Anterior Tooth Replacement with an Implant in a Grafted Alveolar Cleft Site: Case Report with a 10-Year Follow-up

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The aim of this report is to present a case with a 10-year follow-up of a single anterior tooth dental implant replacement with a xenogenous bone graft in a patient with a large bone defect associated with a cleft lip and palate. At 10 years postloading, the implant was healthy and well-integrated. Although the implant restoration appeared slightly intruded due to growth and development at that time, the patient was happy with the esthetic result and refused corrections of the uneven occlusal plane. Int J Periodontics Restorative Dent 2019;39:511–515. doi: 10.11607/prd.4191

Cleft lip and palate represent the second most frequent craniofacial congenital deformity.1 The overall incidence of orofacial clefting is 1 in 700 live births.2 The etiology of this deformity is multifactorial, associated with environmental and genetic factors.3,4 Cleft lip and/or cleft palate are associated with many problems, including cosmetic deformities, dental abnormalities, and speech, swallowing, and growth difficulties.2 Treatments for cleft lip and/or cleft palate include oral and maxillofacial surgery, otorhinolaryngology, orthodontics, and speech therapy.2

Dental treatment of the edentulous space depends on the condition of the remaining teeth in the area of the cleft. The reported incidence of missing teeth in the permanent dentition in the cleft population is between 30% and 50%, which is six-fold higher than in noncleft subjects. It is possible to restore missing teeth in cleft patients with orthodontic gap closure, a conventional prosthesis (fixed, removable, or overlay), or dental implants.1,5

Currently, the use of dental implants placed in grafted alveoli after repair of an alveolar cleft using a secondary bone graft with autogenous bone is accepted as a viable option for the dental reconstruction of patients with cleft lip or palate.6–10 However, autogenous bone is limited in amount, is associated with an

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increased morbidity, and requires a secondary surgical donor site. Another bone graft option is utilizing allograft bone.\textsuperscript{11} To date, there is a paucity in the literature utilizing xenogenous bone for the placement of implants in cleft palate patients.\textsuperscript{12}

The purpose of this case report is to present a case with a 10-year follow-up of a single anterior tooth dental implant replacement with a xenogenous bone graft in a patient with a large bone defect associated with a cleft lip and palate.

**Clinical Case**

In 2008, an 18-year-old systemically healthy male was referred to the Ashman Arthur Department of Periodontology and Implantology, College of Dentistry, New York University, New York, for implant placement in the area of the missing maxillary left central and lateral incisors (Fig 1). During a thorough review of the patient’s medical and dental history and a clinical examination, it was revealed that the patient had many surgeries and dental treatments to correct a unilateral complete cleft lip and palate, including lip surgery in 1988, palate surgery using an iliac graft in 1995, orthodontic treatment from 2003 to 2006, orthognathic surgery in 2005, and secondary bone grafting in 2006.

Orthopantomograms were taken in November 2005 and June 2006 to evaluate the site of the cleft lip and palate. The orthopantomogram taken in 2005 showed that the patient had orthodontic braces and that the defect area included the maxillary left central incisor embedded in the cleft repair site (Fig 2a). The orthopantomogram taken in 2006 showed that the orthodontic braces and maxillary left central and lateral incisors were removed and the patient had orthognathic surgery (Fig 2b). Following removal of the maxillary left central and lateral incisors, the orthodontic retainer was modified for use as a provisional prosthesis. A cone beam computed tomographic (CBCT) scan was obtained to evaluate the defect, which showed an absence of the facial wall at the defect site. Utilizing the CBCT scan and three-dimensional model, the treatment plan for the defect site was determined to be bone augmentation using guided bone regeneration with a xenogenous graft.

The surgical procedure was carried out under local anesthesia (2% lidocaine, 1:100,000, Dentsply Sirona). The patient received...
antibiotic prophylaxis 2 hours prior to surgery (1,000 mg amoxicillin, Actimox) and following surgery (500 mg) three times a day for 7 days. Following the administration of local anesthesia, a full-thickness midcrestal incision was made in the edentulous area and vertical releasing incisions were made at the distal aspects of the maxillary right central incisor and maxillary left canine. A full-thickness flap was then reflected, revealing the facial bone defect (Fig 3). The bony defect was debrided of granulomatous tissue, using curettes and back-action chisels. Cortical perforations (decortication) were then made with a #1 and #2 round bur (Brasseler) using high speed (with copious irrigation) to create bleeding at the surgical site. A resorbable collagen membrane (Bio-Gide, Geistlich) was placed at the surgical site, from the buccal to the palatal bone. Once the membrane was in the correct position, a single tack was positioned apically through the membrane into native bone for stabilization. The graft material (1 g small-particle xenogenous bone [0.5 to 1.0 mm]; Bio-Oss, Geistlich) was placed and condensed to fill the bone defect, which was then covered with the resorbable membrane. Stabilization of the membrane and the underlying graft material was achieved by using horizontal mattress sutures (chronic gut suture 4-0, monofilament; Ethicon), suturing to the periosteum (Fig 4). Final tissue adaptation was achieved by means of multiple interrupted 4-0 chronic gut sutures, which were used to suture the crestal and vertical incision.

Following 6 months of healing, a CBCT scan was taken to evaluate the morphology of the augmented bone (Fig 5). Implant placement was performed with a two-stage protocol. The implant (4.1 × 13 mm; SybronPro XRT, Sybron) was placed 1 mm subcrestally. A cover screw was then placed. After 3 months of unloaded and uneventful healing, second-stage healing abutment-placement surgery was performed and the removable prosthesis was converted to a fixed provisional restoration. Six weeks later, the provisional was modified to develop the maximum esthetic outcome. The final restoration was then fabricated and delivered. Periapical radiographs and a CBCT scan were taken, revealing complete augmentation of the surgical site (Fig 6). After delivery of the final restoration, it was observed that the soft tissue on the facial aspect was concave and the interproximal papilla was deficient. A soft tissue graft was then performed 3 months after delivery of the final restoration. A subepithelial connective tissue graft was harvested from the left side of the palate to augment the soft tissue thickness and height. The graft healed uneventfully, and the facial contour and interdental papilla were restored and maintained 1 year later.
Clinical Outcomes

The patient returned for follow-up 10 years postsurgery (Fig 7a). At that time, the implant restoration appeared slightly intruded due to growth and development. The patient, however, was pleased with the esthetic and functional results. Both soft and hard tissues appeared stable.

Radiographic Outcomes

The panoramic radiograph showed the incisal edges to be uneven due to extrusion of the adjacent teeth, which was a result of growth and development (Fig 7b). However, the bone level appeared to be well maintained.

Discussion

Anterior teeth replacement with implants in a grafted alveolar cleft site is challenging for clinicians and requires careful evaluation, planning, and execution to achieve long-term success and to satisfy the patient’s expectations.

In the present case report, the patient had his cleft palate repaired first by using an iliac graft as a primary bone grafting material prior to the orthodontic treatment. The 10-year follow-up after implant placement showed that growth and development had affected the occlusal plane (Fig 7a). The impact of these growth changes may be almost imperceptible on the adjacent dentition but may also be significant, causing substantial esthetic and functional changes around the implant. This occurred in the patient in this case report; however, the patient was pleased with the result and refused any further treatment.

To obtain space closure in the cleft area, secondary bone grafting combined with orthodontic therapy may be indicated. This was the protocol used in the present case report. In general, grafted alveoli maintain their height only in association with occlusally functioning teeth. Eruption and orthodontic movement of teeth into the area may support the bone created by the grafting procedure. Schultze-Mosgau et al demonstrated that the resorption losses of grafted alveoli were significantly lower with orthodontic gap closure than with gap openings.

Although implant placement in the original graft is feasible in selected cases, additional tertiary grafting is frequently desirable because it allows better implant positioning and angulation.

Xenogenous bone grafts used in the present case were deproteinized skeletal tissues from bovine or porcine origin. Comparative studies with bone substitutes indicate anorganic xenogenous bovine bone demonstrating the best performance for purposes of bone reconstructions for the installation of osseointegrated implants. Published studies have shown that anorganic xenogenous bovine bone demonstrated results similar to...
to autogenous bone, whether used alone or combined with autogenous bone.\textsuperscript{19} In the present case report, the soft tissue augmentation was done using a subepithelial connective tissue graft because of the success rate of the autogenous grafts, based on blood supply, closer color blend of graft to the adjacent tissue, and absence of keloid healing.\textsuperscript{20} Furthermore, the secondary connective tissue graft was necessary to establish a harmonious soft tissue morphology with the adjacent teeth.

**Conclusions**

As shown in this case report, anterior tooth replacement in a treated cleft-palate patient using a xenogenous bone graft with implant placement followed by a soft tissue graft is a treatment modality that is predictable and results in favorable functional and esthetic results. However, more research and cases are required to evaluate the predictability of the approach used in this case report.

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