Case Report - Developmental Defect

Esthetic and functional rehabilitation in patients with cleft lip and palate

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ABSTRACT

Oral rehabilitation of missing teeth in cleft patients has acceptable success rates. A two-stage approach is indicated; however, timing of implant placement in the grafted maxilla varies within existing protocols. This case highlights successful implant osseointegration and esthetic oral rehabilitation following placement of two implants at 5 months after maxillary grafting (alveolar bone grafting) with a corticocancellous block obtained from the iliac crest. A 31-year-old male patient had already undergone repair of his bilateral cleft lip and soft palate according to established guidelines for cleft patients. Initial closure of his alveolar clefts and further correction of the maxillary hypoplasia with a bi-maxillary osteotomy were completed in 2002. However, bone resorption due to infection in 2003 necessitated removal of all maxillary incisors. The patient was not satisfied with the removable partial denture provided. In 2007, he did undergo anterior maxillary augmentation under general anesthesia, and 5 months later two implants were placed. A 3-unit bridge did replace functional and esthetic demands. Postoperative recovery was uneventful, and overall bone loss, and oral health remain within standards 28 months following implant placement. Optimal outcome is achievable when replacing missing teeth in cleft patients when timing does not exceed approximately a 6-month interval from bone grafting to implant placement. This article demonstrates that overall esthetic and functional rehabilitation is feasible in cleft lip and palate patients. In this patient, overall oral treatment was achieved with an implant prosthesis.

Keywords: Cleft palate, functional rehabilitation, graft, reconstruction, tongue flap

INTRODUCTION

Cleft lip and palate (CLP) represents the second most frequently occurring congenital deformity. It is associated with problems including cosmetic deformities, oral abnormalities, speech, swallowing and growth difficulties. Due to their congenital deformity, alveolar bone grafting (ABG) is an essential step in their reconstruction.[1] Oral rehabilitation includes the replacement of missing teeth, and the use of endoosseous implants has become a secure option of treatment with predictable and acceptable rates.[2-4] Time of grafting has been controversial among surgeons. There remain a few supporters of primary bone grafting,[5] in which the cleft alveolus is usually reconstructed at the same time as the closure of the cleft lip, or shortly thereafter. Secondary bone grafts are more popular and can be placed at three stages: (1) Very early secondary bone grafting, which facilitates the eruption of the lateral incisor but probably inhibits maximal growth of the maxilla, (2) early secondary bone grafting depending upon the development of the upper canine, which facilitates the eruption of the canine into the graft and permits the maxilla to develop undisturbed for a longer period and (3) late secondary bone grafting after eruption of the upper canine.

Grafting of the cleft is accomplished with cancellous bone from the ilium or tibia or corticocancellous from the calvarium or mandibular symphysis.[1,6-9] Also, the use of chest rib as a donor site has been reported, and there is a growing interest in the use of bony substitutes to reconstruct maxillofacial defects.[10] The question of the preferred donor site for alveolar cleft grafts has been debated for many years. Its choice is influenced by several

factors that include the surgeon's experience and preference, the volume of bone that is required and available, and the morbidity that is associated with its harvest.

Many reports suggest that autogenous bone from the iliac crest is the gold standard by which other types of alveolar grafts should be compared.[1] It is easy to access and can supply large quantities of cancellous bone with pluripotent or osteogenic precursor cells that support osteogenesis in the early period after grafting.[3] Because of its higher content of osteogenic cells, cancellous bone is thought to be superior to corticocancellous bone. The number of osteogenic cells/unit volume of cancellous bone can be increased further by compacting it, which is thought to increase its reliability even further.[3] The main criticism of its use as secondary bone grafting is that it produces an unacceptably high degree of postoperative morbidity, such as persistent pain, prolonged recovery time, hemorrhage, limping, visible scarring, bone contour deformities, lesions of the lateral femoral cutaneous nerve, pelvic fracture and peritonitis.[11,6-8]

However, several studies have shown that the severity of postoperative pain after iliac crest bone harvesting is minimum when a less aggressive surgical approach is followed with a trephine to obtain cores of bone. Most patients indicated that the pain was not severe and was readily alleviated with small quantities of analgesics.[11] Furthermore, in most of the earlier studies evaluated pain experience following a graft harvest procedure from the iliac crest, undergoing another surgery (arthrocentesis etc.).

Now-a-day, this surgical approach has been developed to a minimum invasive surgical intervention when bone is to be harvested for augmenting bone volume in advanced oral implantology procedures. This is because the shape of corticocancellous blocks and the amount of cancellous bone are approximately predetermined in the overall treatment planning, and less aggressive instrumentation (i.e., trephines, saws) induce less trauma. Moreover, overall postoperative discomfort can be significantly reduced by administering a bolus of long-lasting anesthesia locally immediately postoperatively.

Several surgeons have reported that roughly 86% of their patients would be willing to have an ABG using bone from the hip, if recommended, and many patients are satisfied with the residual scar.[11] Other surgeons have reported that harvesting bone from the iliac crest did not delay mobility, and almost all patients were able to walk within the first 24 h after operation and could walk normally within 2 weeks.[11] Comparison between graft donor sites can be seen in Table 1.

CASE REPORT

A 31-year-old patient had already undergone repair of his bilateral cleft lip and soft palate according to established guidelines for cleft patients in the UK. Initial closure of his alveolar clefts and further correction of the maxillary hypoplasia with a bimaxillary osteotomy were completed in 2002. The palatal fistula was closed with an anteriorly based tongue flap.[12,13] However, bone resorption due to severe oral infection in 2003 necessitated removal of all maxillary incisors [Figure 1a and b]. The patient was not satisfied with the removable partial denture provided. In 2007, he did undergo anterior maxilla augmentation with two corticocancellous blocks obtained from the anterior iliac crest under general anesthesia, secured with 10 mm screws [Figure 2]. Five months later two 10 mm 4.1Ø Straumann implants (Basel, Switzerland) were placed, which were left another 7 months, prior second stage surgery and abutment connection. A 3-unit bridge did replace functional and esthetic demands [Figures 3 and 4]. Healing was uneventful and marginal bone loss and gingival health remains within standards 28 months following implant placement. Overall, the patient was satisfied with improved appearance and masticatory function.

DISCUSSION

Patients with CLP are at increased risk for the development of oral diseases, which are associated with both anatomic defects and long-term orthodontic treatment.[14] Anatomic defects, delays in the formation and eruption of teeth, problems with orthodontic movement, and the presence of prostheses, all contribute to reductions in bone levels in the areas adjacent to cleft regions. Maxillary arch segment irregularities, orthodontic appliances, and persisting soft tissue folds before palatoplasty as well as the presence of scar tissue after cleft closure make oral hygiene control difficult. All of these factors enhance the progression of the disease.[14] Prosthetic replacement of missing anterior teeth in the maxillary arch of cleft patients has always been considered an important part of their rehabilitation.[15] Wegscheider *et al*.,[16] described the following possibilities:

- Fixed prosthodontics (crowns, bridges, and Maryland bridges)
- Removable prostheses (conventional cast partials, overdentures, and full dentures), and
- Precision prostheses (appliances with bars, splints, and telescope retainers).

These authors reported a 50% failure rate with Maryland bridges and attributed this to the high frequency of mobile teeth in the maxillary cleft segments. Of 12 fixed bridges placed, seven failed as a result of periodontal disease, marginal defects, or dissolution of cementurn, and all four of the bar constructions had to be removed because of marginal defects developing as a result of poor access for oral hygiene.

Studies conducted by Verdi *et al*.,[17] Lund and Wade,[18] introduced prosthetic rehabilitation with endosseous implants inserted in grafted clefts. The implants can be inserted either at the time of osteoplasty[19] or in a second operation. In the one-stage procedure (bone grafting followed by dental implantation), there is a risk of unpredictable loss of height of the grafted bone.[17,20] It is then sometimes necessary to graft additional bone in a two-stage procedure.[21] Kearns *et al*.,[21] inserted 20 dental implants in 14 cleft patients and reported on the necessity of additional bone grafting in six cases with the time between osteoplasty and implantation being an average of 26.4 months (4–46 months). Deppe *et al*.[19] reported on a total of 14 patients with 14 implants and a time interval between osteoplasty and implantation of 6 months to 7 years without giving information on the necessity of a second bone graft. According to their

Table 1: Comparison between graft donor sites

Site	Advantages	Disadvantages/complications
Ilium	Large quantities of cancellous bone Decreased operative time with two team approach	Mild pain, scarring, transient gait disturbance, dysesthesia
Calvarium	Minimal postoperative pain and discomfort Scar hidden in the hair line	Complications caused by harvesting range from 0.25% to 5.5% and include hematomas, seromas up to 9.5%, osteomyelitis 0.2%, dural exposure 5-12%, subdural hemorrhage, leaking of cerebral spinal fluid and serious neurological problems 0.09%
Tibia	Short harvesting time Two team approach Minimal bleeding, scarring Excellent quality of cancellous bone	Need to operate on both legs because of insufficient amount of bone, complications of tibial fracture range from 0% to 2.7%, delayed mobilization, no contact sports for 3 months
Mandibular symphysis	Same site of operation Minimal pain, discomfort Shorter stay in hospital Invisible scar	Small amount of bone, possibility of loss of unerrupted teeth, necrosis of pulp, revitalization of teeth, mental nerve injury
Rib	Two team approach	Problematic visible scar, pleuritic pain up to 7%, risk of pneumothorax 5-30%

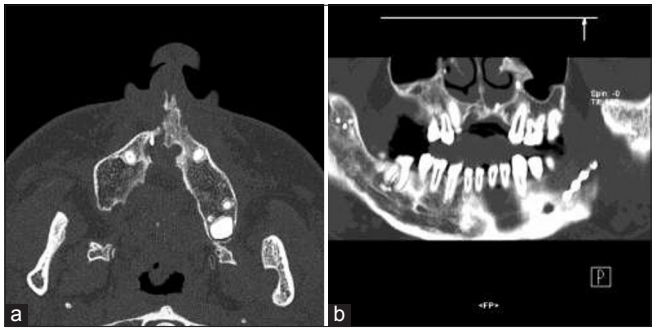

Figure 1: (a and b) Radiographic assessment at 2006 of the previously grafted alveolar clefts. Note the narrow width of the alveolar ridge, especially in the right anterior maxilla, which is not suitable to accommodate dental implants

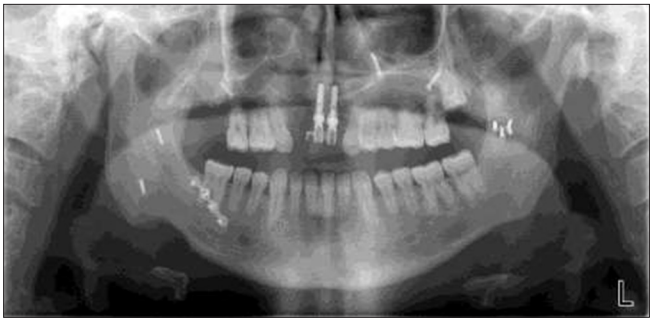

Figure 3: Orthopantomogram following attachment of the implant fixed bridge. A third implant was not accommodated due to infection of the grafted right maxilla

Figure 2: Postoperative orthopantomogram on the first follow-up visit following maxillary bone augmentation with iliac crest bone (blocks secured with two titanium screws each in the anterior maxilla). Titanium plate and screws in the mandible/maxilla were used for fixation during the bimaxillary osteotomy and screws in the left infraorbital area were used for fixation of an alloplastic facial implant for further masking of maxillary hypoplasia

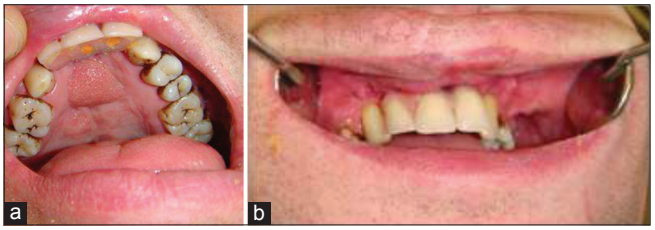

Figure 4: (a and b) Clinical assessment of the fixed prosthesis at 18-month follow-up visit

experience with 4 dental implants in three cleft patients, Ronchi *et al*.[2] preferred a time interval of 6–12 months.

Kearns *et al*.[21] reported a success rate of 90% in the two-stage procedure. The average time between implantation and follow-up was 39.1 months (1–54 months). Härtel *et al*.,[20] reported a success rate of 96% with an average time of 28 months (4–36 months) between implantation and follow-up whereas no bone resorption recorded in those cases where the time between bone grafting and implantation was only 6–8 weeks. Kramer *et al*.,[22] conducted a long-term follow-up study with an observation period extended to 5.5 years in average (minimum 1.5, maximum 11.3 years) and implant success rate was 82.2% at the end of the observation period.

No cases were available in the literature with application of the implant prosthesis earlier than an interval of 6 months. Bone in the anterior maxillary area had considerably resorbed following secondary ABG 15 years ago. Consequently, an additional grafting procedure was necessary in order to provide adequate bone volume for the placement of the implants in the anterior maxilla. Due to early infection, following the grafting procedure, there was space available to accommodate only two implants, which were enough to support a fixed 3-unit bridge to replace missing teeth. Implants were placed within 6 months following grafting of the maxilla and osseintegration was uneventful. Following a standard hygiene protocol, implants remain in good health.

SUMMARY

The outcome of the management of this case suggests that the placement of endoosseous implants can be successfully carried out in grafted alveolar clefts. The interval between the alveolar cleft bone graft and implant placement is of considerable importance to the success of the procedure. Optimal outcome is achievable when replacing missing incisors in cleft patients when timing does not exceed a 6-month interval from bone grafting to implant placement.

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