Original Article

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A COMPARATIVE STUDY OF ANCHORAGE LOSS BETWEEN SDRS AND SLIDING MECHANICS TECHNIC WITH MINISCREWS DURING EN MASS RETRACTION OF MAXILLARY SIX TEETH IN CLASS II MALOOCLUSION PATIENTS : IN VIVO STUDY

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ABSTRACT:

This study aimed to compare anchorage loss between SDRS and sliding mechanics technic with miniscrews during en mass retraction of the maxillary six teeth in class II malocclusion patients.

Sample consisted of 30 patients, aged between 18 -25 years, which were divided into two groups according to the followed retraction technic (15 patients treated with sliding mechanics technic and 15 patoents with SDRS), measurements correlated with anchorage loss were taken and processed by using of T student test. It was found that there were significant statistical differences between two methods of retraction, Results showed a superiority of sliding technic with miniscrews in respect with anchorage loss. However, it was noticeable that the two methods provide maximum anchorage.

As a result, we advise to use SDRS when absolute anchorage is not a critical requirement in treatment procedures.

Key Words: mini screw, sliding mechanics, SDRS, Class II Maloclusion, Anchorage.

INTRODUCTION

The dentoskeletal morphology of Class II malocclusion has been analyzed in a number of cephalometric investigations (Craig et al, 1951)(Gilmore WA,1952). Some studies found that the maxilla in Class II/1 patients were more protrusive, and the mandible was normal in size and position (Rosenblum,1995). Other studies found that the maxilla was in a normal position in relation to the cranial base while the mandible was retrusive (Rosenblum,1995)(McNamara,1981).

Others found that the Class II skeletal pattern in Class II/1 patients is due to both maxillary protrusion and mandibular retrusion (Craig et al, 1951)(Pancherz et al, 1997). The retraction of the upper anterior teeth is an important stage in many orthodontic cases which are treated by extraction and particularly camouflages for the class II cases(Kuroda et al 2009) and the treatment of bimaxillary protrution cases (Upadhyay et al 2008).

Extracting the first four premolars and retracting the anterior segments with maximum anchorage is the most common way to reduce lip protrusion and to straighten the patient's profile(Bills et al, 2005). Several studies

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have indicated that the en mass retraction of the anterior six maxillary teeth is considered favorable in comparison with the retraction of upper anterior teeth in two phases which are canine retraction and then incisors retraction, due to the multiple biomechanical features and in particular the better control of the incisors' vertical position and torque (Heo et al 2007)(Michael and Mrcotte 1990) .

Accurate prediction of the amount of anchorage loss during extraction space closure is critical in determining both the treatment planning and the selection of appropriate mechanics (Heo et al, 2007). For minimizing anchorage loss and maximizing tooth movement efficiency, Tweed (Tweed CH.,1941,1966) emphasized anchorage preparation as the first step in orthodontic treatment. Storey and Smith (Storey E, Smith R. ,1952)advocated the use of light force values, and Begg (Begg PR., 1956)emphasized the advantages of differential force to produce the maximum rate of movement of teeth. Moreover, The entry of structural support devices in the orthodontic clinical field, particularly the orthodontic mini-screw, enabled orthodontist specialist to overcome many of the difficulties that arise during orthodontic treatment as the Control of anchorage and the need for the cooperation of the patient and the loss of posterior teeth.(Melsen and Verna 2005)(Nanda and Uribe 2009).

Sliding mechanics technique is counted as the most widely used technique in the en mass retraction of maxillary anterior teeth with the support of the orthodontic mini-screws(Nanda and Uribe 2009) (Lee et al 2007). However, there are several problems with this technique, particularly the problem of friction that determine the effectiveness of the teeth movement(Park et al 2004) and prolong the treatment duration.(Kapila et al 1990)(Downing et al 1994)(Edward et al 1995). Both friction sliding and frictionless loop mechanics are used for space closure in extraction therapy.

In sliding mechanics, the wire and position of the bracket give control of tooth movement, whereas in a loop-spring system, control is built into the spring. Either method has its own advantages, and the methods complement each other. One of the major advantages of frictionless mechanics is that a known force system is delivered to teeth because there is no dissipation of force by friction. However, it may be difficult to measure the exact force system clinically produced by a loop-spring appliance because when both ends of a loop spring are engaged in brackets, a moment and a force are generated concomitantly, and it is difficult to measure both a moment and a force simultaneously. This results in a statically indeterminate system.(Choy et al, 2002)

The aim of this study is to compare between Sliding mechanics technique

with the anchorage of the orthodontic mini-screws and statistically determinate retraction system SDRS in the en mass retraction of maxillary anterior teeth in terms of efficiency in maintaining Anchorage.

MATERIALS AND METHODS

Sample consisted of 30 adult patients with Class II malocclusion, who needed to be treated with a treatment plan of retraction of the anterior upper six teeth, while minimizing posterior anchorage loss.

Insertion criteria:

1- Patients ages are between 18 – 25 years.

2- The six superior anterior teeth were good aligned.

3- over jet ≥ 5 mm

4- No history of previous orthodontic treatment.

5- No history of trauma to the dento-facial structures

6- Subjects must have fully erupted permanent dentition up to second molar tooth.

7- There is no (supernumerary teeth, missed teeth, or impacted teeth) except third molars.

8- There is no posterior cross-bite

9- No history of periodontal diseases

Thirteen patients fulfilled the criteria and were allocated into group 1(n = 15, en masse retraction, using sliding mechanics with miniscrews) and group 2 (n = 15, en masse retraction, using the statically determinate retraction system (SDRS).

0.018 slot width brackets were the choice to use with all cases (American Orthodontics). For first group, mini screws type (American Orthodontic) size (D16.17) were used. Whereas SDRS which is a spring suggested by Choy and Burstone was formed from a titanium – molybdenum alloy. size (0.0017x0.0025 inch) and used for patient.

Lateral cephalometric radiographs were taken before treatment (T1) and after treatment (T2). All lateral cephalograms were traced by one investigator. Data was stored in DICOM (Digital Imaging and Communications in Medicine) format. All traces were digitized by means of a Radiant Dicom Viewer. Landmarks and reference planes and angles used for this study were illustrated in Figure 1.

(T Student) Test was conducted for the related samples to study the difference reference in the mean of each studied variables between the two periods (before retraction- after retraction).

Anchorage variables:

LA-PTV: the horizontal distance from LA to PTV(mm)

LO-PTV: the horizontal distance from LO to PTV (mm)

U6M-PTV: the horizontal distance from U6M to PTV (mm)

U6D-PTV: the distance from U6D to PTV (mm),

U1-Angle:the Angle between the long Axis of the central upper incisor and SN.

U6-Angle:the Angle between the long Axis of the upper first molar and SN.

RESULTS:

Table (1) shows the distribution of the clinical study sample according to retraction technic:

Table(2) and Table (3) show T Student test results which was conducted for the related samples to study the difference reference in the mean of liner and angular dental variables between the two studied periods (before retraction-after retraction) in both study groups.

Regarding to LO-PTV : there was no significant statistical difference between mini-screw retraction method and the SDRS.

Regarding to LA-PTV : there was a significant statistically difference between the two methods, that in the mini-screw method the mean value of apex retraction was larger compared with the SDRS method.

Regarding to U6M-PTV and U6D-PTV and U6-angle U1-angle. there is a statistically significant differences between the two retraction methods.

We notice from the table that U6M-PTV and U6D-PTV moved distally in the mini-screw method and U6-angle decline after the retraction.

Either in SDRS method the movement for the points U6m-PTV and U6d-PTV was mesial. Moreover, it seems from the table that there is a statistical difference between the mini-screw method and the SDRS in maintaining the anchorage for the mini-screws.

DISCUSSION:

We notice from the table 3 : LO-PTV that there is no significant statistical difference between mini-screw retraction method and the SDRS, that in both methods the incisal edge for the maxillary incisors have been retracted in the same efficiency.

The result of two groups of sample are the same as the study of (Heo et al 2007) where the retraction amount of the cutting edges for the maxillary incisors in this study (-6.52 ±1.27 mm) in the retraction mass groups, although the anchorage that has been used in this study was traditional.

The results of the two groups of samples disagree somehow with a study result of (Upadhyay et al 2009), where the amount of retraction of the incisal cutting edges of the maxillary incisors in this study (-5.18 ±2.74).

The results of the two groups of the clinical sample disagree with the results of a study of (Park et al 2008), which showed bigger retraction on the cutting edges level of the maxillary incisors by (-8.59 ±2.62) in the mini-screw group and (-7.47 ±2.69) in the Tweed group. However, we notice from the value of LA-PTV that there is a significant statistically difference between the two methods, that in the mini-screw method the mean value of apex retraction has been was larger compared with the SDRS method.

The results of the two groups of the clinical samples in our study differ from the results of the mini-screw group in the study of (Upadhyay et al 2008 a), which showed a retraction of the incisors roots apex by less than (-0.90 ±1.33). It seems from this difference that the possibility of the torque control during the retraction was more efficient in the mini-screw method. However, the type of movement in both methods is a mix of the controlled tipping movement and the bodily movement. In other words as an outcome for the relation between the cutting edge movement and the apex, we notice that the palatal inclination for the incisors during the retraction is bigger in the SDRS method. Therefore, we recommend it in cases where the incisors show high buccal tipping.

We notice from the table that U6m-PTV and U6d-PTV moved distally in the mini-screw method, because of the friction between the wire and the molars tube during the retraction and this explains the U6-angle decline after the retraction. Either in SDRS method the movement for the points U6m-PTV and U6d-PTV was mesial. Moreover, it seems from the table that there is a statistical difference between the mini-screw method and the SDRS in maintaining the anchorage for the mini-screws and that is expected but the notable that the anchorage which provided by the SDRS method is classified as a maximum anchorage because the molar mesial movement did not exceeded 1mm, and that is explained:

1- Because the spring applied forces are light forces which does not exceed the 150g and because of the absence of the friction forces in the loop technic.

2- The existence of the TPA.

In addition to banding the second molar.

CONCLUSION:

In mini-screws technic the first molars moved distally in a small amount as a result of the friction between the wire and molar tube whereas in SDRS technic the first molars moved mesially in a small amount.

-In both methods we had an anchorage classified as the maximum.

-We noticed when applying SDRS technic that it caused bigger palatal tipping for the maxillary incisors comparing with the miniscrews. Therefore, it is favorable in

cases when the maxillary incisors are tipped bucally significantly.

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TABLES AND FIGURES:

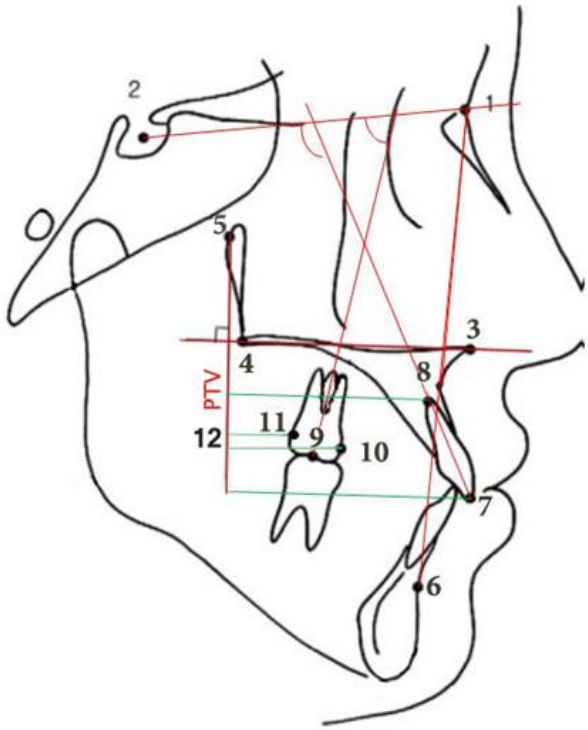

Figure 1. Landmarks and reference planes used for this study.
1,nasion (N); 2, sella (S); 3, anterior nasal spine (ANS); 4, posterior nasal spine (PNS); 5, pterygoid point (Pt point); 6,supramentale (point B); 7, upper incisor edge (LO); 8, upper incisor root apex (LA); 9, center of maxillary first molar crown on
occlusal surface (U6C); 10, most mesial point of mesial surface of maxillary first molar crown (U6M); 11, most distal point of mesial surface of maxillary first molar crown (U6D) 12,vertical reference plane through Pt point (tangent to palatal plane) (PTV).

Table (1) shows the distribution of the clinical study sample according to retraction technic:

Retraction Technic	Patients Number	Percentage (percent)
Mini-screw technic	15	50
SDRS technic	15	50
Total	30	100

Table No.(2) T test for the doubled samples for the difference of the variables mean technic mini-screw between before and after Retraction.

T test		After Retraction					Before Retraction					Type
Sig	T value	Maximum	Minimum	Std. Deviation	Mean	N	Maximum	Minimum	Std. Deviation	Mean	N	
**0.000	53.023	55	50	1.727	51.13	15	61	56	1.765	57.40	15	**LO_PTV**
**0.000	19.000	46	41	1.944	43.73	15	49	43	1.981	46.27	15	**LA_PTV**
**0.000	37.073	29.8	22.4	2.465	26.462	15	30.4	23.0	2.437	27.060	15	**U6M_PTV**
**0.000	27.907	17.65	10.5	2.096	13.669	15	18.2	11.2	2.128	14.233	15	**U6D_PTV**
**0.000	57.080	105.1	93.1	3.825	100.5	15	116.7	105	3.871	111.167	15	**U1_ANGLE**
**0.000	28.486	76.7	67.3	3.720	73.243	15	77.3	68.2	3.647	73.980	15	**U6_ANGLE**

Table (3) T test for the doubled samples for the difference of the variables mean technic SDRS between before and after Retraction.

T test		After Retraction					Before Retraction					Type
Sig	T Value	Maximum	Minimum	Std. Deviation	Mean	N	Max	Min	Std. Deviation	Mean	N	
**0.000	42.833	54	50	1.457	51.47	15	60	56	1.633	57.67	15	**LO_PTV**
**0.000	16.000	49	42	1.959	46.13	15	52	44	2.052	48.27	15	**LA_PTV**
**0.000	-15.824-	31.4	23.55	2.264	26.89	15	30.4	23	2.206	26.26	15	**U6M_PTV**
**0.000	-13.216-	19.2	12	2.3117	14.257	15	18.2	11	2.3219	13.51	15	**U6D_PTV**
**0.000	89.882	105.6	93	3.9519	99.677	15	118.6	104.9	4.0213	112.3	15	**U1_ANGLE**
**0.000	-25.282-	78.4	67.9	3.8702	73.06	15	77.5	67.2	3.8882	72.25	15	**U6_ANGLE**

Table (4) shows T Student Test results, which was conducted for the independent samples to study the difference reference in the mean value of each of the liner and angular dental variables between the mini-screw technic group and the SDRS technic.

It was noticed from the table that there were significant statistical differences between all measurements except the measurement LO-PTV.

T test			Mean	SDRS				Miniscrews				
	Sig	t	Difference	Max	Min	Std. Dev	Mean	Max	Min	Std. Dev	Mean	
-	0.325	-1.003-	-.1333	-5.6	-6.6	0.340	-6.013	-5.6	-6.7	0.387	-6.147	LO_PTV
**	.000	-4.114-	-.5866	-1.5	-2.6	0.313	-1.967	-2.0	-3.3	0.455	-2.553	LA_PTV
**	.000	-28.640-	-1.224	1.0	0.6	0.153	0.627	-0.5	-0.7	0.062	-0.598	U6M_PTV
**	.000	-21.883-	-1.308	1.0	0.6	0.218	0.743	-0.5	-0.7	0.078	-0.565	U6D_PTV
**	.000	8.168	1.907	-11.9	-13.0	0.542	-12.573	-10.0	-12.0	0.724	-10.667	U1_ANGLE
**	.000	-37.555-	-1.550	1.0	0.6	0.125	0.813	-0.6	-0.9	0.100	-0.737	U6_ANGLE