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TABLE OF CONTENTS

[INTRODUCTION] [DISCUSSION] [REFERENCES] [FIGURES]

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Maxillary Anterior Segmental Advancement by Using Distraction Osteogenesis: A Case Report

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ABSTRACT

After the first clinical application of distraction osteogenesis (DO) to correct mandibular deformity was reported in 1992, various applications such as maxillary or midface advancement, temporomandibular joint reconstruction, alveolar augmentation, and mandibular widening have been described in the oral and maxillofacial region. Block et al and Altuna et al first examined anterior segmental DO experimentally in the maxilla and reported successful results. After these studies, DO has been used clinically for the total advancement of the maxilla or midface. But no clinical application of DO for maxillary anterior segmental advancement was found by a review of the literature in English. In this article, we present a case with a skeletal Class III abnormality resulting from a maxillary deficiency, which was treated by using anterior segmental DO.

KEY WORDS: Maxilla, Class III relationship, Anterior segmental distraction osteogenesis.

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INTRODUCTION Return to TOC

Concepts in craniofacial and maxillofacial surgery have evolved rapidly during recent decades and now offer new techniques related to the correction of some deformities that were almost impossible to treat in the past. Distraction osteogenesis (DO) advanced the field of maxillofacial surgery because of its versatility, simplicity, and possibility of avoiding bone grafts, infections, blood transfusions, or intermaxillary fixation for long periods of time.[1] Additionally, DO establishes the augmentation of the soft tissue simultaneously with the bone. These advantages cause DO to be a good alternative in many cases where conventional surgical techniques are rather difficult to use, and the results are so impressive that today we are even more confident about using it.

In the beginning, DO was used in the treatment of developmental or acquired mandibular deficiency cases and found vast implications in the maxillofacial region. There are many successful results for procedures such as maxillary advancement, temporomandibular joint reconstruction, alveolar augmentation, and mandibular widening in the literature.[2–6] Recently the reconstruction of alveolar deficiencies have been managed by dento-osseous segment DO.[7,8]

The first applications of DO were made with extraoral distractors according to Ilizarov's principles; but because of these applications, the clinician was faced with problems such as external scarring, facial nerve damage, inferior alveolar nerve damage, and social problems, and

so intraoral devices were developed.[9,10]

Micheli and Miotti[11] addressed these concerns by using a specially fabricated intraoral tooth-borne appliance to stabilize the mandibular segments as well as to provide the necessary distraction forces. This tooth-borne technique was satisfactorily applied for the advancement of the mandible and demonstrated that the mandibular teeth could be used to anchor a distraction device.[12]

In this article, the treatment of a patient who had a skeletal Class III abnormality resulting from maxillary hypoplasia is presented and was treated with an anterior segmental advancement by DO with a tooth-borne device and postoperative prosthetic treatment.

Case report

A 42-year-old male patient was referred to our clinic with a complaint of a radicular cyst at the maxillary anterior-posterior region. The teeth 12, 16, 17, 22, 23, and 26 had been extracted previously. He had Class III skeletal relation. The teeth (11, 12, 14, 15) related to the cyst in the radiological examination were nonvital with electrical pulp testing. The patient complained about both the periapical lesions and skeletal anomaly present. A surgeon, an orthodontist, and a prosthodontist evaluated the case. A cephalometric evaluation established that the Class III malocclusion resulted from maxillary hypoplasia. But the patient had a deep anterior crossbite (Figure 1). Upon working up a treatment plan, it was determined that for an ideal prosthetic reconstruction there was a need for the anterior segment to move eight mm forward and two mm occlusally. The freeway space was enough to raise the occlusion. After the cystic lesion was treated, an anterior segmental DO to correct the sagittal discrepancy was planned. The enucleation of the cystic lesion was performed, and teeth 11, 12, 14, 15 were treated with apicoectomies. Histopathologic examination showed the existence of a radicular cyst. Postoperative healing was uneventful. On the fourth postoperative month, after the residual cyst cavity became somewhat smaller, it was decided to proceed with DO for the patient. A device was constructed resembling the intraoral tooth-borne distractor described by Altuna et al.[13] The distractor was fabricated using a two-part acrylic appliance with a hyrax screw (Lewa Dental, 1114-22 Remchingen, Germany). The anterior segment that is to be moved forward was joined to the posterior part using a hyrax screw. The acrylic plate, which completely covered the crowns of the teeth, was planned to lift the occlusion three mm up when the distraction was performed. The operation was carried out under local anesthesia. A horizontal incision was made from the vestibular sulcus and a mucoperiosteal flap was dissected in a superior direction. Two mucoperiosteal tunnels were formed up to the alveolar crest on the location of vertical osteotomies. A surgical saw was used to make a horizontal osteotomy approximately five mm above the apex of the teeth in a form such that the incisive nerve was protected under the nasal spine. This osteotomy was achieved with two vertical osteotomies made by the saw at a distance of approximately two mm from the periodontium of teeth. After the completion of osteotomy with the osteotome, the segment to be distracted was mobilized by the osteotome making a slight rotation movement at osteotomy line in the horizontal plane. The mucoperiosteal flap was closed primarily and the distractor was cemented to the teeth with glass-ionomer cement. The patient was prescribed oral penicillin and mouth rinses during the postoperative period for 10 days. After a latency period of three days, we began the distraction by turning the hyrax screw twice a day (0.5 mm/d). On the 16th day, using a lateral cephalogram, it was determined that adequate forward movement was present and the consolidation period took two months. At the end of this period, the distractor was removed. The distracted anterior segment was stable and both the teeth and the soft tissue showed no signs of any complication (Figure 2).

Superimposition of the cephalometric films taken before and after treatment revealed that the anterior segment moved forward eight mm almost parallelly (Figure 3). The occlusion was rehabilitated with prosthetic reconstruction immediately after distraction to prevent occlusal trauma of the anterior teeth and to establish posterior occlusal contacts. The prosthesis was completed according to the preoperative planning. At the end of the treatment, both function and esthetics were ideal (Figure 4).

DISCUSSION Return to TOC

Maxillary deficiencies have been treated for a long time by using various osteotomy techniques. Today, the use of DO in the craniofacial area is a good treatment alternative in cases where conventional osteotomy techniques are inefficient or where relapse occurs with extreme bone movements.

After the first clinical application of the technique of McCarty et al[14] in the mandible, DO was used especially in mandibular deficiency cases. Block et al[12,15] and Altuna et al[13,16] first examined anterior segmental DO experimentally in the maxilla. Block et al[12,15] used two different devices in two experimental studies that were performed on dogs. They determined that when a tooth-borne distractor was used, dental movement exceeded bone movement, and they concluded that the relapse tendency was greater in the long term. According to these results, they claimed that a bone-borne distractor should be used. Altuna et al[13,16] used an occlusal splint modified tooth-borne device on primates. They determined that anterior segment movement with DO is a reliable method and can be applied clinically. Both researchers showed the existence of a well-organized alveolar bone in histological investigation made on the distraction area.

After these reports, extreme maxillary hypoplasia cases were treated successfully by DO.[2,3] This method made optimal treatment of skeletal deformation possible especially on cleft patients.[17] Clinical applications made until now included entire maxilla or totally forward movement of the midface. An electronic review of the literature revealed no previous publication of clinical application of DO for the maxillary anterior segmental advancement. This case presented is the first known clinical application. The other alternative treatment in this case is anterior movement by a Le Fort 1 osteotomy. When a Le Fort 1 osteotomy is compared with the DO method, the disadvantages of the Le Fort 1 include the requirement for general anesthesia, higher risk of morbidity, need for a longer surgery time, requirement of fixation, and

relapse tendency. In addition, during advancement with a Le Fort 1 osteotomy there can be some unexpected changes in the nasal construction. This complication was eliminated with DO by preparing the segment that will be distracted with the cut supra-apically under the nasal cavity.

In this case, we used a device similar to the ones that Altuna et al[13] used and we obtained similar results. The device worked without any problem despite the strong and thick palatal and buccal mucoperiosteal tissue that surrounds maxilla. We were not faced with any abnormal responses related to the hard and the soft tissues. We did not observe more movement of the teeth than osseous tissues and normal overjet and overbite was obtained. The device was well tolerated by the patient. The case has been under follow-up for 12 months from the time of submission, and the prosthetic rehabilitation placed right after consolidation provided permanent retention in the long term; however, this prevented the evaluation of any long-term relapse tendency. Moreover, because the distracted segment is a minor segment containing three teeth, we do not have any idea about the clinical effects of using larger segments.

Although these four experimental studies and our clinical application give an idea about the relevance of anterior segmental advancement using DO, more research and clinical results with long-term follow-up is needed to have a more exact idea.

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FIGURES Return to TOC

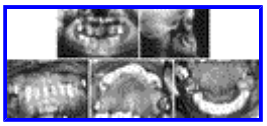

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FIGURE 1. (A) Preoperative panoramic radiograph. Note the cystic lesion associated with the teeth in right maxilla. (B) Preoperative lateral cephalogram. (C) Dentition, frontal view. (D) Preoperative occlusal view of the maxilla. (E) Preoperative occlusal view of the mandible.

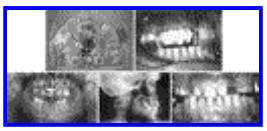

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FIGURE 2. (A) Distractor. (B) View of the device cemented to the teeth after the operation. (C) Panoramic view, at the end of the distraction period. (D) Lateral cephalogram, at the end of the consolidation period. (E) Frontal view of the dentition after distraction osteogenesis.

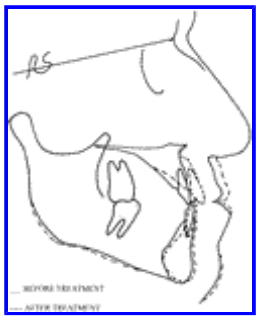

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FIGURE 3. Superimposition of the cephalometric films before and after treatment

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FIGURE 4. (A) Frontal view of the dentition after treatment. (B) Panoramic radiograph after treatment. (C) Occlusal view of the maxilla after treatment. (D) Occlusal view of the mandible after treatment. (E) Lateral cephalogram after treatment.

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