CASE REPORT

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Repositioning of an Ankylosed Maxillary Central Incisor Using the Distraction Osteogenesis Method and a Custom-Made Device: A Case Report

Tooth ankylosis can lead to chewing function abnormality and a bad bite, resulting in an esthetically unappealing smile line. The dentoalveolar distraction osteogenesis method is a good option for the treatment of an ankylosed tooth, as it facilitates both hard and soft formation and repositioning of the tooth. Successful repositioning of an ankylosed tooth improves both function and esthetics. In this clinical case report, we describe the treatment of an ankylosed maxillary central incisor in a 21-year-old female using a simple tooth-derived intraoral distractor. An expansion screw and stainless-steel wire were used in the construction of the distractor. This intraoral apparatus provided ease of movement of the dentoalveolar segment after the osteotomy. After repositioning the central incisor by distraction osteogenesis procedure improvement of chewing function and smile esthetics achieved. The dentoalveolar distraction osteogenesis method using a tooth-borne distraction device can yield good results in patients with tooth ankylosis.

Key Words: *Alveolar distraction osteogenesis, dentoosseos distraction osteogenesis, osteogenic distraction, ankylosis, ankylosed tooth*

Ankiloze Bir Maksiller Santral Kesici Dişin Kişiye Özel Aygıt Kullanılarak Distraksiyon Osteogenezis Yöntemi Yeniden Konumlandırılması: Bir Olgu Sunumu

Diş ankilozu, çiğneme fonksiyonunda anormalliğe ve kötü bir ısırmaya yol açarak estetik açıdan tatmin edici olmayan bir gülümseme çizgisine neden olabilir. Dentoalveolar distraksiyon osteogenez yöntemi dişin hem sert hem de yumuşak oluşumunu ve yeniden konumlandırılmasını kolaylaştıran ankiloze dişlerin tedavisi için iyi bir seçenektir. Ankiloze dişlerin başarılı bir şekilde yeniden konumlandırılması hem işlevi hem de estetiği iyileştirir. Bu klinik vaka raporunda, 21 yaşındaki bir bayan hastada ankiloze maksiller santral dişin kişiye özel üretilmiş, diş destekli ağızıçi distraktör kullanılarak tedavisi anlatılmaktadır. Distraktörün yapımında genişletme zembereği ve paslanmaz çelik tel kullanılmıştır. Bu ağız içi aparat, osteotomi sonrası dentoalveolar segmentin hareketini sağlamıştır. Distraksiyon osteogenez prosedürü ile santral kesici dişin yeniden konumlandırılmasından sonra çiğneme fonksiyonu ve gülümseme estetiğinde iyileşme sağlanmıştır. Diş destekli distraksiyon aygıtı kullanılan dentoalveolar distraksiyon osteogenez yöntemi, diş ankilozu olan hastalarda iyi sonuçlar verebilir.

Anahtar Kelimeler**:** *Alveolar distrasiyon osteogenezis, dentoosseos distraksiyon osteogenezis, osteojenik distraksiyon, ankiloz, ankiloz dişler*

Introduction

Ankylosis, which refers to pathological fusion between the alveolar bone and cementum of teeth hinders both physiological and orthodontic tooth movement. It is most seen with deciduous molars. In addition, embedded canine teeth and traumatized maxillary first and second incisors can be affected by ankylosis. The absence of normal physiological tooth movement, such as chewing, and occlusal contact can cause ankylosis. Ankylosis may also be the result of trauma and subsequent dental splinting preventing physiological tooth movement (1-4). Ankylosis and infraocclusion, leading to tipping of neighboring teeth and insufficient alveolar bone development, can lead to orthodontic problems, such as an anterior and/or posterior open bite, midline shift, vertical dimension inadequacy, occlusal incompatibility, and chewing disorders, all of which can result in a non-esthetic facial appearance and smile line (1-7).

The treatment of teeth with ankylosis is usually tooth extraction (1-7). There are various treatment options for ankylosis in adults, including prosthetic treatment, luxation, and surgical positioning, depending on the size and position of the tooth. Surgical repositioning of a single tooth can be achieved by performing an osteotomy, alone or in conjunction with distraction osteogenesis (1-9).

In this clinical case report, we describe the treatment of an ankylosed maxillary central incisor tooth using the Ilizarov distraction osteogenesis method in an adult female patient.

Case Report

A 21-year-old female presented to the orthodontist with the complaint of an anterior open bite (Figure 1 A, B, C, D). The patient had received conventional orthodontic treatment for the anterior open bite, except for the maxillary right central incisor tooth. No orthodontic movement was achieved, despite the application of force to the maxillary right central incisor. The patient did not mention any trauma history but reported a finger sucking habit history. A radiographic and clinical examination raised the suspicion of ankylosis (March 8, 2018). Force was applied to the tooth for 6 months, but tooth movement was not achieved. Accordingly, a diagnosis of ankylosis was made (Figure 1 E, F, G, H). In fixed orthodontic treatment, the anterior teeth were extruded, and the posterior teeth were intruded. Extraction treatment also reduced the open bite. Extraction of teeth 14, 24, and 34 was planned. The space of tooth right mandibular first molar was not closed to prevent slipping into the lower midline.

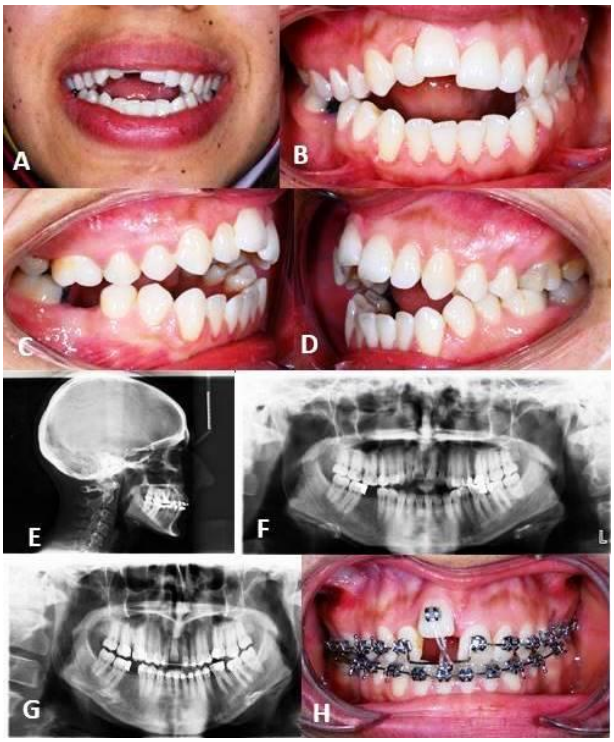

Figure 1. A. Frontal facial view and **B.** Intraoral frontal view of the patient at the beginning of the first orthodontic treatment. **C.** Right side and, **D.** Left side intraoral view of the patient at the beginning of the first orthodontic treatment **E.** Cephalometric and **F.** Panoramic films taken at the beginning of orthodontic treatment. **G.** Panoramic film taken after the first orthodontic treatment. Ankylosis of the right first incisor can be seen. **H**. Despite the force applied to the right first incisor, no orthodontic tooth movement was observed after the first orthodontic treatment.

Distractor Design and Surgical Applications: Before the distraction osteogenesis procedure, a custom-made, tooth-borne rigid distractor consisting of an apparatus with a slow expansion screw and bands and brackets was applied. After the model was taken, the central incisor tooth was brought to the desired position in the model, and the set-up process was applied. The band was then attached to the central incisor tooth. Satinless-stell wire (1.2 mm diameter) was then bent appropriately and soldered to the tube bands that would come to the molars and the band on the central tooth. The slow expansion screw of the apparatus was opened before soldering and closed again after soldering. In this tooth-borne custom-made distractor, each rotation corresponded to 0.2 mm of movement (Figure 2 A, B, C, D).

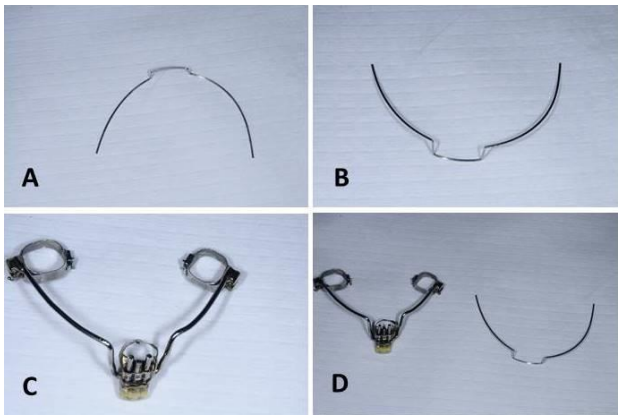

Figure 2. Archwire shaped according to the distractor apparatus **A.** Occlusal and **B.** Frontal view. **C.** Distractor and arch wire made with thick steel wire. **D.** The molar bands are soldered.

All surgical procedures were performed under local anesthesia in Fırat University, Faculty of Dentistry, Department of Periodontology, Elazig, Turkiye. Local anesthetic was applied to the vestibular mucosa. A linear incision was made from the junction line of the keratinized gingiva and lip mucosa and from the canine tooth in the right maxilla to the lateral tooth in the left maxilla, by taking bone contact (1-4). The mucoperiosteal flap was lifted, exposing the anterior maxilla, including the piriform opening. The nasal mucosa was elevated on the right side. The right maxillary central incisor was ankylosed at the base of the nose. Bone tissue was reached with subperiosteal tunnels in the interdental area. Vertical osteotomies of the mesial and distal parts of the right maxillary central incisor were performed using a thin steel bur. These vertical osteotomies were combined with a horizontal osteotomy under the base of the nose and priform edge. After the osteotomies, mobility of the bone segment was achieved using a chisel and curved osteotome. During the osteotomies, care was taken to protect the periosteum layer on the palatinal side to prevent malnutrition and tissue necrosis. After achieving mobilization of the segment, the mechanism of the custom-made distractor was controlled (Figure 3 A, B, C, D). The mucoperiosteal flap was repositioned in its original position and sutured with 3-0 silk suture. An antibiotic (penicillin), analgesic (dexketoprofen), and chlorhexidine mouthwash solution were prescribed after the surgical procedures to prevent infection and pain (1-7).

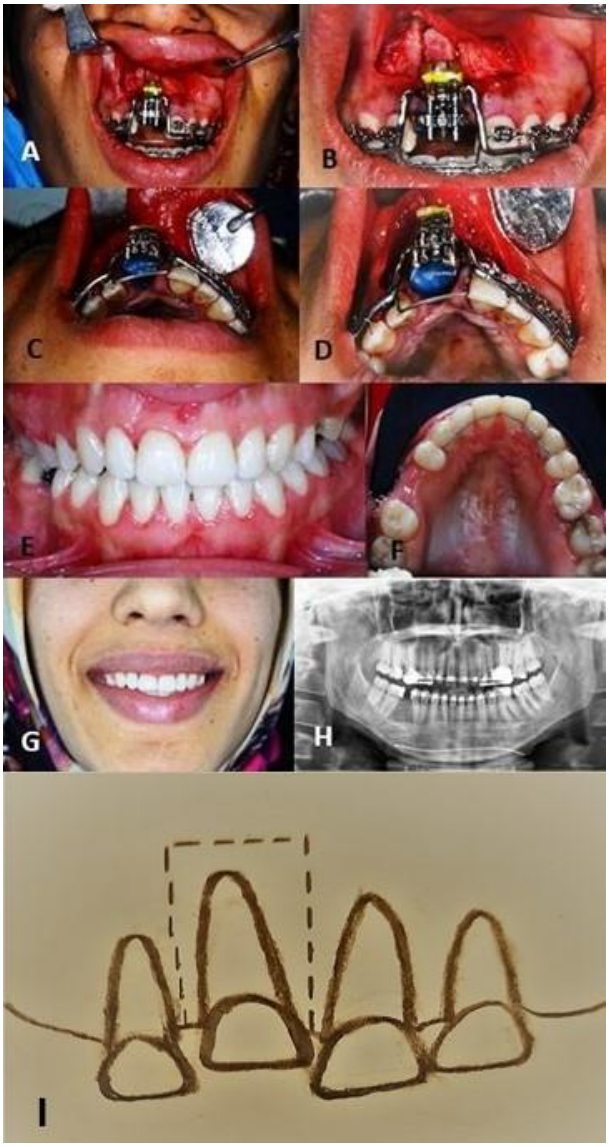

Figure 3. After raising the mucoperiosteal flap, subapical osteotomy was performed, and it was checked that the distractor moved the segment. **A.** Extraoral and **B.** Intraoral views of the patient in frontal angle. **C.** Extraoral and **D.** Intraoral views of the patient in occlusal plane. **E.** Intraoral frontal and **F.** Intraoral occlusal views of the patient after the distraction period of the patient's in various angle. **G.** Extraoral views of the patient after the treatment protocol fully. **H.** Panaromic radiograph after the treatment protocol fully. **I.** Demonstration of the subapical osteotomy line during surgery and distraction direction.

Distraction Protocol: Four days after the surgery, the distraction procedure was started. The distraction rate was 0.6 mm per day. The distractor was activated twice a day for 8-hour periods. The positon of the segment was 1 mm overcorrected. The distraction phase was ended on the 14th day. The moved segment was fixed with arch wires, and the consolidation period then commenced. After 12 weeks of fixation, the arch wires were removed, and orthodontic treatment was completed (1-7). A Class I occlusion, with a normal overjet and overbite was obtained. An improved smile profile was obtained by ensuring that the anterior maxillary teeth were placed in the Class I occlusion. Panoramic and cephalometric films taken after the treatment confirmed healthy bone tissue formation around the moving segment (Figure 3 E,F,G,H,I).

Discussion

Various treatment methods, including surgical luxation, are available for ankylosed teeth. However, surgical luxation can cause reankylosis and damage and intrusion of neighboring teeth during the application of force. Reimplantation after tooth extraction is another treatment option. However, reimplantation causes root resorption. Extraction of ankylosed teeth and prosthetic treatment with either implants or conventional methods can also be considered. However, esthetic concerns are a major consideration with this treatment method. In ankylosis, the alveolar segment does not develop sufficiently in the vertical direction. Thus, both hard and soft tissue deficiencies may occur. As a result, prosthetic treatment methods may not yield desired results. Mobilizing an ankylosed tooth, together with the bone tissue surrounding the tooth with interdental osteotomies and then fixing. Total mobilization of the segment poses a risk of palatal mucosal damage and impaired blood flow and nutrition of the segment. In addition, the gingival tissue may not be able to follow the movement of the tooth-bone segment, which can cause gingival recession and undesirable esthetic results at the gingival level (1-7). The advantage of distraction osteogenesis is that it can bring the positions of the clinical crown, incisal edge, and gum edge into line with those of adjacent teeth. The distraction osteogenesis method can be performed to treat ankylosed teeth using orthodontic tooth-borne distractors, internal bone supported screw distractors, or arch wires (1-7). In the present case, we used an orthodontic tooth-borne distractor.

In the present case, we describe the successful treatment of an ankylosed central incisor by integrating orthodontics and surgery using a modified expansion device. Direction control is an important issue in alveolar distraction If the the distractor is fixed to bone or maxillary teeth, it is difficult to change the direction of the distraction apparatus. In the present case, we used 0.9 mm stainless steel wire supported by the upper jaw teeth to fix the distractor and ensure what in terms of the direction and position of the distractor (4,5). The alveolar structure adjacent to the ankylosed tooth was reconstructed by dento-osseous segment distraction osteogenesis. A number of studies have shown that the distraction osteogenesis method using a tooth-borne device is a viable treatment option to achieve optimum occlusal and esthetic results (1-7,9,10).

Retention appliances play an important role in bone maturation after orthodontic treatment and distraction osteogenesis (11-15). Essix or Hawley retainers are generally preferred after orthodontic treatment. In the present case, because of the open bite, we choose Hawley appliances. The use of Essix plates could have led to increasing the interdental distance in the posterior

region and recurrence of the open bite. In addition, a lingual retainer was attached to the lower and upper anterior teeth. At the last stage of the treatment, prosthetic treatment of tooth number 16 was planned (2, 5, 6).

Distraction osteogenesis is an effective treatment option for vertical alveolar tissue deficiencies, as it can aid the formation of both soft and hard tissue (16-18). The ankylosed tooth can act as an anchor for the distraction device. In the present case, repositioning of an ankylosed maxillary central incisor in an adult patient was achieved using a simple, custom-made device connected directly to the tooth.

Conflict of Interest

The authors declerate there is no conflict of interest.

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