



Comprehensive Evaluation of Accelerated and Predictable Canine Retraction Mechanics As Detected At Premolar Region: An Original Research Study

Dr. Adel Alharbi

Assistant Professor of Orthodontics, Department of Orthodontic and Pediatric Dentistry, College of Dentistry, Qassim University, Saudi Arabia
Email: dr.adel.alharbi@qudent.org

Abstract

Background and Aim: Orthodontic tooth movements are highly revolutionalized these days with latest concepts and technological aids. However all methodologies have their own limitations and issues. Accelerated canine retraction mechanics is also one of such highly experimented modalities. This study was planned to comprehensively evaluate the accelerated and predictable canine retraction mechanics as seen at premolar region.

Materials and Methods: All 20 patients of age range 16 to 25 years were included in the study and informed consents were obtained. All twenty subjects were further divided into 2 groups. Group 1 consisted of 10 patients those received conventional treatment with pre-adjusted Edgewise Appliance bracket system. Group 2 patients included those 10 who received rapid canine retraction through distraction osteogenesis. Amount of movements and other different parameters were recorded. Data was also recorded about the changes in maxillary canine and first molar position and mean space closure and time taken for the same. P values less than 0.05 was considered as significant.

Statistical Analysis and Results: All patients 20 were grouped into 4 age groups wherein 3 patients were in the age group of 16-18 years. Maximum 9 patients were in the age range of 19-21 years. In Group 1 mean canine movement was 1.43 (mm/week). Mean Canine Rotation was 9.65 (degree). The p value was highly significant (0.020). Mean Molar rotation was reported to be 0.06 (degree). The relative p value was highly significant (0.010). In Group 2 for canine movement, the statistical mean was 3.65 (mm/week). Mean Canine Rotation was 12.43 (degree). The relative p value was highly significant (0.020). One-way ANOVA calculations also confirmed highly significant p value (0.001).

Conclusion: Within the limitations of the study, authors concluded that Rapid Canine Retraction by Distraction Osteogenesis method results in sufficient tooth movement even in lesser time when compared with Conventional Treatment with Pre-Adjusted Edgewise Appliance. Results and interpretations of Rapid Canine Retraction were highly significant also.

Keywords: Canine Retraction Mechanics, Accelerated Mechanics, Orthodontics, Premolar Orthopantomogram, Distraction Osteogenesis



Introduction

Orthodontic therapy is commonly practiced for alignment correction of dentition of young age. Apart from other dental procedure, orthodontic correction usually requires 1 to 2 years. This time may be even more in special clinical circumstances.^{1,2} Many of the young patients usually hesitate in having orthodontic correction due to lack of time and multiple visits. Currently, biological tooth movements are achieved by conventional orthodontic therapy. However, canine retraction usually takes most of the treatment time up to 10 months.^{3,4} All these clinical demands actually led foundation stone for rapid treatment or rapid orthodontics. This was primarily focused on the accelerated orthodontic tooth movement and shortening of the treatment duration. Many of the researchers in the literature have also experimented several methods to reduce the multiple visits as well as long treatment timing.⁵ However with the introduction of rapid canine retraction through distraction osteogenesis, these clinical dilemmas have been controlled to a certain extent. Therefore, this in vivo study was conducted to comprehensively evaluate the accelerated and predictable canine retraction mechanics as seen at premolar region.

Materials and Methods

This study was completed on total 20 patients of age range 16 to 25 years. Both male and female patients were studied in detail. All subjects were included in the study only after selection via purposive sampling procedure. Inclusion criteria included patients those requiring canine extraction along with premolar extraction. All participants have been explained about the study included their parents. Informed consents were also obtained as and when required from their legal parents. Exclusion criteria included patients with any known bony disorders, patients with known ongoing medication for calcium and related disorders, patients with any possibility of loss of

eISSN1303-5150

future follow up. For the relative ease of study and data recording, all twenty subjects were further divided into 2 groups. Group 1 consisted of 10 patients those received conventional treatment with pre-adjusted Edgewise Appliance bracket system. Group 2 patients included those 10 who received rapid canine retraction through distraction osteogenesis. Data was recorded from these two study groups logically. Amount of movements and various other parameters were noted with the help of records taken in subsequent follow up visits. For all patients, weekly recall visit was ensured and measurements were done using precise digital caliper, orthopantomogram, intraoral periapical radiographs of intended regions, study models both pre and post operative, vitality tester for distracted canine and adjacent teeth. Preoperative and post operative extra oral clinical photographs were also taken and preserved. Exclusion criteria included a) patients with possibility of loss of follow up b) patients with gross anomaly in the face c) patients with known systemic complication. Data was recorded pertaining details of changes in maxillary canine and first molar position and mean space closure and time taken for the same. The privacy and other rights of the patients along with their freedom of expression were kept totally confidential. The recorded data was subjected to suitable statistical tests to obtain p values, mean and other statistical parameters. P values less than 0.05 was considered as significant.

Statistical Analysis and Results

All the measured data were gathered in systematic way and subjected to suitable statistical analysis using SPSS statistical package for the Social Sciences version 22 for Windows. For the relative ease, all patients were grouped into 4 age groups depending on their age range. Out of the total studied size of 20 patients, 3 were in the age group of 16-18 years. P value was reported to be significant for first age group (0.02). Maximum 9 patients were in the

www.neuroquantology.com



age range of 19-21 years. In general, we studied 10 male and 10 female patients (Table 1 & Graph 1). Table 2 depicts about patients distribution according to group and modality utilized. Table 3 discussed about fundamental statistical description with level of significance evaluation using “Pearson Chi-Square” test For Group 1 Conventional Treatment With Pre-Adjusted Edgewise Appliance, n=10. For canine movement, the statistical mean was 1.43 (mm/week). Mean Canine Rotation was 9.65 (degree). The relative p value was highly significant (0.020). Mean Molar rotation was reported to be 0.06 (degree). The relative p value was highly significant (0.010). Mean space closure time was found to be 23.72 days. The relative p value was highly significant (0.010). Means of space closure as measured combined

for closure interval 1, 2 and 3 was 2.72 (mm). In Group 2 [Table 4, Rapid Canine Retraction through Distraction Osteogenesis, n=10] for canine movement, the statistical mean was 3.65 (mm/week). Mean Canine Rotation was 12.43 (degree). The relative p value was highly significant (0.020). Mean Molar rotation was reported to be 0.34 (degree). The relative p value was highly significant (0.010). Mean space closure time was found to be 18.20 days. The relative p value was not significant (0.100). Means of space closure as measured combined for closure interval 1, 2 and 3 was 2.93 (mm). The relative p value was not significant (0.560). Table 5 shows comparison among the three study groups using one-way ANOVA [for group 1,2]. The measured p value was highly significant (0.001).

Table 1: Age & gender wise allocation of patients

1720

Age Group (Yrs)	Male	Female	Total	P value
16-18	2	1	3	0.02*
19-21	3	6	9	0.07
22-23	4	1	5	0.08
24-25	1	2	3	0.01*
Total	10	10	20	*Significant
*p<0.05 significant				

Table 2: Patients distribution according to group and modality utilized

Group	Modality	[n]
Group 1	conventional treatment with pre-adjusted Edgewise Appliance bracket system	10
Group 2	rapid canine retraction through distraction osteogenesis	10



Graph 1: Age range and gender wise distribution of patients

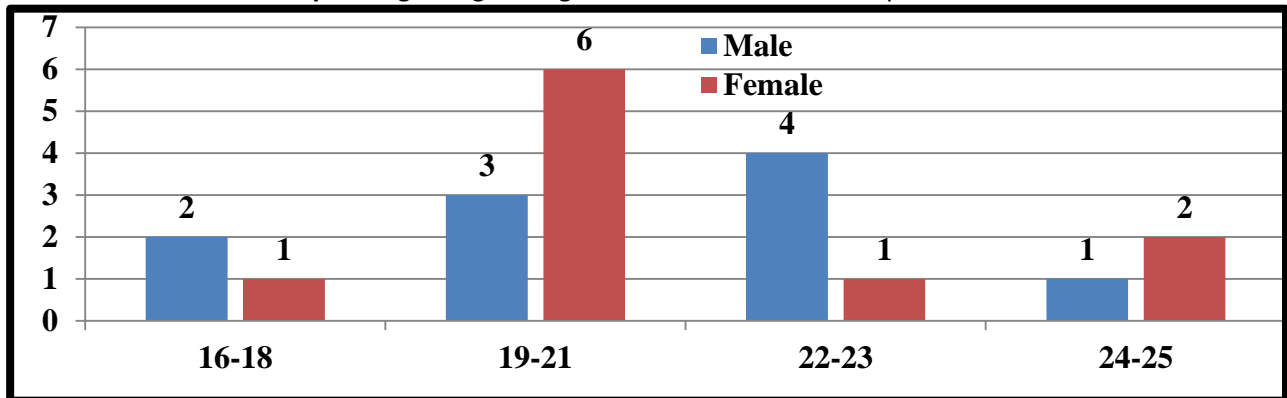


Table 3: Fundamental statistical description with level of significance evaluation using “Pearson Chi-Square” test For Group 1 [Conventional Treatment With Pre-Adjusted Edgewise Appliance, n=10].

Parameters	Statistical Mean	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level Significance (p value)	of
Canine Movement	1.43 (mm/week)	0.563	0.325	1.96	2.345	1.0	0.054	
Canine Rotation	9.65 (degree)	0.434	0.456	1.96	2.124	2.0	0.020*	
Molar Rotation	0.06 (degree)	1.346	0.877	1.96	2.786	1.0	0.010*	
Space Closure Total	4.23 (mm)	0.786	0.356	1.96	1.556	1.0	0.090	
Space Closure Time	23.72 (days)	0.637	0.527	1.32	2.831	1.0	0.010*	
Space Closure (1-3 interval)	2.72 (mm)	0.402	0.499	1.04	2.193	2.0	0.210	

*p<0.05 significant

1721

Table 4: Fundamental statistical description with level of significance evaluation using “Pearson Chi-Square” test For Group 2 [Rapid Canine Retraction through Distraction Osteogenesis, n=10]

Parameters	Statistical Mean	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level Significance (p value)	of
Canine Movement	3.65 (mm/week)	0.563	0.325	1.96	2.345	1.0	0.054	
Canine Rotation	12.43 (degree)	0.434	0.456	1.96	2.124	2.0	0.020*	
Molar Rotation	0.34 (degree)	1.346	0.877	1.96	2.786	1.0	0.010*	



Space Closure Total	6.11 (mm)	0.786	0.356	1.96	1.556	1.0	0.090
Space Closure Time	18.20 (days)	0.536	0.244	1.56	2.433	1.0	0.100
Space Closure (1-3 interval)	2.93 (mm)	0.764	0.336	1.10	1.063	2.0	0.560
*p<0.05 significant							

Table 5: Comparison among the three study groups using one-way ANOVA [for group 1,2]

Variables	Degree of Freedom	Sum of Squares Σ	Mean Sum of Squares $m\Sigma$	F	Level of Significance (p)
Between Groups	3	2.123	1.878	2.4	0.001*
Within Groups	18	6.566	0.542	-	
Cumulative	132.03	11.312	*p<0.05 significant		

Discussion

Orthodontics is the field of dentistry which deals primarily with the alignment corrections and treatment of dentition and related esthetics. Rapid orthodontics is a newer modality of orthodontics which offers several benefits to patients in terms of time, cost and comfort.^{6,7} Conventional treatment with pre-adjusted edgewise Appliance is traditional technique and practiced worldwide very frequently. However, long time and multiple visits are its potential disadvantages.^{8,9,10} Due to all these clinical issues people are gradually diverting towards rapid orthodontics which offer excellent results within shorter time. Rapid canine retraction is typically assisted by distraction osteogenesis. This method is highly popular among orthodontists and budding practitioners.^{11,12} Our study results were highly comparable to the results of other significant studies in the literature. Our study confirms that rapid canine retraction through distraction osteogenesis method results in sufficient tooth movement even in lesser time when compared with conventional treatment with pre-adjusted edgewise appliance. Kumar and associates in 2013 studied dento-alveolar distraction osteogenesis for rapid orthodontic canine

eISSN1303-5150

retraction. Their results were highly predictable and had clinical applicability also.¹³ Williams and colleagues in 2023 studied about effective quality control in the medical literature: investigation and retraction vs inaction. Their recommendations were highly imperative.¹⁴

1722

Conclusion

Within the limitations of the study, authors concluded that Rapid Canine Retraction through Distraction Osteogenesis method results in sufficient tooth movement even in lesser time when compared with Conventional Treatment with Pre-Adjusted Edgewise Appliance. Rapid Canine Retraction method also achieved greater space closure and potent molar rotation. Therefore, Rapid Canine Retraction through Distraction Osteogenesis is clinically advantageous over Conventional Treatment in several ways including maximum patients comfort. Results of Rapid Canine Retraction were significant also. Nevertheless, presumptions of the study must be clinically correlated before applying in clinical settings. More studied needs to be conducted to authenticate these finding and suggestions.

References



1. Geiger AM, Gorelick L, Gwinnett AJ, Benson BJ. Reducing white spot lesions in orthodontic populations with fluoride rinsing. *Am J Orthod Dentofacial Orthop.* 1992;101:403–407.
2. Pandis N, Nasika M, Polychronopoulou A, Eliades T. External apical root resorption in patients treated with conventional and self-ligating brackets. *Am J Orthod Dentofacial Orthop.* 2008;134:646–651.
3. Rygh P. Elimination of hyalinized periodontal tissues associated with orthodontic tooth movement. *Scand J Dent Res.* 1974;82:57–73.
4. Vieira-Andrade RG, Drumond CL, Alves LP, Marques LS, Ramos-Jorge ML. Inflammatory root resorption in primary molars: prevalence and associated factors. *Braz Oral Res.* 2012;26:335–340.
5. Vig PS, Weintraub JA, Brown C, Kowalski CJ. The duration of orthodontic treatment with and without extractions: a pilot study of five selected practices. *Am J Orthod Dentofacial Orthop.* 1990;97:45–51.
6. Gkantidis N, Mistakidis I, Kouskoura T, Pandis N. Effectiveness of non-conventional methods for accelerated orthodontic tooth movement: a systematic review and meta-analysis. *J Dent.* 2014 Oct;42(10):1300-09.
7. Khanna R, Tikku T, Sachan K, Maurya RP, Verma G, Ojha V. Evaluation of canine retraction following periodontal distraction using NiTi coil spring and implants. A clinical study. *J Oral Biol Craniofac Res.* 2014;4(3):192-199.
8. Makhlof M, Aboul-Ezz A, Fayed MS, Hafez H. Evaluating the Amount of Tooth Movement and Root Resorption during Canine Retraction with Friction versus Frictionless Mechanics Using Cone Beam Computed Tomography. *Open Access Maced J Med Sci.* 2018;6(2):384-388.
9. Barsoum HA, ElSayed HS, El Sharaby FA, Palomo JM, Mostafa YA. Comprehensive comparison of canine retraction using NiTi closed coil springs vs elastomeric chains. *Angle Orthod.* 2021 Jul 1;91(4):441-448.
10. Kulshrestha RS, Tandon R, Chandra P. Canine retraction: A systematic review of different methods used. *J Orthod Sci.* 2015 Jan-Mar;4(1):1-8.
11. Hashemzadeh H, Soleimani M, Golbar M, Dehghani Soltani A, Mirmalek SP. Canine and molar movement, rotation and tipping by NiTi coils versus elastomeric chains in first maxillary premolar extraction orthodontic adolescents: A randomized split-mouth study. *Int Orthod.* 2022;20(1):100601.
12. Sebastian B, Bhuvanaraghan A, Thiruvengkatachari B. Orthodontic space closure in sliding mechanics: a systematic review and meta-analysis. *Eur J Orthod.* 2022;44(2):210-225.
13. Kumar N, Prashantha G, Raikar S, Ranganath K, Mathew S, Nambiar S. Dento-Alveolar Distraction Osteogenesis for rapid Orthodontic Canine Retraction. *J Int Oral Health.* 2013 Dec;5(6):31-41.
14. Williams ACC, Hearn L, Moore RA, Stewart G, Fisher E, Eccleston C, O'Connell NE. Effective quality control in the medical literature: investigation and retraction vs inaction. *J Clin Epidemiol.* 2023:S0895-4356(23)00042-2.

