 64.7 ± 4.0 and post treatment measurement as 60.0 ± 4.1; which showed a mean change of 4.8 ± 0.6.

The mean U1A-hor (Upper incisor apex distance to pterygoid vertical) during pre treatment was 50.7 ± 4.1 and during post treatment 49.0 ± 4.5 which showed a mean change of 1.8 ± 1.4. This indicated distal movement of the incisors. This was statistically significant. (P<0.0001)

The mean U6M-hor (occlusal molar distance from the pterygoid vertical) during pre treatment was 31.8 ± 2.0 and during post treatment 33.1 + 1.8 which showed a mean change of -1.3 ± 0.5

The mean U6A-hor (apical molar distance from the pterygoid vertical) pre treatment 32.5 ± 1.7 and post treatment as 33.4 + 1.5 which showed a mean change of -0.8 ± 0.9. This indicated a mild mesial movement of the molars. This was statistically significant. (P<0.0001 and P<0.02)

DISCUSSION

Many appliance systems are designed primarily to deal with later stages of tooth movement involving space closure and root torque. While in some cases initial alignment may be only a minor problem, with major irregularities of the teeth, the arch wire bracket system is worthy of serious consideration[9]. It has been claimed that the Mini-Uni Twin Brackets give a more rapid and a better-controlled alignment with minimal patient discomfort as the inter-bracket distance is considerably increased due to the reduced slot width.[10,11]

During the aligning stage, the increased interbracket span leads to faster and efficient alignment but the same could be a disadvantage during the space closure because of the reduced archwire 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 interbracket span of the single width bracket but at the same has the rotational control of a double width bracket. Even though the design can have a beneficial effect on the initial aligning, the decreased archwire bracket contact area could lead to a reduced torque control of the anteriors during retraction. As stated by Creekmore[12] the interbracket width changes throughout treatment as the tooth moves and varies around the arches from the variation in tooth size.

The advantages of a single width bracket include increased interbracket width leading to a greater span of wire between adjacent brackets. Hence the aligning and leveling forces were maintained well within the physiologic limits of the teeth. Bracket placement in smaller teeth and crowded teeth was more convenient. Size of the first rectangular wire would not necessarily be the smallest wire and hence the total treatment duration was reduced due to quicker change to higher wires. The bulk of the bracket was reduced significantly hence esthetically pleasing with increased patient comfort. The torquing forces are light due to the greater span of wire and hence these lighter torquing forces are also associated with reduced root resorption.

Various disadvantages of a single width bracket include inadequate tipping and rotational control (especially in brackets without rotational wings)[8]. Reduced torquing efficiency due to a smaller area of contact between the arch wire and the bracket slot is another major problem.

This study was carried out to determine the anchorage loss and torque control during retraction using single width brackets (mini uni twin) with traditional retraction mechanics in 0.018" ROTH System. Rauch[13] has defined torque as 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. Anchorage control throughout the orthodontic treatment is essential for uncompromised results. Staggers and Germane[14] described anchorage as 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.

Controlled space closure requires the creation of a biomechanical system to deliver the relatively constant predetermined force and moment to force ratio in order to avoid unwanted side effects such as distal tipping. Differential tooth movement is accomplished by unequal moments on the anterior and posterior segment. In a tear drop loop, bends are placed in mesial and distal leg of the loop called alpha and beta bends respectively. Alpha bend produces an alpha moment which gives rise to distal root movement of the anterior teeth. The beta bend produces a beta moment which causes the mesial root movement of the posterior teeth. In this study alpha moment of 10° angulation and beta moment of 25° angulation was incorporated. If the beta moment is greater than alpha moment, anchorage is enhanced by mesial root movement of posterior segment along with posterior extrusion and anterior intrusion[15]. Also the alpha moment counteracts the tipping of the anterior teeth by cancelling the moment produced by the retraction forces thereby effecting a bodily movement of the anterior teeth. Clinically for anterior retraction, the tear drop loop is placed closer to the canine than the molar and an increased beta moment produces an increased posterior anchorage. Regardless of the initial magnitude of alpha and beta moment, changes in magnitude occur during retraction. As the anterior teeth are retracted, alpha moment decreases faster than beta moment resulting in an increased posterior anchorage with greater intrusive force on anterior teeth and greater extrusive force on the posterior teeth[15].

This clinical study was conducted to assess the efficiency of Mini Uni Twin brackets regarding Anchorage loss/Torque control. The mean value of change for P2 (inclination of upper incisors) showed a change of 6.2 $\pm$ 1.0. This indicated a loss of torque. 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. The UIE-hor change was 4.8$\pm$ 0.6 and U1A-hor change was recorded as 1.8 $\pm$ 1.4. This torque loss occurred inspite of using a 17x25" SS wire with a gable bend of 10^0 alpha and 25^0beta 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 in the 0.018 slot.

The mean value of change in $P2_1$ (occlusal molar distance from pterygoid vertical) was -1.3 $\pm$ 0.5. The mean $P2_2$(apical molar distance from pterygoid vertical) change value of -0.8 $\pm$ 0.9.This indicated a mesial movement of molars. In case of maximum anchorage, where enmass retraction is indicated, mesial movement of the molar is not uncommon. As the molar tooth is the anchor component, the reactionary forces acting on it would bring about a mesial movement of the molars.

CONCLUSION

To conclude, the Mini Uni Twin brackets may be efficient during alignment and levelling but comparatively are less efficient for torque control during the retaction of anteriors. More clinical studies need to be performed on these Mini Uni Twin brackets, with an increase in the sample size and also the number of parameters to analyze their efficacy.We tend to accept those mechanism and systems in which the advantages outweigh the disadvantages. Since we will never find a completely ideal appliance, we must rely on the one that has the maximum advantages and the one that is best according to the biologic requirements.

Source of support : Nil
Conflicts of interest: None declared

REFERENCES

1. SebancJ, BrantleyW.A, PincsakJ.J and ConoverJ.P. (1984). Variability of effective root torque as a function of edge bevel on orthodontic arch wires. American Journal of Orthodontics , 86, 43–51
2. GermaneN, BentleyB.E, Jr. and IsaacsonR.J.(1989).Three biologic variables modifying faciolingual tooth angulation by straight-wire appliances. American Journal of Orthodontics and Dentofacial Orthopedics, 96, 312–319
3. MiethkeR.R and MelsenB . (1999.) Effect of variation in tooth morphology and bracket position on first and third order correction with preadjusted appliances. American Journal of Orthodontics and Dentofacial Orthopedics, 116, 329–335.
4. Morina E, EliadesT,P, Jäger A and BourauelC .(2008). Torque expression of self-ligating brackets compared with conventional metallic, ceramic, and plastic brackets. European Journal of Orthodontics, 30, 233–238.
5. Archambault A.Major,T.W.CareyJ,P.HeoG.BadawiH and MajorP.W . (2010). A comparison of torque expression between stainless steel, titanium molybdenum alloy, and copper nickel titanium wires in metallic self-ligating brackets. The Angle Orthodontist, 80, 884–889
6. Papageorgiou S.N, Konstantinidis I, Papadopoulou K, Jäger A and Bourauel C. (2014).Clinical effects of pre-adjusted edgewise orthodontic brackets: a systematic review and meta-analysis. European Journal of Orthodontics, 36,350–363
7. Hong RI, Sunwoo J, Park J H.(1997). Incisor Inclination Indicators for Diagnostic Setups. J Clin Orthod, 31, 620 – 623.
8. 3 M Unitek literatures: 1990.
9. Bednar J G, and Gruendeman G W.(1993). Influence of bracket design on moment production during axial rotation. Am J Orthod Dentofacial Orthop, 104, 254-61
10. Bennet J C and Mclaughlin.(1990). Controlled Space Closure with a Preadjusted Appliance System. J Clin Orthod, 4, 251 – 260.
11. Burstone C J. The segmented arch approach to space closure. (1982) Am J Orthod Dentofacial Orthop, 11,361 – 378.
12. Ceekmore T D. (1976). The Importance of interbracket width in Orthodontic Tooth Movement. J Clin Orthod , 10, 530 – 534
13. Rauch E D. (1959). Torque and its application to orthodontics: Am J Orthod Dentofacial Orthop, 817 – 830.
14. Siatkowski R E.(1994) Force System Analysis of V-Bend Sliding Mechanics. J Clin Orthod, 28, 539 – 546
15. ProffitW.R: Contemporary orthodontics. 4th edition: Mosby publication 2000