

Mandibular Ramus Cortical Tenting Graft and Particulate Allograft in the Management of Unilateral Alveolar Cleft

Amin Rahpeyma^{1,2}, Saeedeh Khajehahmadi^{3,4}

¹Oral and Maxillofacial Diseases Research Center, School of Dentistry, Mashhad University of Medical Sciences, Departments of ²Oral and Maxillofacial Surgery and ⁴Oral and Maxillofacial Pathology, School of Dentistry, Mashhad University of Medical Sciences, ³Dental Research Center, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract

Background: Alveolar bone grafting in the mixed dentition stage is an important step in the management of cleft lip/palate patients. Intraoral donor sites are favored by patients and their parents. **Objective:** This study investigated a novel bilaminar cortical tenting grafting technique. The technique used a combination of autogenous mandibular ramus cortical bone and particulate allograft in unilateral cleft lip/palate patients during the mixed dentition stage. **Materials and Methods:** Five patients with nonsyndromic unilateral cleft lip and/or palate, in mixed dentition stage, were included in the study. **Results:** The operation was performed on five patients, and patients were followed up at least for one-year postoperation. Permanent maxillary canine erupted in the grafted alveolar region spontaneously in 80% of the patients. One wisdom tooth bud that had been exposed during the ramus bone harvest was removed. There was no alteration in the sensation of the lower lip as checked by light static and two discrimination tests. **Conclusion:** Unilateral alveolar clefts can be repaired using mandibular cortical block ramus bone in the form of bilaminar tenting grafts combined with particulate allografts.

Keywords: Alveolar cleft, cortical tenting graft, mandibular ramus

INTRODUCTION

Bone grafting is an important step in the management of patients with alveolar cleft. The operation is done once the cleft lip/palate has been repaired and before cleft-orthognathic and rhinoplasty procedures.^[1] There are many advantages associated with bone grafting, especially if it is performed according to the scheduled timing in the mixed dentition stage.^[2] Autogenous bone is considered to be the gold standard. Available common donor sites include the anterior iliac crest, tibia-cranium, rib, chin, and ramus.

Intraoral donor sites are preferred by patients and their parents.^[3] Despite the widespread use of ramus bone grafts for intraoral hard tissue augmentation in implant dentistry, the use of the ramus in alveolar cleft bone grafting is limited to adults.^[4]

This study investigates a novel bilaminar cortical tenting grafting technique. The technique uses a combination of

autogenous mandibular bone and particulate allograft in the mixed dentition stage.

MATERIALS AND METHODS

Five patients with nonsyndromic cleft lip and/or palate were included in the study. The patients had unilateral alveolar cleft at the mixed dentition stage, and there was no previous attempt for alveolar bone grafting. All procedures were approved by the Ethics Committee of Mashhad School of Dentistry in Iran.

Under general anesthesia, the nasal floor was repaired by a perifistular incision followed by suturing. Nasal mucosa acted

Address for correspondence: Dr. Saeedeh Khajehahmadi, Dental Research Center, Mashhad University of Medical Sciences, Vakilabad Blvd., Mashhad, Iran.
E-mail: khajehahmadis@mums.ac.ir

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as a basal layer for particulate graft. A sulcular incision with a distal release in the distobuccal line angle of the permanent maxillary first molar was used to provide the buccal sliding flap. Full-thickness palatal mucoperiosteal flaps were reflected in the cleft region and extended one tooth from the cleft margin; the flaps were sutured edge to edge to provide palatal coverage.

A cortical block from the buccal plate of the mandibular mid-ramus was obtained.

The upper limit has three mm distance with mandibular notch, and lower limit may extend three mm to distal root of mandibular second molar. Harvested bone was sectioned into two halves [Figure 1]. One segment was used on the buccal side of the alveolar cleft, while the other segments was used on the palatal side. The placement of the vertical palatal cortical bone was done while the edges of the free bone graft rested on the palatal bone surrounding the fistula. The buccal cortical bone was shaped according to the buccal opening of the alveolar gap and was wedged between the two segments. The hollow bony box was filled with particulate allograft (freeze-dried bone allograft; Cenobone, Kish, Iran) and covered with the lateral sliding flap [Figure 2].

Amoxicillin susp 250 mg and ibuprofen syrup 200 mg/four times a day were prescribed for one week. Chlorhexidine gel was used topically three times a day for two weeks after operation. Patients were followed for one week after surgery and then at one, three, six, and 12 months.

Immediately after the operation, panoramic radiography was taken to check both the donor and recipient sites. Three months after the operation, a cone-beam computed tomography (CBCT) was taken before referral to the orthodontist to check the width of newly formed bone. Bone graft of the alveolar defect was measured; intraoral periapical radiographs were taken using the parallel technique before and one year after the surgery. The remaining bone in the alveolar cleft was evaluated using the criteria of Bergland *et al.*^[5]

RESULTS

The operation was performed on five patients, and they were followed up for at least one year after the operation. Demographic information of these patients is reported in Table 1. The grafts were incorporated with the adjacent bone in all cases, and normal bone height was obtained [Figure 3]. The permanent maxillary canine erupted in the grafted alveolar

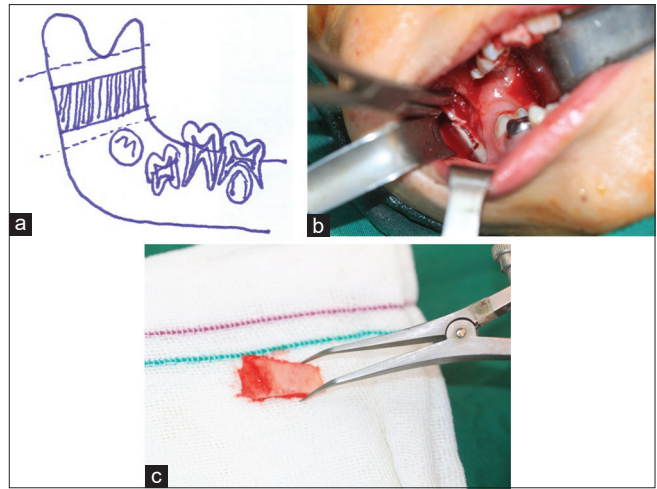


Figure 1: (a) Schematic picture of ramus donor site in the mixed dentition stage. (b) Intraoral photograph. (c) Harvested cortical bone

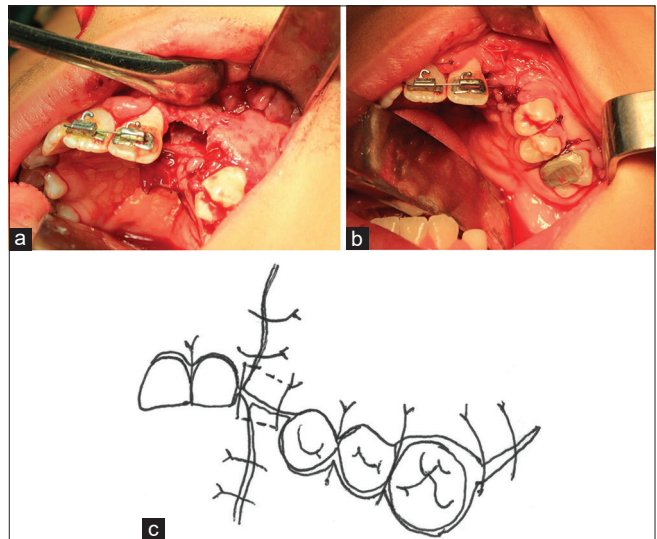


Figure 2: (a) Bilaminar bone grafts. (b) A lateral sliding flap used to cover the graft. (c) Schematic diagram



Figure 3: Three-month postoperative cone-beam computed tomography revealing the incorporation of the bone graft with the adjacent bone. Note the width of the newly formed bone

Table 1: Demographic information of the patients

Patient number	Age	Sex	R/L	Spontaneous eruption of canine	Follow-up (month)
1	8	Female	L	+	15
2	9	Female	L	+	12
3	8.5	Male	R	+	18
4	9	Male	L	-	24
5	8	Female	L	+	14

L=Left; R: Right

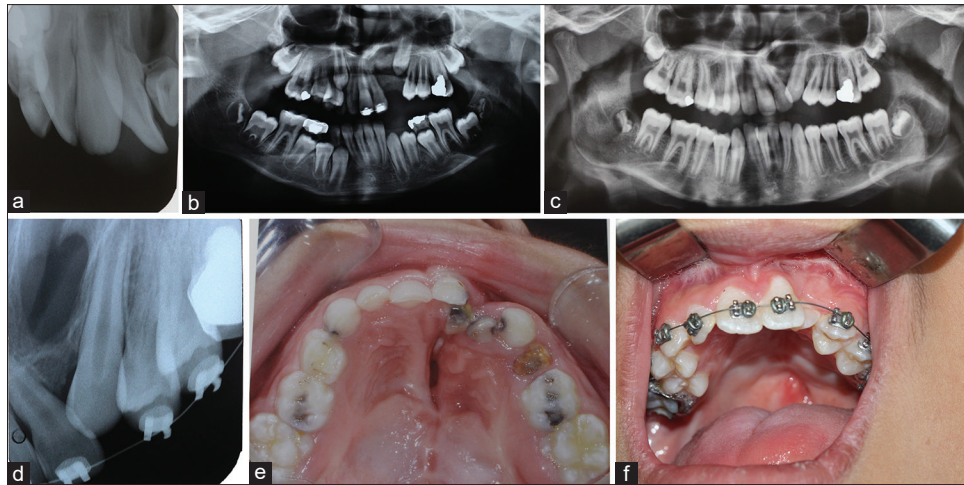


Figure 4: (a) Preoperative periapical graphy. (b) Immediate postoperative panoramic view. (c) Postoperative orthopantomogram of the mandibular graft donor site 6 months after operation. (d) Radiograph taken 1 year after surgery. (e) Preoperative picture. (f) Photograph taken 1 year after surgery showing eruption of canine tooth

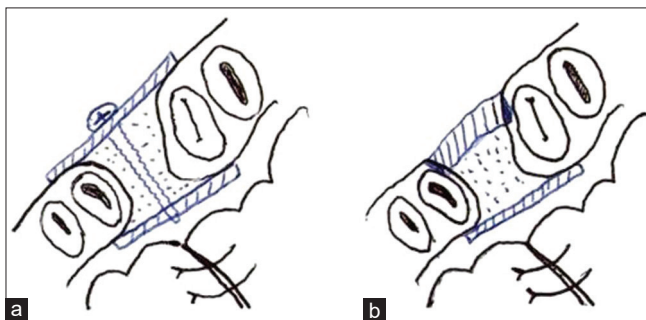


Figure 5: Schematic diagram indicating the particulate allograft filling the gap between the two cortical grafts. (a) A miniscrew interferes with the eruption of canine tooth in mixed dentition. (b) A cortical graft is wedged in the alveolar gap on the buccal side, while the vertical palatal graft rests on the palatal bone

region spontaneously in 80% of the patients (four of the five patients) [Figure 4]. One wisdom tooth bud that had been exposed during the ramus bone harvest was removed. There was no alteration in the sensation of the lower lip as checked by light static and two discrimination tests.

DISCUSSION

Tenting grafts have been used for alveolar process reconstruction before implant insertion in both mandibular and maxillary bones.^[6] This technique has two main advantages: decreasing the amount of autogenous bone required to fill the defect and preventing the soft tissue from interfering with the regeneration of the bone.^[7]

CBCT indicated that a common problem in postoperative grafted alveolar clefts performed using conventional techniques is that there is insufficient bone on the palatal side of the cleft.^[8] Vertical palatal cortical bone placement resolves this problem. A cortical graft is used on the palatal side of the cleft to maintain the space thus increasing the

width of the grafted alveoli on the palatal side. Palatal flap reflection should be done considering the dimensions of the bone graft.

In our practice, the majority of the alveolar cleft bone graft procedures are done in the summer when schools are closed. Pain at extraoral donor sites prohibits sport activities, especially bicycling and swimming, which means that the entire summer can be wasted for these patients. Thus, intraoral donor sites are more favored by the patients and their parents due to the rapid recovery time. Other advantages of intraoral donor sites include avoiding facial scar, ease of harvest, and low rate of complications.^[9]

The chin is the most widely used site. However, while the bone volume may be sufficient to repair adult unilateral alveolar clefts, it is not sufficient to repair the wide alveolar cleft at the mixed dentition stage. The surgeon should have a special look at the donor site to avoid injury to the incisive nerve and to determine the presence of an unerupted mandibular canine or erupted mandibular permanent incisors.^[10] Of the various intraoral donor sites, the harvest of the mandibular ramus bone has the lowest complication rate and is well accepted by the patients.^[11] The use of a particulate allograft reduces the need for additional autogenous bone, while the cortical bones protect the particulate material from spilling into the soft tissue. In implant dentistry, the fixation of the bilaminar tent graft for the augmentation of the alveolar process is performed using a mini screw which engages both grafted cortexes.^[6] At the mixed dentition stage, this screw acts as a physical barrier for the eruption of maxillary canine through the grafted alveolar bone. Wedging the buccal bone graft provides graft stability [Figure 5].

The cortical architecture of bone graft does not interfere with eruption of the permanent maxillary canine. This is due to the thin nature and elasticity of the mandibular ramus cortex in children.^[12,13]

CONCLUSION

The bilaminar cortical tenting grafting technique using the mandibular ramus bone and particulate allograft is suitable for repairing a unilateral alveolar cleft in the mixed dentition stage.

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Conflicts of interest

There are no conflicts of interest.

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