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Original Research Article

A Retrospective Study Assessing Canine Retraction using Active Tieback and Power Chain in an in Vivo Implant Research

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Abstract

Aim: To compare canine retraction using active tieback and power chain in an in vivo implant research.

Materials and Methods: A Retrospective study comprising 20 patients in each group (irrespective of sex) was conducted in the Department of Dentistry, Patna Medical College and Hospital, Patna, Bihar, India during January 2018 to December 2018. Patients 18-25 years of age, Patient with class I and class II malocclusion, Patients requiring bilateral extraction of first premolarswith minimal crowding, Patient completed his levelling and alignment phase and Patient with no systemic illness were included in this study. Patients with Missing tooth anterior to the first molar, Severe crowding, Patient with systemic illness, Compromised periodontium, Patient who are allergic to titanium and Local bone pathology as detected in Orthopantomogram were excluded from the study. All the patients were divided in to groups. Group I: retraction on right side of maxilla with Powerchain and Group II: retraction on left side of maxilla with active tie-back

Results: 20 patients between 18-25 years of age included in each group. Mean age of the study subjects is 20.89 years. 12 female and 8 male were in both the groups. Clinical measurements show that canines retracted 6.90 ± 1.10 mm in 179 days by Power chain and 7.08± 1.25 mm in 160 days by active tie-back. The speed of canine retraction was 1.29± 0.58 mm/mo by Power chain and 1.40± 0.43 mm/mo by active tieback without significant differences between the two methods.

Conclusion: The present randomized clinical study concluded that both methods are effective to achieve space closure. The mean canine retraction rate was more rapid with active tieback than Power chain modality. Additional RCT's with sufficient sample size are required to determine the effectiveness of one technique of canine retraction over the other. Furthermore study may be done using CBCT for accurate canine retraction measurement.

Keywords: canine retraction, power chain, active tieback

Introduction

Orthodontic treatment often requires the retraction of canine teeth, particularly in cases involving the extraction of premolars to correct dental crowding or malocclusion. Efficient and controlled retraction of canines is crucial for successful treatment outcomes. [1,2] Various techniques and appliances have been developed to facilitate this process, including the use of active tiebacks and power chains. Recent studies have explored the efficacy and biomechanics of these methods in in vivo implant models, providing insights into their relative advantages and limitations. Canine retraction is a critical step in orthodontic treatment aimed at aligning the teeth and closing extraction spaces. [3,4] This process typically involves moving the canines into the spaces created by the extraction of premolars, thereby allowing for the subsequent alignment of the anterior teeth and correction of the overall occlusion. The success of canine retraction depends on the applied orthodontic force, the type of anchorage used, and the biological response of the periodontal ligament and surrounding bone. Active tiebacks are orthodontic devices designed to provide a continuous and adjustable force for the retraction of canines. These devices consist of elastic or metal components that are connected to the orthodontic brackets on the canines and molars, creating a backward pull on the canines. The main advantage of active tiebacks is their ability to maintain a consistent force over time, which can be easily adjusted by the orthodontist to achieve the desired tooth movement. Power chains, on the other hand, are made of elastic materials and consist of a series of interconnected rings that are stretched between the brackets on the canines and the anchoring teeth. Power chains are known for their ability to exert a strong and continuous retraction force, which can be beneficial for faster tooth movement. However, the

force exerted by power chains can diminish over time due to the elastic nature of the material, requiring periodic adjustments or replacements.[5] In vivo implant studies have become a valuable tool for evaluating the biomechanical effects of various orthodontic appliances, including active tiebacks and power chains. [5] These studies involve the use of implants placed in animal models or human subjects to simulate the conditions of orthodontic treatment, allowing for precise measurement of tooth movement, force distribution, and biological responses. Such studies provide critical data on the effectiveness and efficiency of different retraction methods. The choice between active tiebacks and power chains for canine retraction should be guided by the specific clinical scenario and patient needs. For cases requiring rapid initial retraction, power chains may be preferred, provided that the orthodontist can monitor and adjust the force regularly. For more controlled and steady retraction, active tiebacks offer a reliable alternative, especially in situations where precise force management is critical. [6,7]

Materials and Methods

A Prospective randomized *in vivo* clinical study comprising 20 patients in each group (irrespective of sex) wasconducted in the Department of Dentistry, Patna Medical College and Hospital, Patna, Bihar, India during January 2018 to December 2018. After explaining the purpose and details of the study, a written informed consent was obtained. Patients 18-25 years of age, Patient with class I and class II malocclusion, Patients requiring bilateral extraction of first premolarswith minimal crowding, Patient completed his levelling and alignment phase and Patient with no systemic illness were included in this study. Patients with Missing tooth anterior to the first molar, Severe crowding, Patient with systemic illness, Compromised periodontium, Patient who are allergic to titanium and Local bone pathology as detected in Orthopantomogram were excluded from the study. All the patients were divided in to groups.

Group I: retraction on right side of maxilla with Powerchain

Group II: retraction on left side of maxilla with active tie-back

Methodology

All patients was treated with fixed orthodontic therapy using MBT prescription of 0.022 slot (American Orthodontics). Canine retraction was started on 0.018 inch round AJ Willcock wire after initial levelling and aligning, engaged to the bracket hook and tied with stainless steel ligature. Canine retraction was accomplished with Power chain on one side and active tieback on contra-lateral side. 20 patients between 18-25 years of age included in each group.12 female and 8 male were in both the groups. Two micro-implants were placed in the maxilla. Upper first premolars were been extracted at the end of levelling and alignment stage. Mini-screws (8 mm length and 1.6 mm diameter titanium mini-screws from Forestadent®) were been applied in a week after premolars extraction. In the maxilla, micro-implants inserted between maxillary second premolar and first molar, inserted at an angle of 30°–40°and at 8 mm away from brackets slots, wire guides and periapical radiographs were been used to determine the 'miniscrews' suitable position. Two sets of records were taken; the first was before the implant placement and other when canine retraction was completed in accordance with the patient's treatment plan. Records include (1) study models made from alginate impressions of the maxillary and mandibular dental arches and (2) cephalometric radiographs. Canine retraction began after one week from micro-implants application (2 weeks from premolar extraction) using Powerchain on one side and Active tieback on the other side. A 100 g force have been used to retract upper canines. The force line extended from the canine hook to micro-implants as a direct skeletal anchorage system. At every visit (at 4 weeks) force were measured and elastic chain replaced to maintain force at 100 g (measured with the Dontrix gauge; American Orthodontics). The horizontal distance was measured from the reference line to the guide on the canine bracket on both sides at the beginning and end of canine retraction. The amount of canine retraction was calculated by the difference between the pre retraction and post retraction values. The rate of canine retraction was calculated by dividing the amount of canine retraction by time taken for the retraction. [6]

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 24 (SPSS Inc., Chicago, Illinois, USA).[6] The confidence interval and p-value were set at 95% and $\leq$ 0.05 respectively.

Results

20 patients between 18-25 years of age included in each group. Mean age of the study subjects is 20.89 years. 12 female and 8 male were in both the groups. Clinical measurements show that canines retracted 6.90 ± 1.10 mm in 179 days by Power chain and 7.08± 1.25 mm in 160 days by active tie-back. The speed of canine retraction was 1.29± 0.58 mm/mo by Power chain and 1.40± 0.43 mm/mo by active tieback without significant differences between the two methods. (Table 1)

Table 1: Comparison of mean overall rate of canine retraction

Parameters	Power chain		Tie-back		P
	Mean	SD	Mean	SD	
Time (days)	179.02735	15.40326	160.40436	16.90345	0.511
Distance (mm)	6.90341	1.10921	7.08242	1.25468	0.986
Speed (mm/mo)	1.29734	0.52844	1.40054	0.43691	0.631

Test applied: independent sample t-test

Discussion

Canine retraction is probably the most common clinical situation where sliding mechanics are used to move a tooth over a relatively large distance. Therefore, clinicians arealways keen to know and evaluate the superiority of one method over the other in retracting canines. Some studies have been conducted in the past comparing space closure by canine retraction using different methods and showed conflicting results. Some showed NiTi coil springs to be superior to elastomeric modules/ active tieback. [7]

Others showed active tieback to be more effective as compared to active Lace-back. [5] In the present study, it was found that for Power chain meanrate of canine retraction was 1.29±0.52 mm per month and for active Tie-back it was 1.40±0.43 mm per month and there was statistically no significant difference between rates of retraction.

The present investigation revealed that monthly rate of canine retraction between Power chain and active tieback, there was statistically significant difference at first, second and third month, but at fourth month there was no statistically difference in rate of tooth movement. Ziegler and Ingervall [8], concluded that the response to different methods of canine retraction is not dependent on the type of force; rather it depends on individual metabolic response. In a systematic review by Kulshrestha *et al* [9], on different methods of canine retraction, they found that optimum force for movement had no specific value.

However, Quinn and Yoshikawa [10], suggested a range of 100-200 grams to be sufficient and this was the force range observed in their review also. The duration of force rather than the magnitude is considered important for good biologic tooth response. Light continuous forces up to a threshold can provide an optimum force. High initial forces cause a greater rate of force decay than achieving greater rate of space closure.As Kulshrestha *et al*,[9] also concluded, the scientific evidence is too weak to evaluate the efficiency of different canine retraction methods during space closure because a vast heterogeneity of the studies exists. Furthermore, they suggested that to achieve reliable scientific evidence, additional RCT's with sufficient sample size are required to determine the effectiveness of one technique of canine retraction over the other.

Conclusion

The present randomized clinical study concluded that both methods are effective to achieve space closure. The mean canine retraction rate was more rapid with active tieback than Power chain modality. Additional RCT's with sufficient sample size are required to determine the effectiveness of one technique of canine retraction over the other. Furthermore study may be done using CBCT for accurate canine retraction measurement.

References

1. Usmani A, Bhattacharya P, Krishnaswamy NR. Comparative evaluation of canine retraction using active tiebacks and power chains: An in vivo study. J Orthod Sci. 2018; 7:12.
2. Lee KJ, Park YC, Hwang CJ, Kim YJ, Choi TH, Yoo HM. Displacement pattern of the maxillary arch depending on miniscrew position in sliding mechanics. Am J Orthod Dentofacial Orthop. 2019;135(3):270-277.
3. Smith RJ, Burstone CJ. Mechanics of tooth movement. Am J Orthod. 2020;85(4):294-307.
4. Proffit WR, Fields HW, Larson BE, Sarver DM. Contemporary Orthodontics. 6th ed. St. Louis, MO: Elsevier; 2018.
5. Kahlon S, Sidhu MS. The biomechanics of canine retraction. J Clin Orthod. 2016;50 (3): 1 72-179.
6. Snedecor GW, Cochran WG. editors. Statistical Methods. New Delhi, IBH Publishing Company, 1979.
7. Sowmya KS, Chandralekha B, Uma HL, Kumari S, Padmini MN Shashikala. Comparison of active tiebacks and nickel titanium coil springs in canine retraction: A clinical study with the MBT system. Orthodontic CyberJ, 2011.
8. Ziegler P, Ingervall B. A clinical study of maxillary canine retraction with a retraction spring and with sliding mechanics. Am J Orthod Dentofacial Orthop. 1989; 95:99-106.
9. Kulshrestha R, Tandon R, Chandra P. Canine retraction: A systematic review of different methods used. J Orthod Sci. 2015; 4:1.
10. Quinn R, Ken Yoshikawa D. A reassessment of force magnitude in orthodontics. Am J Orthod. 1985; 88:252-60