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Isolated keratinized gingiva incision in alveolar cleft bone grafts improves qualitative outcomes: A single surgeon's 23 year experience

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ABSTRACT

Background: Few publications have described the flap design of the secondary cleft alveoloplasty. In this article we describe a modified technique of the classical flap design with the purpose of minimizing injury to the dental papillae and periodontium of the involved dentition. We report our long-term experience, specifically with regards to oronasal fistulae recurrence, wound healing and graft exposure and loss.

Methods: All the patients were operated on using the same technique by a single surgeon. A total of 148 clefts have been operated with this approach, involving 117 patients with complete cleft lip and palate with a follow-up between 12 and 240 months.

Results: The most important finding in this study is the excellent wound healing observed in almost all patients. Only three patients (2%) suffered a dehiscence with oronasal fistulae recurrence and bone loss. Another patient lost the graft without fistula recurrence. Minor dehiscence with partial bone loss occurred in 4 patients (2.7%). These patients did not need surgical closure and only superficial exposed bone particles were lost without compromising the clinical outcome.

Conclusions: Our modification presents a flap design that is easy to elevate and mobilize, without disturbing the buccal sulcus or the gingival inter-dental papillae.

1. Introduction

Over the last three decades, alveolar cleft bone grafting has become the standard of care. Secondary alveoloplasty was introduced by Boyne (Boyne and Sands, 1972) and popularized by Abyholm et al. (1981). The literature on cleft alveoloplasty has been defined regarding timing (Boyne and Sands, 1972; Abyholm et al., 1981; Horswell and Henderson, 2003; Rosenstein, 2003), surgical technique (Abyholm et al., 1981, de Ruiter et al., 2014), results (Bergland et al., 1986; Enemark et al., 1987), dental rehabilitation (Verdi et al., 1991; Kearns et al., 1997; Jansma et al., 1999; Lilja et al., 1998), radiological evaluation (Witherow et al., 2002; Tai et al., 2000; Trindade et al., 2005), orthodontic management (Figueroa et al., 1993; Kalaaji et al., 1994; Semb and Bergland, 1991), alveolar cleft management with distraction osteogenesis (Liou et al., 2000; Buis et al., 2001; Rachmiel et al., 2013).

The main objectives of this technique are to close the persistent oronasal fistula, provide support for the teeth adjacent to the cleft, prevent relapse of expanded maxillary segments and also improve the support for the nasal base.

Historical publications of secondary alveolar bone grafting outlined the importance of placing keratinized gingiva over the area of tooth eruption (Bergland et al., 1986; Cohen et al., 1989). However, few publications have described the flap design of the secondary cleft alveoloplasty (Epker, 2009; Precious, 2009).

In this article we describe a modified technique of the classical flap design with the purpose of minimizing injury to the dental papillae and periodontium of the involved dentition. This retrospective study was undertaken to assess the outcome of alveolar bone grafts performed in two institutions by a single surgeon. We report our long-term experience specifically with regards to oronasal fistulae recurrence, wound healing, graft exposure and loss, as well as alterations on gingival contour, loss of gingival papillae and dental root exposure.

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2. Material and methods

In 1991 we began treating secondary maxillary alveolar clefts with cancellous iliac bone autografts. Our technique is a modification of the standard approach described by Boyne and Sands (Boyne and Sands, 1972; López-Cedrún et al., 1997a,b). The records of patients from two institutions were retrospectively reviewed. All the patients were operated on using the same technique by a single surgeon (JLC). A total of 148 clefts have been treated utilizing this approach.

All patients with cleft lip and palate were considered candidates for secondary alveoloplasty. All patients in the study were evaluated with the assistance of the orthodontist, and the decision for surgery was based on developmental, orthodontic, surgical and prosthodontic factors. The optimal timing for performing surgery was determined radiographically when one third to half of the cleft side canine root was developed. The treatment sequence for all patients in the study began with orthodontic preparation of the maxillary arch including corrections of dental rotations and transverse maxillary expansion as required. Care was taken to not over expand the maxillary segments so as to not increase the width of the alveolar cleft. The purpose of the orthodontic treatment was to align the anterior maxillary dentition to provide better surgical access to the surgical site (Enemark et al., 1987).

Prior to surgery, fixed maxillary expanders and the arch wire across the cleft were removed. In patients with bilateral alveolar clefts the arch wire was replaced after surgery in order to stabilize the premaxilla. In two patients in whom we performed a late alveoloplasty we combined the procedure with premaxillary repositioning after a vomer osteotomy was done. In one case we stabilized the bone segments with the orthodontic arch wire and the other more severe case the stabilization was achieved with a modified Hyrax device.

2.1. Surgical technique

Nasoendotracheal intubation was used for most patients with unilateral clefts (using the non-cleft nostril) and oral intubation for patients with bilateral clefts. Amoxicillin/clavulanic was administered intravenously 30 min before surgery and postoperatively for 8–10 days. Two teams of surgeons operated simultaneously, one preparing the alveolar cleft site and the second harvesting the iliac cancellous bone.

The incisions were made as outlined in Fig. 1. The vestibular incision on the cleft side extends posteriorly along a slightly superior line, always over keratinized gingiva and without any vertical releasing incisions in the mobile mucosa. This is in strong contrast to other incision designs in which full length vertical oblique incisions through attached gingiva and mobile mucosa are performed in order to achieve tension free closure over the cleft anteriorly.

In the cleft area, an angled ocular knife is used to make the incision along the mucosa over the mesial line angle of the canine tooth, extending to the superior rim of the fistula and then across and inferiorly to the mucosa over the distal line angle of the non-cleft central incisor (Fig. 1). A periosteal elevator is used to raise the labial mucogingival flaps in a subperiosteal plane.

After reflection of the flaps, the nasal mucosa is separated from the oral mucosa and from the level of the alveolar ridge and hard palate (Fig. 2). The separated nasal mucosa is pushed into the floor of the nose. Nasal mucosa edges are freshened and sutured with 6-0 (10 mm 5/8 tapercut™ needle) and 5-0 vycril sutures (Ethicon®) for meticulous watertight closure of the oronasal fistulae (Fig. 3). Confirmation of a tension-free flap for closure was performed. If any tension is appreciated, isolated periosteal releasing incisions are made with an angled ocular knife to further mobilize the flaps. Elevated palatal flaps are freshened along the previous fistula track, granulation tissue is removed, and 3-0 or 4-0 rapid vycril (Ethicon®) sutures are used for watertight fistula closure. A cancellous iliac bone graft was packed in the cleft pocket (Fig. 4) and the two vestibular flaps were sutured together over the original fistula line and to the palatal flaps over the alveolar ridge in the cleft area with a 4-0 rapide vycril suture (Ethicon®) (Fig. 5).

3. Results

This retrospective study involved 117 patients with complete cleft lip and palate (86 unilateral and 31 bilateral) with a follow-up between 12 and 240 months. Eighty six (73.6%) patients had a unilateral deformity and 31 (26.4%) a bilateral cleft. The sample of patients from the two institutions had similar characteristics (Table 1).

An advantage of secondary alveoloplasty is the establishment of a sound and well-contoured alveolar process, which will provide support for teeth and periodontium. The most important finding in this study is the excellent wound healing observed in almost all patients. No releasing incisions in the free gingiva were required in any patient. Only three patients (2.0%) suffered a dehiscence with oronasal fistulae recurrence and bone loss, corresponding to one secondary alveoloplasty and two to late alveoloplasty. Another patient lost the graft without fistula recurrence. The 4 cases in which bone was lost equate to 2.7% of the total sample (Table 1).

Minor dehiscence with partial bone loss occurred in 4 patients, two of them from each hospital (2.7%). These patients did not require secondary surgical closure since only superficially exposed bone particles were lost, without compromising the clinical outcome. Although we did not compare the measurements of the keratinized gingiva in each side in this study, we appreciated a healthy and normal gingiva in the cleft side, without signs of swelling.

All hip surgical sites healed well with the exception of one patient who developed a minor wound complication related to a stitch abscess that healed after removing the suture. All patients were discharged from the hospital within two days. This technique allows excellent clinical outcomes (Fig. 6).

4. Discussion

Most centres have incorporated secondary bone grafting in conjunction with orthodontic treatment in their protocol for the management and rehabilitation of patients with alveolar clefts (Abyholm et al., 1981; Enemark et al., 1985; Hall and Posnick, 1983; López-Cedrún et al., 1997a,b). Although advocated by some teams (Rosenstein, 2003; Hathaway et al., 1999) early bone grafting has been abandoned by most surgeons due to the unsatisfactory long-term results (Robertson and Jolleys, 1968; Friede and Johanson, 1974).

In the beginning, attention was directed toward stabilization of the maxillary segments with blocks of cortical bone and cancellous bone particles to provide stability of the maxillary segments and prevent cross bite. Prosthodontic devices and bridges were subsequently used for dental and aesthetic rehabilitation. Boyne and Sands (1972) are credited as the first to recommend bone grafting of alveolar clefts at the mixed dentition stage. They recommended treatment with particulate cancellous bone in conjunction with orthodontic treatment to achieve stability of the maxilla, teeth eruption through the auto graft, and facilitate postoperative orthodontic manipulations of the erupted teeth.

Several flaps have been proposed for soft-tissue coverage of the cleft maxilla in conjunction with bone grafting (Stenstrom and