Canines on a Fast Track: Canine Distalization by Dentoalveolar Distraction Osteogenesis

ABSTRACT
Conventional techniques for biological tooth movement is routinely achieved at a slow rate and in high anchorage cases where individual canine retraction is indicated lasts for 6 to 8 months, followed by retraction of the incisors. Hence, the overall treatment time taken is about 18 to 24 months. Rapid canine distalization through dentoalveolar distraction (DAD) technique can be achieved within 2 to 3 weeks with this technique. This clinically efficient method significantly reduces the overall treatment time without causing any serious discomfort or damage to the patient. In this technique osteotomies surrounding the canines are made to achieve rapid movement of the canines within the dentoalveolar segment, in compliance with distraction osteogenesis principles.

Keywords: Canine distalization, Distraction osteogenesis, Tooth movement, Anchorage.

INTRODUCTION
Distraction osteogenesis is a process whereby new bone is grown by mechanically stretching a pre-existing bone tissue. It was made popular in studies by Ilizarov\(^1\) who showed in hundreds of patients that new bone could be formed after surgical corticotomy followed by distraction osteogenesis. The first phase of treatment in premolar extraction cases is distal movement of the canines. Biological tooth movement with conventional techniques is limited.\(^2,3\) The retraction phase of the canine tooth into an extraction site usually lasts about 6 to 8 months, and under normal circumstances, conventional treatment with fixed appliances is likely to last about 20 to 24 months. In addition, retraction of the canines enhances the need for using extraoral or intraoral anchorage appliances when maximum or moderate anchorage is required. In 1959, Kole\(^4\) presented a technique that combined orthodontics with ‘corticotomy’ surgery to increase the rate of tooth movement. In 1998, Liou and Huang\(^5\) introduced the technique of distraction of the periodontal ligament for rapid tooth movement. In 2001, Iseri and Kisnisci\(^6-9\) introduced a new technique named dentoalveolar distraction (DAD), which achieves rapid tooth movement using the principles of distraction osteogenesis.

In the present high anchorage case the upper canines were distracted over a period of 11 days using a tooth supported dentoalveolar canine distractor made of stainless steel.

DISTRACTOR APPLIANCE DESIGN
The preformed canine distractor is a tooth-borne, semirigid device made up of stainless steel, manufactured by SK Surgical (Figs 1 and 2). After the bands were selected for the canines and first molars, an impression was obtained, the bands were transferred into the impression material, and the study cast was made. The distraction device consisted of a conventional hyrax screw and canine and first molar bands soldered on the arms of the screw (Figs 3 and 4).
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Surgical Method

A horizontal mucosal incision was made parallel to the gingival margin of the canine and premolar beyond the depth of the vestibule\(^1\) (Figs 5 and 6). Multiple cortical holes were made on the alveolar bone with a small, round, carbide bur on the medial aspect of the tooth to be distracted. The same procedure was applied on the distal aspect of the canine close to the extraction area, and the holes around the canine root were connected using a thin, tapered fissure bur. The osteotomy curved apically at a distance of 3 to 5 mm from the apex. Then, the osteotomes were advanced in the coronal direction. At this stage, the first premolar was extracted (Figs 7 and 8) and the buccal bone removed (Fig. 9) between the outlined bone cut at the distal canine region anteriorly and the second premolar posteriorly using a round bur. The palatal shelf was preserved, but the apical bone near the sinus wall was removed (Fig. 10), leaving the sinus membrane intact to avoid interference during the distraction process. Osteotomes were used along the anterior aspect of the canine to split the surrounding bone around its root from the palatal or lingual cortex and neighboring teeth. The transport dentoalveolar segment that included the canine also included the buccal cortex and the underlying spongy bone that enveloped the canine root, leaving an intact lingual or palatal cortical plate and the bone around the apex of the canine after these sutures were given (Figs 11 to 14). Finally, the distractor was cemented onto the canine and the first molar (Fig. 15). To ensure that the transport segment was fully mobilized, the alveolar segment carrying the canine

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Fig. 3: Banding of canines and molars

Fig. 4: Soldering of bands to distractor

Fig. 5: Incision given

Fig. 6: Flap raised
was mobilized intraoperatively by activating the device several millimeters and setting it back to its original position. The incision was closed with absorbable sutures, and an antibiotic and nonsteroidal anti-inflammatory drug were prescribed for 5 days. The surgical procedure usually lasted about 30 minutes for each tooth. The patient was instructed to discontinue tooth brushing for 3 days to avoid trauma around the surgical site. A 0.2% chlorhexidine gluconate rinse was prescribed twice a day during the distraction period.
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Distraction Protocol

The device was activated right after surgery (0.5 mm) twice a day until each canine tooth was distracted into the desired position (Fig. 16). The patients were closely monitored during the distraction period, and a class I canine relationship was attained after an average of 2 weeks (Figs 17 to 19). After a 2-week consolidation period, the distractors were removed and retraction of incisors was started. Intraoral photographs and radiographs (IOPA) of a patient before and after rapid canine distalization were taken (Figs 20 and 21).

Treatment Progress

The distractor was continued for 12 days, and then the leveling phase was immediately initiated by 0.014- or 0.016-inch nickel-titanium archwires in the upper and lower dental arches. Next appointment, retraction of the maxillary anterior teeth was started.

Pulp Vitality

- Clinically, no color changes were observed.
- No positive findings were reported with electronic pulp tester.
Advantages
- Rapid retraction of the canine.
- Minimal loss of anchorage in capital and vertical direction.
- Elimination of need of additional anchorage support.

CONCLUSION
- Canine distraction is primarily indicated in adults presenting bimaxillary protrusion, a class II division 1 malocclusion with maxillary dentoalveolar excess or anterior crowding. When maximum anchorage is
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required, it can also be used in the treatment of adolescent patients with anterior crowding.

- Canine distalization with dentoalveolar distraction minimizes treatment time, and both the upper and lower canines can be distalized successfully within 3 weeks with controlled distal tipping. Incisor retraction can also be facilitated with this technique because the bone distal to the lateral incisors is still fibrous.

- Overall treatment time can be reduced significantly.

REFERENCES


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