



Accelerating tooth movement with modified surgical and dentoalveolar distraction technique

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ABSTRACT

The duration of treatment is the most concern among orthodontic patients. It is of challenge for orthodontist to shorten the treatment time. A new surgical technique was introduced to accelerate tooth movement during orthodontic treatment. This new technique is surgical reduction of the bone mass in the pathway of desired tooth movement before orthodontic treatment. This case report explained about a treatment of a 21-year-old male patient with severe-to-moderate crowded dentition and he requested to get the treatment done in a short period of time. Upper right first premolar and lower left second premolar were extracted, the bone in the desired pathway of all teeth movement was reduced and the dentoalveolar distraction procedure performed using nickel–titanium closing coil spring and rubber power chain. Full teeth alignment was achieved in 3 months period and the anchorage teeth were able to withstand the retraction forces with minimal anchorage loss.

Key words: Distraction; osteotomy; rapid tooth movement; surgical orthodontics

INTRODUCTION

Adult patients usually request a rapid solution to their malocclusion. A certain number of these potential patients refused orthodontic treatment, with their decision influenced by the long period of wearing the braces to correct the malocclusion. In addition, they request rapid achievement of a good occlusion and facial esthetics using safe procedures and, possibly, with reduced costs. Conventional orthodontic treatments with either fixed or removable appliances rely

on biological tooth movements that have a limited rate (1). This feature is thought to be a shortcoming, especially when major tooth correction is necessary. The time required for tooth movement within the alveolar bone may lengthen the overall orthodontic treatment time. In this clinical report, we describe a new modified surgical technique for rapid tooth movement as well as a new distraction method. The aim of this case report was to establish an approach to reduce the overall orthodontic treatment time by applying of a principle of distraction osteogenesis through the periodontal ligament and bony callus after performing a minor alveolar osteotomy and corticotomy cuts.

MATERIALS AND METHODS

This case of 21-year-old male patient with teeth malalignment in the upper and lower jaw (Figure 1).

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FIGURE 1. (a) Intraoral photograph after bonding of braces and before surgery; (b) pre-treatment panoramic X-ray.

He requested an orthodontic treatment done in a very short time due to his wedding ceremony was around the corner. The patient was informed regarding the treatment plan options involving prosthodontics, surgery, and alternative conventional treatment. Informed consent was obtained before the surgical procedure. All the bones in the desired pathway of tooth movement were reduced and the dentoalveolar distraction (DAD) procedure performed using nickel–titanium closing coil spring and power chain. We performed multiple vestibular osteotomies and immediately applied high orthodontic forces.

Surgical technique in the upper jaw

A new surgical technique has been modified from DAD technique which was developed by Kışınçı et al. (2002) (2). This distraction technique did not mobilize the alveolar segment around the canine tooth that previously done by fracturing the surrounding spongy bone behind its root that joins it to the palatal bone shelf (2).

The surgery was undertaken under local anesthesia with a full-thickness trapezoidal flap reflected exposing the alveolar bone area over the right lateral incisor, canine, and retained root of the first premolar. The buccal bone plate over the first premolar root was removed using fissure surgical bur, and the first premolar root was extracted using apexo elevator.

The buccal and apical bone in the extraction socket and the possible bony interferences at the buccal aspect that may be encountered during the distraction process were also eliminated or smoothed (Figure 2a). A vertical line of multiple cortical holes was made in the alveolar bone medial to the canine root using a small, round, surgical bur, then the osteotomy was continued and curved apically at a distance of 3–5 mm from the apex using taper fissure bur. All the bones mesial to the upper canine that was located in the pathway of movement of the upper lateral incisor were removed, leaving a thin layer of bone covering its root. The incision was then closed with resorbable sutures. Clindamycin 300 mg bd and ibuprofen 400 mg tds were prescribed. Fixed appliance orthodontic therapy was immediately started.

Surgical technique in the lower jaw

We followed a dental distraction (DD) surgical technique developed by Liou and Huang (1998) (3). After the lower left second premolar extraction, the medial part of the extraction socket was undermined with a surgical carbide fissure bur. It is done by grooving vertically inside the extraction socket, along with the buccal and lingual sides, and extending obliquely toward the base of the interseptal bone to weaken its resistance (3) (Figure 2b).

Appliance activation and distraction phase

Orthodontic treatment was initiated with bonding of upper and lower 0.22 Roth metal bracket (Ortho Technology, USA). Aligning of both dental arches started immediately after the above surgeries.

In the upper jaw, 0.18 stainless steel wire was applied with nickel–titanium close coil spring and power chain connecting between the upper right canine and upper first molar. After 4 weeks, enough space was created for the upper lateral incisor. Bonding and protraction of it were initiated using power chain and auxiliary 0.16 nickel–titanium wire that was ligated over the stainless steel 0.18 main archwire. During the 3rd month, when upper lateral come to the line of occlusion, a 17 × 25 nickel–titanium wire was inserted to finalize leveling (Figure 3).

In the lower arch, 0.18 stainless steel wire was placed. Mesial and distal stripping of lower incisors

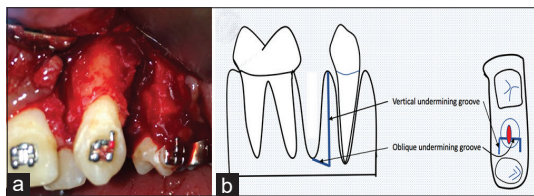


FIGURE 2. (a) Surgical osteotomy in the upper jaw; (b) osteotomy cut drawing shows the vertical and oblique undermining groove in the lower jaw distal to lower right first premolar.



FIGURE 3. Retraction of the upper right canine using nickel–titanium spring and power chain.

was done. Close coil nickel–titanium spring and power chain were applied to close the extraction space between the lower left first premolar and lower left first molar. After 2 months, the lower crowding was resolved and 17 × 25 nickel–titanium wire was inserted to finalize leveling.

RESULTS AND DISCUSSION

Full teeth alignment was achieved in 3 months period. In the upper arch, retraction of the upper right canines closing the extraction space was achieved in 1 month then the upper right lateral incisor protracted from crossbite position to normal alignment in the 2nd month. In the lower arch, closure of the second premolar extraction space and alignment of lower anterior done simultaneously in 3 months period. The anchorage teeth were able to withstand the retraction forces with minimal anchorage loss in the upper arch while some anchorage loss was seen in the lower arch as indicated with widening of the periodontal space distal to the lower

first molar tooth and causing its tipping (Figure 4). No clinical and radiographic evidence of complications, such as root fracture, root resorption, ankylosis, periodontal problems, and soft-tissue dehiscence, was observed. The patient had minimal discomfort after the surgery.

Traditional orthodontic therapy in adult patients often results in prolonged treatment times to allay periodontal tissue concerns. To overcome the orthodontic limits combining strong orthodontic forces and surgery, we can achieve some type of accelerated phenomenon (4). In non-extraction cases, several reports (5,6) have suggested the use of labial/lingual vertical corticotomy with subapical horizontal osteotomy to correct the tooth positions by way of bony block movement. This technique reduced the treatment time compared with conventional techniques by 30–60%. It was further simplified by Vercellotti (2007) (7) and Dario et al. (2011) (8) by application of microsurgical orthodontics. In extraction cases, two main surgical techniques were developed to initiate rapid canine retraction; DAD of the canine tooth using the concepts of distraction osteogenesis (2) and DD through the periodontal ligament (3).

In our case report, the surgical techniques for extraction and non-extraction cases were combined with some modification in one case. A new distraction technique to accelerate teeth movement was applied. We were able to finish treatment in 3-month period and this comes with certain advantages; in the upper jaw, a modified surgical technique (2) is applied by omitting full mobilization of the alveolar bone segment caring the canine, making the surgical procedure less invasive and less critical beside that simplify canine retraction with conventional nickel–titanium close coil spring and power chain instead of using customized distraction appliance. On the other side, a modified surgical technique of Wilcko et al. (4) was applied by surgically remove the bone in the pathway of movement of the upper left lateral incisor leaving only a thin layer of cancellous bone covering its root. This helps to protract the upper left lateral incisor. Hence, we did not only doing surgery to accelerate canine movement but also to facilitate lateral incisor movement and hence alignment of all the upper teeth in a very short treatment time. In the lower arch, we preferred doing the surgical technique described by Liou and Huang (3)

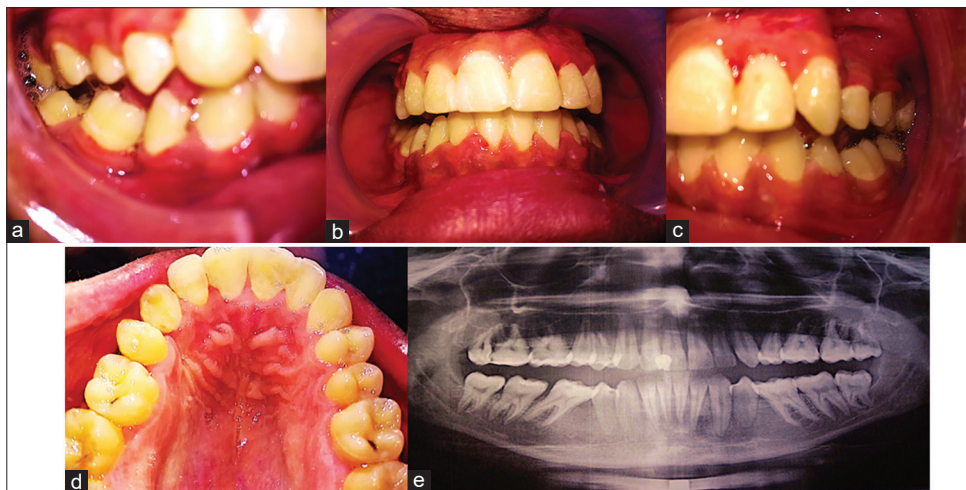


FIGURE 4. (a-e) Post-treatment intraoral photos and panoramic X-ray.

to avoid injury to the mental nerve. There was no need to fully distalize the first premolar in the space of the second premolar extraction as the amount of anterior crowding is minimal so protraction of the lower first molar is desired. In addition to that, we omitting doing surgery in the lower anterior part and only we do stripping of the lower incisor as the amount of lower anterior teeth crowding is minimal. We can correct the anterior teeth crowding without the need for further surgical procedure.

CONCLUSION

As a conclusion in this case report, we used a modified surgical and distraction technique to facilitate tooth movement. We believe that this combined and modified surgical and distraction technique is safe and simple. It allows a reduction in the treatment time for adult patients, with a low biologic cost. No severe complications were reported, and the patient was extremely satisfied.

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