Dento-Alveolar Distraction Osteogenesis for Rapid Orthodontic Treatment- A Case Report

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Abstract

The objectives of this study were to evaluate the rate of canine distalization by segmental alveolar distraction method in first premolar extraction case, to evaluate the displacement of the canine and first molar teeth, to assess the effects of the procedure on the pulpal vitality of the canines, and to determine the amount of root resorption in retracted canines. Pre- and post-treatment dental casts, panoramic radiographs, and standard periapical radiographs were taken. An electrical vitality test was applied before and after the distraction procedure and during the follow-up period. The distraction procedure was completed in 12 to 16 days. There was no anchorage loss. No clinical and radiographic evidence of complications such as root resorption, ankylosis, periodontal problems, and soft tissue dehiscence, was observed. Patients had minimal to moderate discomfort after the surgery and vitality of canine maintained.

Key words: Canine Distalization, Segmental Alveolar Distraction

Introduction

Distraction osteogenesis is a process of growing new bone by mechanical stretching of the preexisting skeletal tissue. It has been most accepted in orthopedic surgery as an effective means of bone lengthening in correction of skeletal deformity and in filling large diaphyseal defects. Distraction osteogenesis has been extensively performed in the craniofacial region and is increasingly becoming a viable treatment option in the correction of craniofacial anomalies. Distraction osteogenesis was first performed in 1905 by Codivilla2 and later popularized by clinical and research studies by Illizarov3 in Russia. Guerrero4 in 1990 and MaCarthy5 et al in 1992 performed distraction osteogenesis in human mandible. Since then it has been applied to various bones of craniofacial skeleton in correcting skeletal class II and Class III deformities. The concept to orthodontic tooth movement and rapid canine retraction through distraction of alveolar bone was first investigated by Liou and Huang7, 8, 9 and applied External devices for performing distraction osteogenesis. Later intraoral devices came into use after the newer techniques were introduced. These intraoral devices can be tooth borne,10, 11 bone borne12 or both. These devices are much simpler and more patient acceptable. Most orthodontic patients have some crowding or proclination which require extractions to gain some space for correction of malocclusion. The duration of treatment is one of the problems that concerns orthodontic patients, especially adult patients. In order to overcome this issues, technique of Dentoalveolar distraction osteogenesis (DAD) was been developed. In the existing technique of distraction osteogenesis by Reha-kisnisci and Halukiseri,13 the dentoalveolus itself is designed as a bone transport segment for posterior movement. In this case report we followed a similar procedure in performing dento alveolar distraction to fasten the orthodontic treatment procedure.
Case Report:
An adult patient exhibiting class II division I malocclusion requiring orthodontic treatment with fixed appliances with extraction of upper first premolars was selected from Department of Orthodontics and Dentofacial orthopaedics of M.S. Ramaiah dental college were selected for this study. Pre and post treatment records were obtained. Periapical radiographs of the canines were taken prior to osteotomy procedure and six months following distraction period.
Fig. 8: At the 4th day of distraction

Fig. 9: Post distraction OPG
Fabrication of Distractor

Separators were placed mesial and distal to canine and molars. Bands were selected and seated in position. Impressions were then made with the bands in place. Working models were obtained with the bands in place. Hyrax screw of 13mm was split and customized to approximate the bands on the cast. Arms of the hyrax was soldered to the bands. After the osteotomy procedure was completed, the distractor was cemented onto the teeth.
Procedure
Crevicular incisions were made with a vertical releasing incision beginning mesial to the distal interdental papilla of the lateral incisor at the vestibule was made. A mucoperiosteal flap was elevated 6 mm above the canine and first premolar. The first premolar was extracted after the flap preparation, and the buccal wall of the extraction socket was removed with osteotomes. The palatal wall of the extraction socket was ground, and the depth of the extraction socket was increased with a round bur to allow the sliding of the distracted dentoalveolar segment. With interdental osteotomes the osteotomy depth was increased.

The distraction procedure was started 3 days following the latency period after surgery at the rate of 0.75mm/d of activation done once a day. Once the distraction procedure was completed, a consolidation period of 2 week was given, following which the treatment was continued with conventional fixed appliances.

Pulp vitality test was performed prior to distraction procedure and 6 months following completion of the procedure. To evaluate the amount of root resorption, periapical radiographs were examined after the completion of the procedure. All radiographs were taken by paralleling cone technique. To evaluate the amount of apical and lateral root resorption, the scale described by Liou and Huang was used.

Observations
The canines were retracted by 8mm. The distal displacement of the canine was mainly a combination of tipping and translation. Patient reported minimal to moderate discomfort, especially during the first 2 days after surgery, and mild oedema was observed. The distraction procedure was completed in 14 days.

Anchorage loss of 1mm was observed in the molars. The mesial movement of right molar was 1mm and left molar was 0.9mm. The amount of root resorption observed during distraction was radiographically insignificant.

It was observed that canines in both the quadrants were vital before and after the distraction.

Discussion
Orthodontists have always strived hard for incorporating newer techniques to reduce the overall treatment duration. Canine distraction was introduced as an alternative treatment modality to reduce the duration of the orthodontic treatment and thus avoiding undue strain on the anchor unit. This is possible because the canines are retracted within the lag phase of tooth movement in the anchorage unit. Orthodontic tooth movement is a process which is dependent on remodelling changes associated with the alveolar bone. Conventional orthodontic treatments with fixed or removable appliances are dependent on such physiological phenomena. Individual factors such as optimum force, bone turnover rate, vitality of periodontal ligament, and bone metabolism contributes in determining the rate of tooth movement. Since duration of orthodontic treatment is a time bound phenomena, rapid canine distraction can be considered in patients desiring faster completion of Orthodontic treatment procedures. Distraction osteogenesis for rapid orthodontic tooth movement is a promising technique in terms of treatment duration is considered. With dentoalveolar distraction, canines can be fully retracted in 12 to 16 days.

Conclusion
The dentoalveolar distraction technique reduces over all orthodontic treatment duration by 6 to 9 months in patients who need first premolar extraction.

There is no need for an extraoral or intraoral anchorage devices in accomplishing this procedure.

There is no unfavorable effects seen in the periodontal and surrounding structures. Results achieved in this case report cannot be validated, unless study is done on a bigger sample size.

The purpose of this case report was to give an insight on distraction osteogenesis technique in fastening the orthodontic tooth movement and to extend the scope in regard to research. However rapid canine distalization through segmental alveolar distraction could be considered as a clinically efficient method that significantly reduces the overall treatment time without causing any serious discomfort or damage to the patient in selected cases.

References


