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Evaluation of the Rate of Canine Retraction with Two Commercially Available Straight Wire Brackets

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ABSTRACT

Objective: This study was to compare the rate of canine retraction with two commercially available straight wire brackets. **Materials and methods**: A sample of 10 patients with an age range from 15 to 18years, requiring orthodontic treatment. The study was designed clinically (split mouth technique) in the same patient right side bonded by Ormco Roth orthodontic brackets while in the left side were bonded byIMD Roth orthodontic brackets . Canine retraction was measured four times every 28 day till complete retraction of canine occurred. **Results:** the rate of canine retraction was non significantly different from right and left side, also monthly, weekly and daily rate of canine retraction was non significantly different in the right and left side. **Conclusion**: The rate of Canine retraction using (IMD brackets is insignificantly different from (Ormco) brackets, both of them have the same rate, during the first ,second, third and fourth interval no significant difference on the rate of canine retraction between the 2 groups

KEYWORDS

Tooth movement, canine retraction, Roth brackets, IMD brackets, Ormco brackets.

INTRODUCTION

Orthodontic tooth movement is defined as the result of biologic response to interference in the physiologic equilibrium of the dento-facial complex by an externally applied force.[1]

Tooth movement was described in one statement as: Orthodontic forces alter blood flow and the localized electrochemical environment, upset the homeostatic environment of the PDL space, initiate biochemical and cellular cascade that resurfaces the bony contour of the alveolus. This statement clarifies that tooth movement cannot be explained in term of one theory.[2]

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Among the factors influencing the rate of orthodontic tooth movement are the type and level of force. Type and level of force have a bearing on the occurrence of root resorption during orthodontic treatment. The teeth showed faster movement with a light continuous force than with dissipating or interrupted forces.[3]

In order to move the tooth, orthodontic treatment requires an optimum force. This optimum force should result in maximum rate of tooth movement with minimum irreversible damage. Several studies recommended a 150 g as the optimum force for canine retraction. However, other studies conclude that was no significant difference between the 100 g and 150 g groups in the rate of canine movement.[4]

In orthodontic therapy extractions are frequently indicated to correct severe crowding, to retract the anterior teeth and to correct molar mal-relationships or to modify the facial profile. The most common mechanism for making retraction space available involves the extraction of first premolar in each quadrant.[5]

Orthodontic brackets are an essential component of modern fixed appliances. In order to deliver the exact force from the wire to the teeth brackets should have the correct hardness and strength.[6] They should have a smooth archwire slot to reduce frictional resistance [7], and an otherwise smooth surface to reduce the plaque deposition. [8] Because most orthodontic brackets are produced with a three –dimensional prescription for each tooth, they should be accurately manufactured to reflect this.[9] They should also have a high corrosion resistance and good biocompatibility.

Recently, introduced orthodontic brackets of low cost. IMD brackets may have effect on frictional resistance and consequently influence the rate of canine retraction

MATERIALS AND METHODS

The sample of this study consisted of 10 orthodontic female patients with age from 15-18years old, selected from patients seeking orthodontic treatment, Orthodontic Department, Faculty of Dental Medicine, AL- Azhar University, Girls Branch.

Inclusion Criteria:

The subjects in the present study had the following criteria:-

1. Class I malocclusion with severe crowding or proclination or class II division I
2. Orthodontic treatment plan entailed the extraction of bilateral maxillary first premolars.
3. Full eruption of all permanent teeth except the third molars.
4. Good oral hygiene.
5. Patients and their parents signed informed consent forms before the start of orthodontic treatment.

Instructions to the subjects:

1. Oral hygiene measures must be carefully regarded.
2. Appointment must be respected as scheduled.

Methods:

1. The aim and methods of the study was explained to the patient and consents were signed by all willing participants before being enrolled in the study.
2. The following records had been taken for each patient:
   - Extra-oral photographs.
   - Intra-oral photographs.
   - Orthodontic study model.
   - Panoramic Radiographs.
   - Lateral cephalomteric Radiograph.

Both the maxillary right and the left first premolars were extracted. A period of about 12-20 weeks was maintained after extraction (this period for leveling and alignment) before canine retraction was performed. This allowed alveolar bone consolidation at the extraction sites.

After the separation phase, molar bands with buccal tube (0.022"× 0.028") were selected for the right and left maxillary first molars.(Ormco)

In all patients, for the upper arches were fitted by an orthodontic appliance constructed with brackets (0.022"×0.028") slot. Orthodontic treatment was performed with fixed direct bond Roth system appliances, by using split mouth technique brackets bonded to the upper right side were ormco orthodontic bracket with(0.022"×0.028") inch slot, and using IMD orthodontic brackets with(0.022"×0.028") inch slot. Brackets were bonded with light cure composite cured by LED light curing unit from gingival and occlusal directions for optimum curing.

The brackets were bonded from the right second premolar to the left second premolar except the maxillary right and left first premolars which were extracted. Brackets ligated with elastomeric O-rings (Ortho Pro type)

For leveling and alignment arch wires of 0.012 NiTi followed by 0.014 NiTi and 0.016NiTi. Then arch wire of 0. 016 and 0.018 stainless steel was used for completion of leveling and alignment.

For canine retraction, the initial leveling and alignment was followed by placement of an upper continuous 0.016"×0.022" stainless steel arch wire. The arch was left in situ for 3 weeks before initiation of canine retraction. This period enabled full arch wire passivity before retraction of the maxillary canines.

Prior to the canine retraction phase both right and left maxillary first molars and second premolars were ligated together using 0.009-inch stainless steel wire in the form of figure 8. This aided in increasing the anchorage by a transpalatal arch appliance fabricated from 0.9 mm stainless steel wire soldered to the maxillary 1st molar bands. Ligation of the upper incisors using 0.009- inch wire in the form of figure 8 was performed for anterior segment stabilization.

The distal retraction of the maxillary right and left canines was performed using a prefabricated 9mm super elastic Nickel-Titanium closed coil spring. The distal wing of the canine bracket was fixed using 0.009 -inch wire ligature wire to the arch wire to avoid rotation of the canine during retraction.

The right and left canines were retracted with the same force magnitude of 180-250gm on the average checked with force gauge (Dial tension gauge, China).

Measurements

The amount of retraction was measured from the cusp tip of the maxillary canine to the cusp tip of mesiobuccal cusps of the maxillary 1st molar in both sides.

All the changes in the amount of retraction were measured intraoral using digital caliper every 4 weeks till extraction space closure in any of two sides.

RESULTS

Overall throughout the study, a distance of 5.76±1.21 was displaced by the canine in the right side, which was not significantly different than the distance (5.64±1.20) displaced in the left side. P value was (0.8263) (Table 1)

The monthly rate of canine displacement in each side overall throughout the study. A greater mean monthly displacement was recorded in the right side 1.44±0.3. Unpired t test revealed that the difference was statistically insignificant. Overall throughout the study, the weekly rate of canine displacement 0.36 mm in the right side was not significantly different than the rate of displacement 0.35 mm in the left side. P value was (0.5198), (Table 2)

Table(1): *Showing the mean distance throughout the study by which the canine was displaced*

	First interval		Second interval		Third interval		4th interval		Overall	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Mean	2.32	2.11	1.54	1.58	1.11	1.17	0.79	0.77	5.76	5.64
SD	0.66	0.71	0.36	0.52	0.33	0.28	0.13	0.19	1.21	1.20
Min	1.45	1.20	0.91	0.90	0.56	0.76	0.53	0.52	3.79	3.55
Max	3.28	3.30	1.89	2.40	1.52	1.70	0.94	1.12	7.50	7.20
t value	0.6851		0.20		0.4384		0.2747		0.2227	
P value	0.5020 ns		0.8437 ns		0.6663 ns		0.7867 ns		0.8263 ns	

Table (2): *Showing the monthly rate of canine displacement*

	Overall monthly rate of displacement	
	Right side	Left side
Mean	1.44	1.41
SD	0.30	0.30
Min	0.95	0.89
Max	1.88	1.80
t value	0.2236	
P value	0.8256 ns	

DISCUSSION

Tooth movement to close space is one of the most desired goals of orthodontic treatment. For years, orthodontists have searched for an efficient force system that can work quickly, accurately, and effectively to close extraction spaces.[10]

The present study designed to investigate the difference in the rate of canine retraction by using 2 different types of orthodontic brackets (type A) for the right side (type B) for the left side.

The sample size composed of ten patients. The mean age of the human subjects was 16.5±1.7 year. Where, the rate of orthodontic tooth movement is more responsive to orthodontic force in juvenile than in adults.[11]

The age of the patients was selected to be in harmony because orthodontic tooth movement is affects by the age of the patient. This is supported by study found that the rate of canine retraction by Niti canine retraction spring was faster in younger than adult.[12]

Regarding the sex of the patients the sample was consisted of female patients only to avoid the different hormonal side effect. The sex effect was reported. Who found that the rate of tooth movement was affected by many factors among them the sex of the patient.[13]

From the ten included patients, eight patients were diagnosed as Class I with dentoalveolar bimaxillary protrusion and two patients were diagnosed as Class II division 1maloclusion.

The intra-examiner error of the method was estimated by taken each measurement twice and the mean of the two values was recorded. On the other hand, the statistically t-test was performed for pre retraction measurements of both groups to ensure that they were homogenous.

The reported rate of canine retraction in the present study was in harmony with those of Ziegler auther[14] who studied the effect of PG canine retractor,[15] who used ratched bracket[16] who studied the effect of Ricketts retractors.

On the other hand, our result was faster than that of keng et al.[17]who used NiTi T-loop (0.91mm/

month) and TMA T-loop (0.87mm/month) and Watanabe and Miyamoto [12] who used NiTi canine spring (0.62mm/month). This could be contributed to the different designs of the appliances used (shape, wire material and wire cross section), the different samples and different force utilized. Also, the result was faster than those of other auther[18] who use magnet (1.22mm/month).

Canine retraction in the first interval was 2.32mm in the right side and 2.11mm in the left side which was higher than the second, third and fourth intervals and the rate of retraction reduced through the intervals from the first to the fourth due to the occurance of contact at the wire and bracket interface at the mesial and distal aspects of the bracket which form force couple lead to increase the friction and decrease the rate of canine retraction

In the present study the rate of canine movement along 0.016×0.022 stainless steel arch wire were in accordance with findings of many authers[19-22] who found that St St wires generated less friction within St St slots than NiTi wires such that 0.016×0.022 inch NiTi produced a greater mean force value compared with 0.016×0.022 inch St St. This difference was thought to be related to the roughness of the wire alloy surface.

However, some authors reported that less friction with nickel-titanium alloy wires. This behavior is related to the smaller modulus of elasticity for the NiTi archwires. [23,24]

CONCLUSIONS

From the results of the present study, the following conclusions could be extracted

1. The rate of Canine retraction using (IMD)brackets is insignificantly different from (ORAMCO) brackets, both of them have the same rate
2. During the first ,second, third and fourth interval no significant effect on the rate of canine retraction between the 2 groups

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