EurAsian Journal of Oral and Maxillofacial Surgery
Official publication of AÇBİD (Association of Oral and Maxillofacial Surgery Society)

CASE REPORT

Alveolar Distraction Osteogenesis in Wide Alveolar Cleft Patients

Yavuz FINDIK[1], Timuçin BAYKUL[1], Mehmet Fatih ŞENTÜRK[1], Tayfun YAZICI[1], Betül KIRAN[1]

[1]Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Süleyman Demirel University, Isparta, Turkey

Abstract

Introduction

Secondary alveolar cleft repair is commonly accepted for alveolar cleft patients, however, nowadays, controversy remains regarding the surgical technique, the timing of the surgery, and the donor site. Rehabilitation of the large alveolar clefts with autogenous graft or distraction osteogenesis is one of the most common treatment choices. The purpose of the report is to evaluate the surgical techniques for repairing the wide alveolar clefts.

Cases

Four patients with alveolar clefts were included in our case series. The width of the cleft was between 17 to 25 mm. All patients were treated with distraction osteogenesis. The segmental osteotomy was performed under general anesthesia. Distraction was started 5 days after surgery. All distractors were bone fixed but supported by a palatal arch for guiding the distraction. Dental cast models were used before the surgery. Pre and postoperative radiological examinations were performed through orthopantomogram and computed tomography (CT) scan.

Results

With distraction techniques, closure of the alveolar cleft was achieved. The desired movements with new bone formation were attained yet eventful in all cases.

Conclusion

The method of treatments described here is a prospect for treating extremely wide alveolar clefts. Further patients are needed to assess all effects, side effects, risks, and overall benefits of these techniques.

Keywords: alveolar cleft, distraction osteogenesis, wide cleft

Introduction

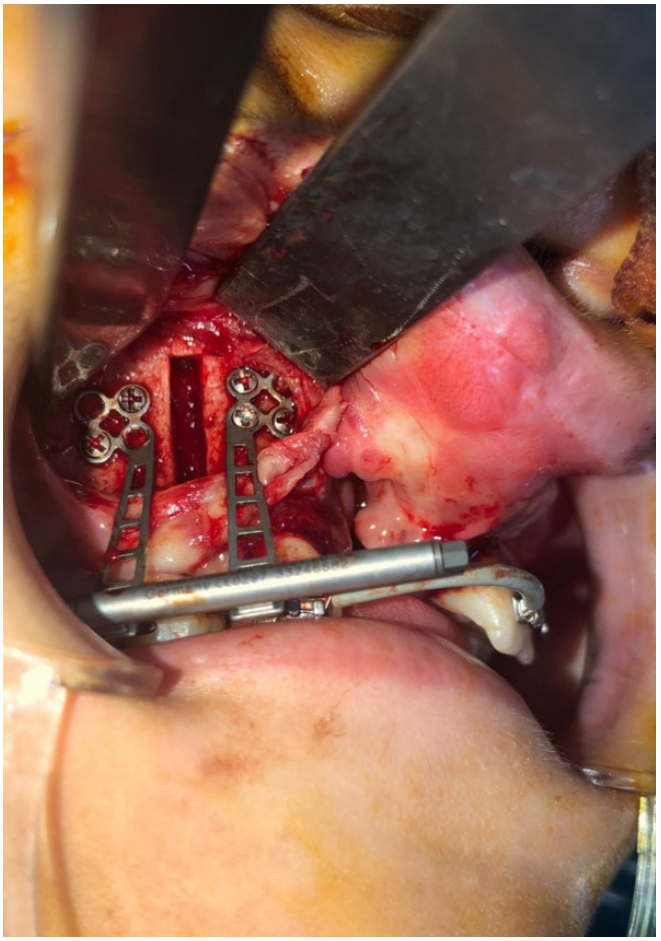
Rehabilitation of alveolar cleft is evolving era compared to other aspects of cleft lip and palate repair. Secondary alveolar bone grafting is the contemporary treatment of alveolar cleft and perialveolar fistula. Autogenous bone grafts from the iliac crest, proximal tibia or mandibular symphysis of the patient or synthetic grafts may be used for grafting.[1,2] In wide clefts failure rate is very high owing to the deficit of soft tissue in the cleft region. Besides, soft tissues affected by chronic inflamed oronasal fistulas may also increase failure rate. However, some cases are found unsuitable for secondary bone grafting. These are generally one of two types of deformities or their combinations: Vertical discrepancies across the cleft region and severe wide clefts. Both situations indicate a severe maxillary deficiency and tend to occur together though one may dominate the clinical picture.[2]

There is no classification for the treatment of ungraftable wide alveolar clefts in the literature. We classified wide cleft treatments in three methods.

1. Distraction osteogenesis

A unique method for new bone generation and soft tissue lengthening, which enables clinician to repair both soft and hard tissues at the same time with the patient's own tissues.[3,4] (Figure 1) Figure 1: intraoral view of the distractor

Corresponding Author: Betül Kıran
Research Assistant
Address: Süleyman Demirel University, Department of Oral and Maxillofacial Surgery, Çünür Mah. Merkez, Isparta
Mobile: +90(534).3597258
e-mail: betulkiran.294@gmail.com



2. Unilateral LeFort 1 osteotomy with elastic traction
In this technique, LeFort 1 osteotomy is performed unilaterally and osteotomized segment is moved with elastics to desired position in vertical discrepancies.

3. Free osteomuscle flap transfer
For wide ungraftable alveolar clefts, free flaps can be used, including bone, muscle and vascular support.

The aim of this case series was to present four patients with ungraftable wide alveolar cleft treated by distraction osteogenesis.

Cases and methods
The surgical procedures of these cases were designed by simulations performed on CT based 3D models and dental casts. Before the surgery, osteotomies were made and distractors was adjusted on the 3D models. All the patients were operated under general anesthesia and nasotracheal intubation.

Patient 1
Unilateral cleft with 17 mm bony defect. At the cleft side, a two teeth bearing segment was freed by interdental and horizontal osteotomies. KLS Martin Liou cleft distractor device was performed for bone-borne distraction. (Figure 2)
The segment was mesially transported and the cleft area was closed. (Figure 3) Alveolar grafting and removal of distractor were made in the same session.

Figure 2 : postoperative radiograph of the patient

Figure 3: panoramic radiograph after the distraction phase

Patient 2
Unilateral cleft including middle line was 25 mm. Because of economic reasons, custom made hybrid type distractor was performed. The cleft was closed desired size. Synthetic alveolar grafting will be going to while the removal of distractor. (Figure 4)

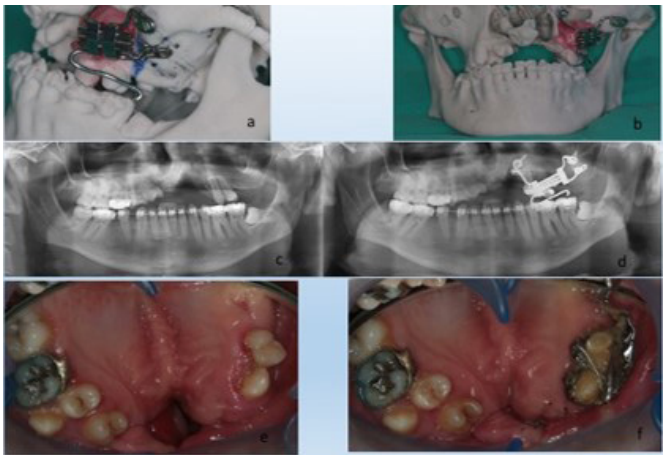


Figure 4: Patient's 3D casts, pre and post-operative radiographs and intraoral images

Patient 3

Unilateral cleft with 22 mm bony defect. At the cleft side, a one tooth bearing segment was freed by interdental and horizontal osteotomies. KLS Martin Liou distractor device was performed. The segment was mesially transported for 13 mm. (Figure 5) Distraction removal and alveolar grafting was performed in the same session.

Figure 5: Panoramic radiograph after the distraction phase

Patient 4

Unilateral cleft with 21 mm bony defect. They were crowding of teeth, therefore maxilla was expanded before the application of distractor and extraction of bad prognosis teeth was made. Interdental and horizontal osteotomies were made and KLS Martin Liou distractor device was performed. The segment was mesially transported for 13 mm. Alveolar grafting will be going to while the removal of distractor after consolidation period.

Results

The healing phase was uneventful and the activation period was completed in all patients. During the distraction, there was no device loosening issues and the segments was stable. No postoperative complication occured in the patients. The treatment of cases continues.

Discussion

Surgical closure of wide alveolar clefts is important not only in the improvement of articulation, establishment of functional occlusion, and aesthetic improvement, but also in the improvement of the oral environment. Secondary autogenous bone grafting for alveolar clefts provides continuity to the alveolar arch by closure of the cleft. Though this method is useful, failure of the bone graft can occur when the cleft is markedly large, or when covering with an oral mucoperiosteal flap is inadequate due to marked scar formation.[5]

Distraction osteogenesis is considered as the indicated approach for wide alveolar cleft patient, which can minimize risks of soft tissue breakdown and secondary bone graft failure. However, DO is a complicated procedure, particularly for alveolar bone, which has a limited place to set the distraction. It is important to design suitable distractor to make operations easier and to reduce morbidity.[6] Intraoral devices work better because they are securely fixed to adjacent bone or teeth, and the strength is easily controlled.[7] Liou et al. completed approximation of a wide alveolar cleft by creating a segment of new alveolar bone and attached gingiva with a tooth-borne intraoral distraction device.[8]

Many advantages have been reported for the distraction of alveolar bone to close large cleft gaps.[8,9,10] It is possible to decrease the size of the gap to a minimum which can be easily repaired. Even though the improvement of the bony cleft is limited, the soft tissue cleft is closed completely and enough attached gingiva is formed to cover the bone graft. Other advantages are that there is no need for a donor site and donor site surgery. Also can be avoided unpredictable resorption of free bone graft. Very large gaps might be closed successfully including new generated bone which can be used to move teeth into. The risk of relapse is less and the recovery time is shorter.[11,12]

There are many distractors on the market, such as bone borne, tooth-borne and hybrid types. The majority of the distractors on the market are bone borne devices so they perform the distraction through a straight line. This requires a secondary orthodontic treatment approach to create symmetric and ovoid arch form. Using a tooth-borne distractor is also advantageous because it makes the protocol simpler by avoiding the surgery necessary for removal of the distractor.[11]

Ding et al.14 studied changes in periodontal tissue during maxillary dentoalveolar distraction osteogenesis using an intraoral tooth-borne distractor to close wide alveolar defects in four dogs. They found that the morphological changes in the periodontal tissues of the supporting tooth were moderate. They could be reversed if the rate and duration of distraction were correct like the physiological changes of the periodontal ligament of the orthodontic tooth. Liou et al. recommend moving the teeth into the new generated bone as soon as possible to avoid shrinkage during maturation.[8]

Due to the abovementioned reasons, distraction osteogenesis remains as an exceptional treatment method generating new bone and following soft tissue utilizing the patients' own tissues. This is a remarkable advantage in cases with large cleft gaps to be closed or at least to diminish the size of the gap to a favourable dimension where further repair is easily feasible. The newly generated bone can also be used to move teeth into when needed.[13]

Conclusion

Recalcitrant alveolar clefts in permanent dentition are faced in all cleft centers.

If they are labeled as ungraftable, transport bone formation through distraction or the other techniques make these clefts amenable to grafting.

In conclusion, treatment of ungraftable alveolar clefts await more innovation.

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