

CASE REPORT

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Corticotomy assisted orthodontic treatment of ankylosed and impacted upper canine

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ABSTRACT

Introduction: Tooth ankylosis is one of the most difficult problems in orthodontics. Conventional orthodontic treatment techniques are insufficient for ankylosis tooth movement and require special treatment approaches. The development of corticotomy-assisted orthodontic treatment is a promising source for movement of the ankylosed tooth. The maxillary canines are important teeth in terms of esthetics and function. The maxillary canine is second only to the mandibular third molars in frequency of impaction. Reported impaction rates have varied from 1–3%. **Case Report:** A 12-year-old girl was presented with impacted and ankylosed upper left canine tooth. Corticotomy assisted orthodontic treatment was done due to upper left canine tooth would never move with orthodontic treatment. **Conclusion:** Vertically upper left canine tooth movement was achieved approximately 5 mm. The results were satisfying for the aesthetic position of the canines.

Keywords: Fixed orthodontic treatment, Impacted, Osteotomy, Tooth ankylosis

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Received: 23 July 2017
Accepted: 16 August 2017
Published: 21 August 2017

How to cite this article

Metin-Gürsoy G, Okur B, Türkyılmaz F, Bozkaya S. Corticotomy assisted orthodontic treatment of ankylosed and impacted upper canine. J Case Rep Images Dent 2017;3:20–24.

Article ID: 100019Z07GM2017

doi: 10.5348/Z07-2017-19-CR-5

INTRODUCTION

Ankylosis of tooth is defined as the fusion of mineralized root surface to the surrounding alveolar bone with obliteration of the periodontal ligament. The causes of ankylosis can be categorized as either genetic predispositions or local metabolic changes. Local reasons include trauma such as luxation injuries, avulsed tooth replantation, deficiency of alveolar bone growth, abnormal pressure of the soft tissue, periapical infections, chemical or thermal irritation and previous surgical procedures. Tooth ankylosis can occur at any time during eruption, before or after a tooth emerges into the oral cavity [1]. The diagnosis of ankylosis can be made by both clinical and radiologic evaluations. Clinically, ankylosed tooth present mostly infraocclusion, typical metallic sounds upon percussion and lack of tooth mobility may be observed. Radiographically, tooth ankylosis is characterized by the absence of periodontal ligament space and continuous replacement of root substance with bone until little or no tooth substance remains. The treatment of an ankylosed tooth is not possible by conventional orthodontics methods. There are several treatment options include reimplantation, extraction, prosthetic restorations for ankylosed tooth depending on the case. However, huge bony defect due to extraction of an ankylosed tooth or

the risk of vertical relapse in growing patient is a concern as the most important side effects of these treatment modalities [2]. Corticotomy is a surgical technique in which a small segment osteotomy is used to reposition both the ankylosed tooth and the adjacent alveolar bone. The cortex of the bone is cut in corticotomy and orthodontic appliances are used to move the tooth over a period of a few weeks following the surgery. Ankylosed tooth movement has been reported a number of times in the literature [3–5]. This article presents leveling of an impacted and ankylosed upper canine with corticotomy assisted orthodontic treatment.

CASE REPORT

The patient was 12-year-old girl with symmetric face and a normal growth development for her age. There was no record related to systemic alterations that were diagnosed in this patient. Intraoral examination revealed that all of the permanent tooth was present with the exception of the upper left and right second molars (17, 27) and left canine (23). The patient presented with a right Angle Class I and left Angle Class II molar relationship and had an arch length discrepancy of -2.5 mm in the upper arch. A panoramic radiograph revealed presence of the correct eruption position upper right and left second molars and impacted upper left canine (Figure 1). The upper left canine tooth was in the correct alignment and orientation for eruption but needed space for full eruption and alignment.

Treatment progress

Miniscrew-assisted upper left molar distalization was done to create enough space for canine eruption and to establish Class I molar relationship. Miniscrew, which was temporary anchorage device (TAD), placed buccally between the upper left canine and first premolar (Spider Screw 1.5x8.0, Short Neck, HDC, Italy). The distalization is achieved by activation of the Nitinol coil springs placed on a 0.017x0.025 inches SS sectional arch wire between miniscrew and first molar. At the end of molar distalization phase, Class I molar relationship was achieved while position of upper left canine tooth did not change. After that, 0.018 inches Roth appliances were placed in upper arch except left canine tooth and routine orthodontic leveling and alignment of the arches accomplished. When 0.016x0.022 inches SS arch wire was placed to the upper arch, surgical uncovering of upper left canine was performed and vertical force was applied by 0.014 inches Ni-Ti second arch wire. Despite all that effort, there is no change in the canine tooth position, while intrusion was observed in adjacent teeth (Figure 2). After that, measurement of canine tooth mobility was carried out by the periotest (Siemens Co., Bensheim, Germany) because of the ankylosis doubt. The periotest is an electronic device that measures the damping characteristics of the periodontium and has

been used for the objective diagnosis of ankylosis [6]. Periotest value was -2.7 for upper left canine tooth. At the same time, obliteration of the periodontal ligament on CBCT was supporting evidence for ankylosis (Figure 3). Corticotomy assisted orthodontic treatment was planned due to upper left canine tooth would never move with orthodontic treatment. Before the surgical approach, all the aseptic precautions were taken. Corticotomy procedure was performed under local anesthesia by using full-thickness mucoperiosteal flap from mesial to distal surface of upper canine. The flap was reflected beyond the apice of the canine. Following flap reflection, two vertical corticotomy cuts were performed to mesial and distal of the upper left canine tooth and one horizontal corticotomy cut was done at the apice of the tooth by a reinforced surgical blade and surgical mallet. The blade was positioned on the cortical bone with an oblique inclination to the long axis of upper canine, and then inserted into the cancellous bone (Figure 4). The blade was removed with a moving up and down. Right after the corticotomy cuts, upper left canine periotest value was measured 11.8. The mucoperiosteal flap was sutured with 4-0 non-resorbable silk sutures, being careful to preserve the interdental papillae; the sutures were removed 10 days after surgery. Two days after the corticotomy procedure, one miniscrew was placed buccally between the lower left canine and first premolar for the absolute anchorage unit. The vertical intermaxillary elastics to the miniscrew were used to eruption of the upper left canine. The patient used full-time vertically intermaxillary elastics (5/16 inches heavy), which created estimated 200–250 gr force. The canine tooth was moved vertically to the level of the adjacent tooth in fourth week after the corticotomy cuts but miniscrew had to be removed due to unstabilization at the end of this time. The leveling of upper left canine was started by 0.016x0.022 inches Ni-Ti arch wire and was completed with 0.017x0.025 inches SS arch wire. After two years of the beginning of the treatment, fixed appliances were removed (Figure 5). The retention was made by full coverage thermoplastic appliances (Essix retainers) with full time wear except during meals for six months and then half days for the next six months. At the end of the retention period of one year, the post retention records showed the position of canine tooth was stable (Figure 6).



Figure 1: At the beginning of the fixed orthodontic treatment.



Figure 2: Intrusion of the adjacent teeth.

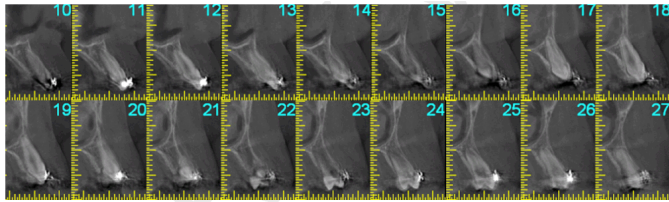


Figure 3: Cone beam computed tomography of ankylosed canine tooth.

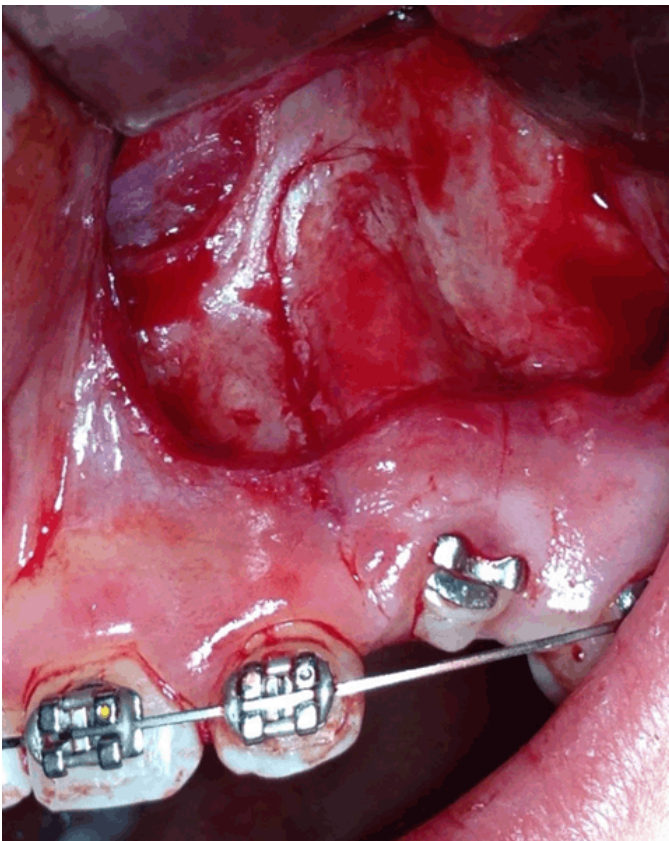


Figure 4: Corticotomy cuts.

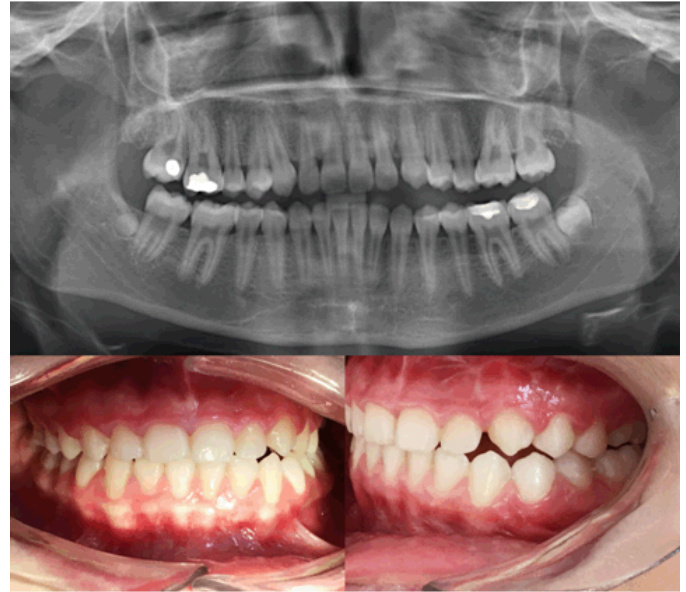


Figure 5: At the end of treatment.



Figure 6: At the end of the retention period of one year.

DISCUSSION

Tooth ankylosis is reported as a significant complication in orthodontic practice. Several procedures are introduced to treat ankylosed tooth with successful results such as osteotomies, corticotomies and distraction osteogenesis [2, 7–9]. Distraction osteogenesis is a technique for new bone formation without bone grafting. This technique is the most suitable treatment protocol for correcting a huge vertical alveolar defect due to its unique ability to simultaneously developing the adjacent soft tissue and the bone volume. However using distraction osteogenesis for treatment of ankylosed tooth has some disadvantages such as distractor's large size, difficulties of placement in the mouth, be irritating for patient, being

expensive and require a second surgery for removal [5, 9].

Repositioning of the ankylosed tooth with surrounding alveolar bone by osteotomy is the other treatment option. But soft tissues resistance and blood supply is the most important limitation of this method.

Corticotomy is defined as any intentional surgical injury to cortical bone which can produce mobilization of the tooth with adjacent bones and soft tissues [5]. The corticotomy technique has been revised and modified over the years to eliminate its possible risks, such as periodontal damage and devitalization of the teeth and osseous segments because of inadequate blood supply. So, we preferred corticotomy procedure except distraction osteogenesis and osteotomy due to their disadvantages.

The force magnitude for corticotomy-assisted tooth movement is still controversial and unclear. Studies reported that heavy force (800 gr) caused greater tooth movement than light force (200 gr) [5, 10]. We applied approximately 200–250 gr force by intermaxillary elastics at the maximum intercuspation but the extrusion force magnitude increased when the mount opened. So, miniscrew stabilization was broken by this force level and we had to remove the mini screw at the end of fourth week even though the canine tooth leveling procedure was not completed. We tried to level the canine with arch wire but it did not adequate enough. We think that, this might be whether insufficient force magnitude or bone healing. Bone segments form callus and show microscopic union about 3–6 weeks after corticotomy procedure [3, 10]. When bone healing produces a bony union of the corticotomy areas, further tooth movement is not possible.

In the previous study, it was showed that ankylosed tooth movement was 0.5 mm/week, approximately [4]. In this study, ankylosed canine tooth moved total 5 mm at vertical direction and tooth movement rate was 1 mm/week. At the end of the treatment left canine tooth would be more extrusive for good Class I and canine guidance occlusion. However, aesthetically patient satisfaction was achieved.

CONCLUSION

In this case, the ankylosed tooth and the adjacent bone segment and soft tissue could be moved with conventional orthodontic treatment mechanics and corticotomy procedure. This technique eliminated the esthetic and functional problems without major surgical procedures with general anesthesia or huge distraction devices. Thus, no extra treatment fee was required and the patient was comforted during the treatment. However, the success of the technique must be evaluated according to heavy forces applied to the mini screw anchorage.

Author Contributions

Gamze Metin-Gürsoy – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Begüm Okur – Substantial contributions to conception and design, Acquisition of data, Revising it critically for important intellectual content, Final approval of the version to be published

Füsün Türkyılmaz – Substantial contributions to conception and design, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Süleyman Bozkaya – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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