CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
SJIF Impact Factor: 7.187
http://doi.org/10.5281/zenodo.4319833

Avalable online at: http://www.iajps.com *Research Article*

A RADIOGRAPHIC STUDY ON THE VARIATIONS IN CANINE ANGULATION AFTER DENTO-ALVELAOR DISTRACTION WITH A RIGID MAXILLARY INTRAORAL DISTRACTOR

Dr. Zeresh Yaqub[1], Dr. Emaan Kamal[2], Dr. Iram Rashid[3]
[1] Dental Section Allied Hospital, Faisalabad., [2] Islam Dental College, Sialkot., [3] de' Montmorency College of Dentistry, Lahore.

Article Received: October 2020 **Accepted:** November 2020 **Published:** December 2020

Abstract:
Introduction: *Prolonged treatment time is the main problem of orthodontic patients. In order to shorten the total time of orthodontic treatment, canine retraction was introduced by dento-alveolar distraction osteogenesis.*
Objective: *To evaluate the canine angulation using dento-alveolar distraction osteogenesis to achieve rapid canine retraction.*
Place and Duration: *In the Orthodontic department of Dental Section Allied Hospital, Faisalabad for one-year duration from June 2019 to June 2020.*
Material and Method: *The study sample consisted of 20 maxillary canines in 10 adult patients (mean age 19.53 years). First, premolars were removed, a custom-made rigid intraoral distractor was placed, and distraction osteogenesis was performed.*
Result: *Complete retraction of canines was achieved in a mean time of 9.23 days with minimal loss of anchorage. The mean change in canine angle was 10.13o ± 3.44o. Canine body movements were observed with a minimum tilt of 7.11o (range 6o-8o). No radiographic or clinical complications were encountered.*
Conclusion: *There was a significant change in angulation in canine after distraction.*
Keywords: *canine distraction, canine rotation and angulation, dento-alveolar distraction, rigid distraction apparatus*

Corresponding author:
Dr. Zeresh Yaqub,
Dental Section Allied Hospital, Faisalabad.

QR code

Please cite this article in press Maria Khalid et al, ***A Radiographic Study On The Variations In Canine Angulation After Dento-Alvelaor Distraction With A Rigid Maxillary Intraoral Distractor.,*** *Indo Am. J. P. Sci, 2020; 07(12).*

INTRODUCTION:

Distraction osteogenesis (DO) is the process of growing new bone by mechanically stretching existing bone tissue [1-2]. It has gained wide recognition in orthopedics as an effective means of bone extension, correction of deformities and filling large shaft defects. Recently, distraction osteogenesis has been widely used in the craniofacial complex and is becoming an increasingly viable treatment option for the correction of craniofacial deformities.

Most orthodontic patients report tooth crowding. Although treatment without extraction has become very popular over the past decade, many patients require extraction [3-4]. The first step in treatment for premolars is further movement of the canine using conventional techniques. Extraoral or intraoral anchorage is required during canine distalization, especially when maximum anchorage is required. The biological movement of the tooth with the canine's retraction phase usually takes 6 to 8 months. Duration of treatment is one of the problems that orthodontic patients complain about mainly adults. To address this problem, a dento-alveolar distraction osteogenesis (DAD) technique was developed [5-6].

In the current technique of rapid orthodontic canine retraction through distraction osteogenesis, described by Reha-kisnisci and Halukiseri, the dentoalveolar is itself designed as a bone transport segment for posterior movement. Then, vertical osteotomies are made around the canine root by splitting a spongy bone around it. Therefore, the design of the surgical technique itself does not rely on periodontal stretching, which prevents overload and stress accumulation in this tissue, which has been a downside to previous distraction attempts by the periodontal ligament, as described by Eric Liou, Shing Huang. does not require any extraoral force and has significant clinical application [7-8]. The tooth can be rapidly inserted into new fibrous distraction bone. In this way, rapid tooth movement can be achieved using the distraction osteogenesis technique. The aim of the study was to evaluate changes in canine angulation after dento-nerve distraction or distraction with a rigid intraoral distractor in the maxilla.

MATERIALS AND METHODS:

This study was held in the Orthodontic department of Dental Section Allied Hospital, Faisalabad for one-year duration from June 2019 to June 2020. For orthodontic patients, 20 custom-made maxillary distractions were performed, based on inclusion criteria, using a custom intraoral distractor. Patients were selected who required the extraction of the maxillary first premolars with maximum anchorage. The maximum canines were reasonably placed in the arch without rotation and without significant tilt. The patients had healthy periodontal teeth.

Patients were excluded when the canines were over palatoversion or labioversion, canines with severe rotation or tilt, abnormal canine root curvature, and a dead tooth. Persons with poor oral hygiene and weak periodontal teeth, with the presence of any systemic diseases and weak internal motivation were also excluded.

10 adult patients were selected for the study, including 5 women and 5 men, aged 14-23 years (mean age 19.53 years), qualified for orthodontic treatment with first premolars extractions; they then underwent canine distalization with distraction osteogenesis surgery.

The canine distractor used in the studies was a custom made rigid intraoral device on the teeth made of stainless steel. Bands were made and placed on the canines of the maxilla and first molars, then an alginate impression was taken. The bands were then transferred to an impression and poured with stone. A sufficiently long distractor was soldered directly to the bands.

The distractor device consisted of (Figure 1):

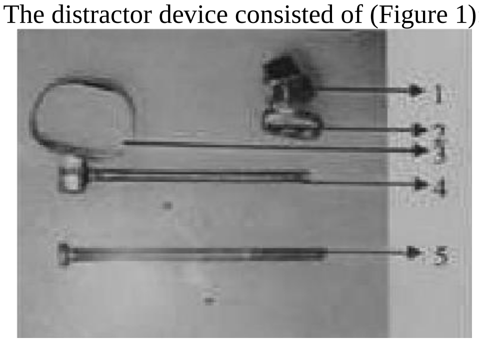

Figure 1: Distractor device

1. The anterior segment consisted of canine band and two non-grooved slots for the sliding rod and screw.
2. The posterior segment consisted a molar band and a slot to which the sliding rod is soldered and a grooved screw slot.
3. The length of the screw was arranged according to the distance between the distal point of the canine and the mesial point of the first molar.
4. Sliding rod is soldered to the posterior segment. The anterior segment slides through it during the activation of the screw.
5. Screw wrench to advance the screw. Since the distractor was unilateral, a 3600 activation of the screw in a clockwise direction with the screw wrench produced 1.0 mm of distal movement of canine tooth.

Surgical procedure

All patients were operated on an outpatient basis under local anesthesia. A horizontal incision of the mucosa, 2 to 2.5 cm long, was made parallel to the edge of the canine gingiva and the vestibular teeth far beyond the depth of the atrium. Periosteal elevation was performed to expose the canine root and the first premolar area. A vertical osteotomy was performed on the anterior part of the first premolar using multiple cortical openings with a round drill and copious irrigation. The osteotomy was apically curved and continued posteriorly in a similar manner in the anterior aspect. A thin, conical fissure drill was then used to connect the holes around the first premolar. The first premolar was at this stage removed, along with the buccal cortex, using the appropriate forceps. A vertical osteotomy was then performed on the anterior part of the canine to distract attention from the rear using multiple cortical openings made in the alveolar bone using a small round drill under copious irrigation. The depth and location of the cortical openings were dictated by the proximity of the adjacent tooth (Fig. 2).

Figure 2: Surgical Procedure of distractor placement

The osteotomy was continued and the apex was curved going 3 to 5 mm from the apex. A vertical osteotomy along the posterior part of the canine was performed in a similar manner. A thin conical fissure drill was used to connect the holes around the canine's root. The canine root was then traced front and back in a cone-shaped apical area. Then, small osteotomies were introduced and proceeded in the coronal direction. The apical bone to the extraction socket and possible bone disturbances in the buccal area that may occur during the distraction process were eliminated and smoothed between the canine and the second premolar, preserving the palatal cortex. Osteotomies were then applied along the anterior portion of the dentoalveolar segment that includes the canines to separate the surrounding bone around the root from the palatal cortex and adjacent teeth. An osteotomy incision was made between the palatal cortex and the palatal portion of the canine root, caring for the canine root, without engaging the lamina propria by using a thin curved scapula osteotome holding it close to the palatal cortex. The dentoalveolar transport segment includes the buccal cortex and the spongy bone beneath it that surrounds the canine root, leaving the apical cortical plate of the palate intact (Fig. 2).

The wound was rinsed with saline and closed with a single layer of mucosa with a 3-0 catgut suture. The distraction device was placed and cemented onto the first molar and canines at the end of the surgery. The patient was prescribed antibiotics and anti-inflammatory drugs for 5 days. Dental alveolar distraction was initiated on the day of surgery and continued at a frequency of 0.5 mm twice daily. There was no latency period. It was broken when the canine tooth moved back to the desired position.

The distracted dentoalveolar segment was maintained for a 3-month consolidation period until radiographic evidence of bone regeneration was confirmed. Later,

orthodontic treatment with fixed appliances was performed. During and after the activation phase, as well as during early and late consolidation periods, the following records were obtained for each patient;
1. Standard photographs (extraoral and intraoral)
2. Periapical radiographs of the maxillary canines with acrylic jigs (Figure 3)
3. Study models were made during pre- and post-distraction periods (Figure 4).

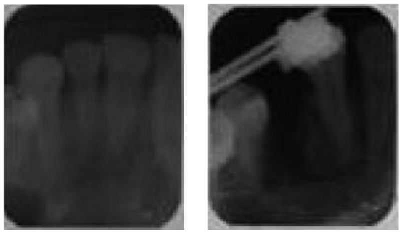

Figure 3: Periapical radiographs; before & during procedure

Figure 4: Study models; before, during & after procedure

Determination of canine tipping:
To analyze inclination of canine, lateral cephalometric radiographs were taken before and after canine distraction (Figure 5). Orientation markers were fabricated using custom made acrylic zigs with brackets on canines to be distracted with Stainless steel wire vertically soldered to the canine wristband. The brackets on canines with vertical markers were temporarily ligated in the patient's mouth, which invariably coincided with angulation of the canine crown and root. Cephalometric radiographs were taken with orientation marks in place before the dispersion device was placed prior to surgery. These markers were removed after the initial cephalogram and stored with the patient's name and the specific side of the canine. At the end of the canine's distraction (consolidation phase), after the distraction apparatus was removed, a post-operative cephalogram was re-performed with the same markers that were temporarily ligated to the brackets of the canines.

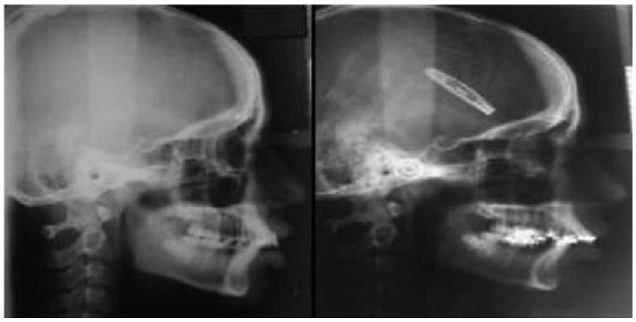

Figure 5: Cephalometric radiographs; before & after procedure

Composite tracking was done on the lateral cephalograms before and after distraction. The amount of canine flexion was measured in relation to the palatal plane (ANS-PNS) using the ANS as a reference. The number of canines was calculated as the difference in tips between the markers on the cephalometric radiographs before and after distraction. In this way, the angulation of the canine to the palate plane was measured. Each measurement was performed twice and the values were recorded. (Table 1).

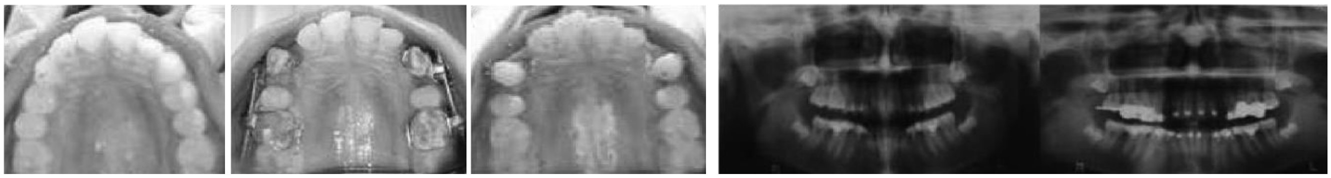

Figure 6,7: Clinical and radiographic progress records

56

Table 1: Degree of tipping of canine

Patient No.	Tooth (FDI Notation)	Degree of Canine Tipping
1	13	9o
	23	10^{o}
2	13	2o
	23	3o
3	13	2o
	23	2o
4	13	2o
	23	2o
5	13	2o
	23	3o

RESULTS:

The results were assessed based on clinical and radiographic data (Fig. 6,7). Clinically and radiographically, although some canines tilted slightly when disengaged, most of the canines moved with the body, with a minimum deviation of about 3.4 ° on average. In our study, the maximum amount of roll was 10o and the minimum amount of heel was 2o. The canines' roots were parallel to the long axis of the second distracted premolar.

Immediate postoperative complications were mild discomfort, pain and swelling at the site of the operation, tenderness in the premolars, and cheek trauma due to the impact of the distal end of the distal screw. These issues were then resolved within a week after surgery. The distractor screw impact was controlled by trimming the screw end to the appropriate length.

DISCUSSION:

Orthodontic movement of the teeth is a process by which the application of force causes bone resorption on the pressure side and bone adhesion on the stress side. Thus, the consolidation period is one of the most important stages of distractive osteogenesis [9-10].

Classically, the rate of movement of orthodontic teeth depends on the size and duration of force, the number and shape of roots, the quality of the trabeculae, and the patient's compliance. The speed of biological tooth movement with optimal mechanical force is approximately 1 to 1.5 mm over 4 to 5 weeks. Therefore, in cases of maximal anchorage premolars, conventional canine distalization typically takes 6 to 9 months, giving a total treatment time of 1.5 to 2 years [11-12]. While every attempt has been made to achieve bodily movement of the canines with distracting osteogenesis, a significant amount of canine tilt has been observed. Therefore, the distal displacement of the canines was mainly a combination of tilt and translation [13].

In all cases, canine movements were noted with a minimum deviation of averaging 7.11 degrees (range 6 degrees to 8 degrees). Maxillary canine tilting was analyzed on pre- and post-distraction cephalometric cephalograms with custom markers (Ahmet Keles et al.). A probable cause for less tilting may be an osteotomy incision around the canine's root, alleviating any bone disturbances in the apical alveolar region that may be encountered during the movement of the tooth. The second reason is keeping the orientation of the distraction apparatus close to the center of the canine resistance. Burstone et al. Found that the center of resistance of a parabolic single-root tooth is located at a distance from the alveolar crest to the root apex. The force passing through the center of the resistance would cause the body to move. Compared to other studies, we encountered a smaller number of tips on average. Zeigler and Ingervall et al. Reported about tilting, Liou and Huang et al., Seher Sayn and Osman Bengi et al. Reported a canine tilt of 11.5 degrees when quickly retracting the canine [14-15].

The orientation of the distraction device was parallel to the occlusal plane of the maxilla and the orientation of the distraction vector was horizontal. It is said that the canines can be straightened during the retraction of the front teeth and the subsequent finishing of the procedure. It should also be taken into account that the canine at the last extraction site moves faster than the healed side, but with more upsets because the center of the tooth's drag may be further at the apex and the bone distal from the canine is denser near the apex than marginal.

REFERENCES:

1. Shivam Verma, M. D. S., Ajit V. Parihar, M. D. S. Kavin Prasanth, M. D. S. Sadhana Swaraj, and Vipul Kumar Sharma. "Appraisal of Minimally Invasive MOP and Maxillary Invasive DAD Surgical Procedures in the Acceleration of Tooth Movement: A Systematic Review." *IJO* 30, no. 2 (2019).
2. Yousif, Atia Abdelwareth A., Neveen F. Abo-Taha, and Emad F. Essa. "Accelerated Canine Retraction by Corticotomy Assisted or Periodontal Distraction." *Egyptian Dental Journal* 65, no. 4-October (Orthodontics, Pediatric & Preventive Dentistry) (2019): 3221-3231.
3. Singh, Harpreet, Sonal Mishra, Dhirendra Srivastava, Pranav Kapoor, Poonam Sharma, and Lokesh Chandra. "Staged therapeutic approach for rehabilitation of severe asymmetric Class II dentofacial deformity secondary to long standing unilateral temporomandibular joint ankylosis." *International orthodontics* 17, no. 3 (2019): 580-595.
4. Jeelani, Waqar, Farheen Fatima, and Maheen Ahmed. "The role of craniofacial distraction in contemporary orthodontics." *Pakistan Orthodontic Journal* 11, no. 2 (2019): 94-103.
5. Ploder, Oliver, Heinz Winsauer, Katharina Juengling, Florian Grill, Oliver Bissinger, Klaus-Dietrich Wolff, and Andreas Kolk. "Is there a significant difference in relapse and complication rate of surgically assisted rapid palatal expansion utilizing tooth-, bone-and orthodontic mini-implant-borne appliances?." *Journal of Oral and Maxillofacial Surgery* (2020).
6. Bayomy, Wael. *Treatment of Class Iii Malocclusion Using Active Skeletonized Sutural Distractor Appliance: a Randomized Clinical Trial*. Partridge Publishing Singapore, 2019.
7. Laney, William R., ed. *GOMI, Glossary of Oral and Maxillofacial Implants*. Quintessence Publishing, 2019.
8. Nik, Tahereh Hosseinzadeh, Elaheh Gholamrezaei, and Mohammad Ali Keshvad. "Facial asymmetry correction: From conventional orthognathic treatment to surgery-first approach." *Journal of Dental Research, Dental Clinics, Dental Prospects* 13, no. 4 (2019): 311.
9. Breeze, John, Sat Parmer, and Niall MH McLeod, eds. *Vivas for the Oral and Maxillofacial Surgery FRCS*. Oxford Higher Specialty Traini, 2019.
10. Anchlia, S., P. Chaudhari, Z. Mansuri, N. Garg, S. Srivastav, H. GosaI, V. Sharma, D. Rajpoot, and H. Patel. "Free Papers–Oral Presentations." In *24th International Conference on Oral and Maxillofacial Surgery*, vol. 48, pp. 5-187. 2019.
11. Matter, Julia-Gabriela Wittneben, and Hans-Peter Weber. *Extended edentulous spaces in the esthetic zone*. Vol. 6. Quintessence Publishing, 2019.
12. Kurt, Gökmen, Haluk İşeri, Reha Kişnişçi, and Özkan Özkaynak. "Rate of tooth movement and dentoskeletal effects of rapid canine retraction by dentoalveolar distraction osteogenesis: a prospective study." *American Journal of Orthodontics and Dentofacial Orthopedics* 152, no. 2 (2017): 204-213.
13. Shivam Verma, M. D. S., Ajit V. Parihar, M. D. S. Kavin Prasanth, M. D. S. Sadhana Swaraj, and Vipul Kumar Sharma. "Appraisal of Minimally Invasive MOP and Maxillary Invasive DAD Surgical Procedures in the Acceleration of Tooth

Movement: A Systematic Review." *IJO* 30, no. 2 (2019).

14. Yousif, Atia Abdelwareth A., Neveen F. Abo-Taha, and Emad F. Essa. "Accelerated Canine Retraction by Corticotomy Assisted or Periodontal Distraction." *Egyptian Dental Journal* 65, no. 4-October (Orthodontics, Pediatric & Preventive Dentistry) (2019): 3221-3231.
15. Kateel, Shashidhara Kamath, Amit Agarwal, Gagan Kharae, Vijay Prakash Nautiyal, Anant Jyoti, and P. Narayana Prasad. "A comparative study of canine retraction by distraction of the periodontal ligament and dentoalveolar distraction methods." *Journal of maxillofacial and oral surgery* 15, no. 2 (2016): 144-155.