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Clinical Paper
Cleft Lip and Palate and Palate

Early secondary closure of alveolar clefts with mandibular symphyseal bone grafts and β-tri calcium phosphate (β-TCP)

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Abstract. Alveolar reconstruction of bony defects in cleft lip and palate patients is a widely accepted treatment regimen for which multiple donor sites can be used. For 25 years, autogeneous bicortical mandibular symphyseal bone grafts have been used at the authors' centre. In cases in which the alveolar defect was too large to match the volume of the mandibular symphyseal bone transplant, β-TCP granules were packed against the bone transplant to fill the defect completely. In a retrospective study, 18 patients, who were treated with mandibular symphyseal bone wrapped in β-TCP granules, were compared with 29 patients, who were treated with mandibular symphyseal bone only. To assess alveolar height, occlusal radiographs were taken directly postoperatively and 1 year later. Mean alveolar bone loss was calculated and compared between groups using Student's *t*-test and linear regression analysis. No statistically significant difference in alveolar height was found between the two groups. It was concluded that mandibular symphyseal bone grafts enriched with β-TCP granules can be used successfully in cases in which the alveolar cleft is too large to be grafted with mandibular symphyseal bone alone.

Keywords: cleft palate; beta-tricalcium phosphate; bone transplantation; mandibular symphyseal bone transplant; maxillofacial surgery; orthodontics.

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Secondary bone grafting of the residual alveolar cleft in patients with cleft lip and palate has become a well-established procedure. Successful grafting allows eruption of teeth into the former cleft area and the achievement of orthodontic movement of teeth adjacent to the cleft site, to obtain non-prosthodontic rehabilitation.[2,8,11] Secondary alveolar bone grafting (SABG) is ideally carried out between 9 and 11 years of age, before eruption of the maxillary canine,[21] to allow the canine to erupt through the grafted site.[1,2,8,17] A slight reduction in anterior vertical maxillary growth has been found after SABG.[17] This effect is partially compensated by the capacity of the erupting canine to generate alveolar bone.[28]

After bridging the alveolar cleft with bone, functional loading either by resumption of eruption of the canine or by orthodontic guidance into the new bone will help to maintain the bone graft. At present, autologous bone is the preferred material for closure of the osseous defect in the alveolar process. Iliac crest particulate cancellous bone[10] is most commonly used for this purpose. Reports advocating the use of mandibular symphyseal bone,[9,20,26] rib bone,[18] calvarial bone[14,37,39] and bone harvested from the tibia have been published.[21,30]

Harvesting an autologous bone graft has several disadvantages. Donor site surgery requires prolonged operating time and may cause morbidity.[14,18,23,34,35] Serious side

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effects of taking iliac crest bone transplants, such as hypersensitivity,[15] pelvic instability, infection,[13,35] and paraesthesia[7] affect 10–30% of patients.[4] The mandibular symphysis has been advocated as an alternative donor site[6,9,26,34], although it is associated with minor complications such as paraesthesia[31] and apical root damage.[23,29]

In the authors' hospital, the SABG-procedure has been performed using a mandibular symphyseal bone transplant for 25 years. In most cases, the volume of the harvested bone was sufficient to fill the cleft region, but sometimes there was a shortage of bone. In those cases, the use of an alternative donor site was considered. To avoid the disadvantages mentioned above alloplastic materials are also an option.

In cases where a discrepancy was found between the volumes of the chin bone transplant and the alveolar defect, β-TCP granules were positioned at the buccal side of the graft and the remaining minor spaces, in such a way that the central part of the cleft region was always filled by autogenous bone, forming a bony bridge between the adjacent parts of the maxilla.

The aim of this study was to compare alveolar height and canine eruption between clefts grafted either with chin bone or with chin bone and β-TCP.

Material and methods

Patients

From April 1998 to December 2005, 182 patients with a cleft lip and palate underwent surgery for early secondary reconstruction of the alveolar process using a symphyseal bone graft. All patients were operated on by one surgeon. SABG was performed when one-quarter to one-half of the final root length of the adjacent canine was formed, as indicated by the radiographic appearance of a root length equal to that of the crown.[9,16] In all cases the canine crown was still completely covered by bone.

β-TCP as an adjunct to autologous symphyseal bone was used in 31 patients (17%) of whom 18 patients, who had complete records, were included in this study. A control group of 29 patients, grafted with symphyseal bone only was taken at random from the remaining 151 patients. In case of a bilateral cleft, the clefts were scored as two solitary clefts. The inclusion criteria for the study were based on the presence of sufficient and accurate radiographs preoperatively, directly postoperatively and 1 year postoperatively. Exclusion criteria were radiographs of insufficient quality and inability to conform to the 1 year postoperative follow up.

Cleft surgery

All operations were performed under general anaesthesia. At induction, a prophylactic antibiotic regimen with cefazolin and metronidazol was given. Surgery began by infiltration of local anaesthetic with adrenaline 1:200,000 (Ultracain DS Forte®) into the anterior vestibulum of both the lower and upper jaw and into the palatal foramen region of the maxilla. The cleft area was exposed subperiosteally by making vertical incisions along the edges of the cleft. On the buccal side the vestibular gingival sulcus incision was extended distally along the attached mucosa of the adjacent teeth to the second molar area. In this region, a buccal relieving incision with an additional periosteal relieving incision was performed. A mucoperiosteal transposition flap was created that covered the alveolar cleft and bone transplant in a tension free manner. At the cleft site, first the nasal mucoperiosteum was separated from the oral mucoperiosteal lining, then elevated and freed from the cleft site extending posterior along the nasal floor. The soft tissue nasal floor was reconstructed using 5–0 vicryl sutures. No tissue glue was used.

Grafting procedure

To harvest the mandibular symphyseal bone transplant, a marginal incision into the gingival sulcus along the lower incisors with two vertical relieving incisions in the canine region was made (Fig. 1). After deflecting the mucoperiosteum, the chin region was exposed. Keeping a minimal distance of 5 mm from the apices of the lower incisors to prevent damage, a rectangle was outlined in the symphyseal region between the developing canine teeth. By drilling a 'through and through' hole using a 2 mm round bur, a starting point was created. Then, using an oscillating saw with a small blade, a rectangular bone transplant was created leaving the

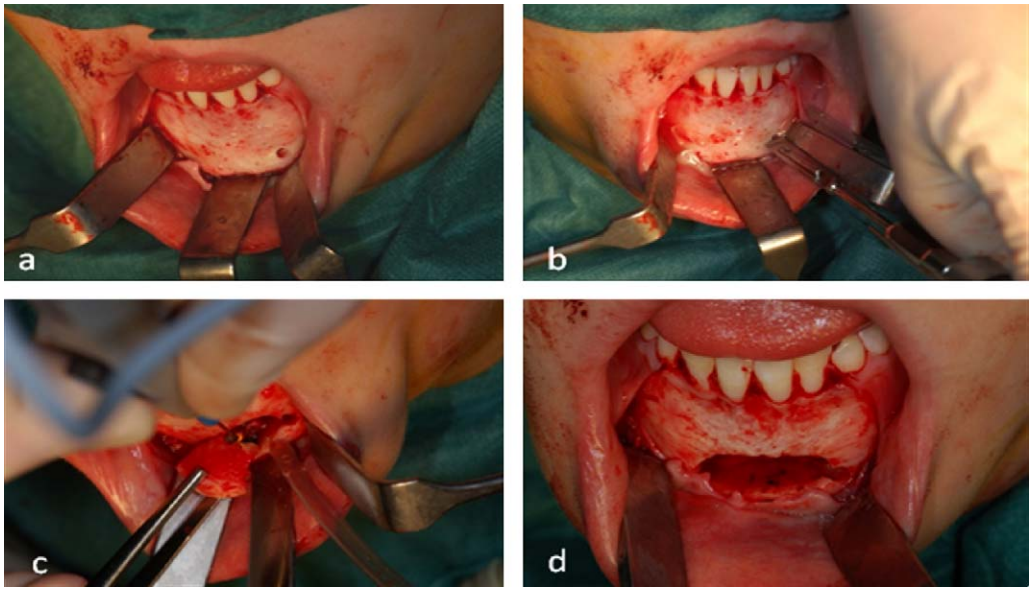

Fig. 1. Donor site procedure. (a) A complete thickness hole was created with a drill. (b) Using an oscillating saw a rectangular bone transplant was harvested. (c) The bicortical mandibular symphyseal bone graft was elevated, leaving (d) the lower border intact.