LABORATORY TECHNOLOGY

Dan Root, CDT/Paul Kozy, DDS, Co-editors

Michael D. Lefkove, DDS/Bill Matheny, CDT/Lee Silverstein, DDS, MS

Implant Prosthodontic Procedures for a Completely Edentulous Patient with Cleft Palate

Abstract

Prosthodontic treatment of the edentulous cleft palate patient presents the dentist with numerous challenges for achieving a satisfactory result for the patient. A technique is described for prosthodontic rehabilitation of a completely edentulous cleft palate patient using bone augmentation procedures, root-form dental implants, and a removable maxillofacial prosthesis. Dental implants may improve prosthesis retention, stability, and occlusal function when used in carefully selected cases.

Key Words: Prosthodontics, Edentulous, Endosteal Implants, Cleft Palate.

Introduction

The congenital cleft lip and palate patient has always required a multi-disciplinary approach for proper surgical and prosthodontic management. Dentists have devised many clever and inventive techniques to develop retention, function, and stability of maxillofacial prosthetic devices in the prosthodontic care of the cleft lip and palate patient. The ability to generate and regenerate osseous tissues in the posterior maxilla, as described by Tatum (1986) in the sinus lift procedure, and the subsequent placement of dental implants in the grafted areas permit dentists to re-think prosthodontic approaches for cleft lip and palate patients.

Following are some of the problems encountered in the completely edentulous cleft palate patient:

(1) There is often an inadequate denture-bearing area. The hard palate is often deficient or lacking in bone support for the maxillary denture. There is often a disruption of the alveolar ridge, caused by the cleft palate defect.

(2) There is often an inability to create a posterior palatal seal, leading to poor denture retention. This can be attributed to oral-nasal communications.

(3) Unrepaired cleft palate defects present problems in creating lateral and vertical stability for the prosthesis. Areas of the desired load-bearing ridge often are not supported by bone.

(4) Horizontal, transverse, and vertical discrepancies of the maxillary and mandibular jaw bases are often present. The abnormal jaw relations which

Figure 1. Pre-operative edentulous maxillary ridge with cleft palate defect and nasal communication.

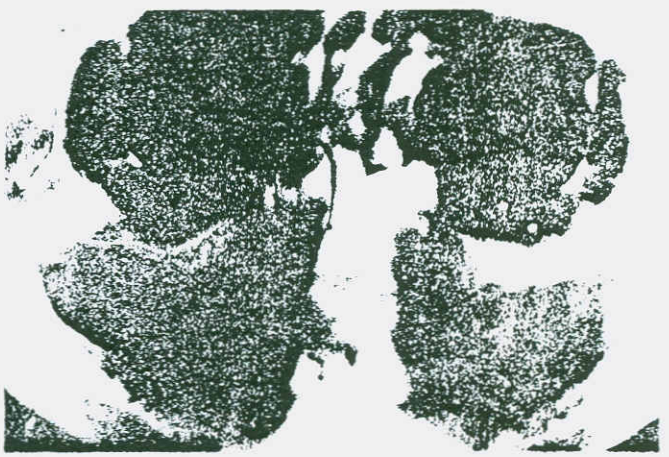
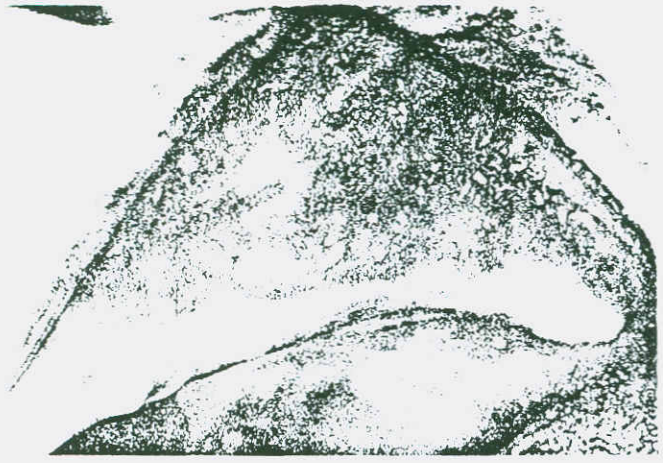
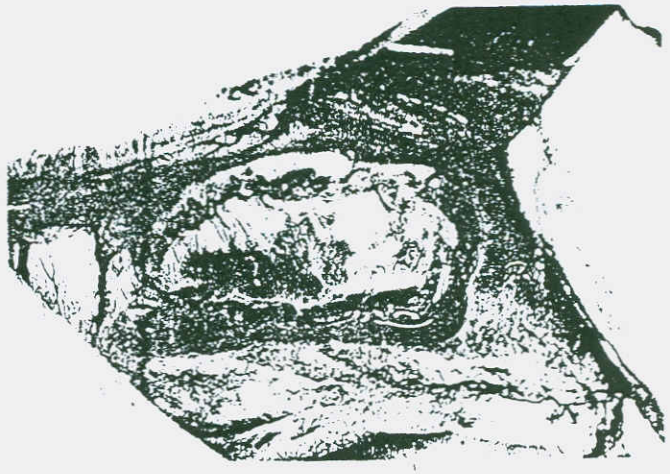


Figure 2. Pre-operative panoramic radiograph with a cleft palate defect and large maxillary sinuses. There is inadequate bone in the anterior or posterior maxilla for the placement of endosseous root-form implants.

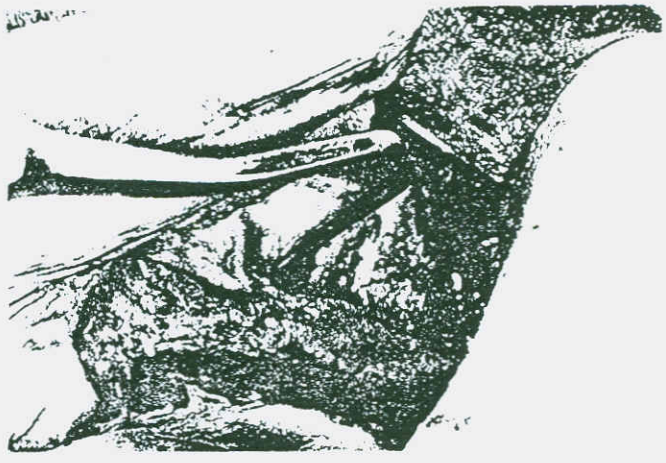


Figures 3A-G. Bilateral maxillary sinus lift procedures are performed *via* the Caldwell-Luc approach.
(3A) The lateral wall of the posterior maxilla prior to incisions and flap elevation.



(3B) A mucoperiosteal flap has been elevated, the bone overlying the maxillary sinus has been identified, and the entry into the sinus compartment has been outlined with a #8 round bur.

(3C) The bone overlying the maxillary sinus is green-stick-fractured medially with a mallet and blunt mirror handle.



(3D) The Schneiderian membrane and overlying bone are gently dissected medially and superiorly with a back-action Molt curette to form a bony compartment which will receive the bone graft.

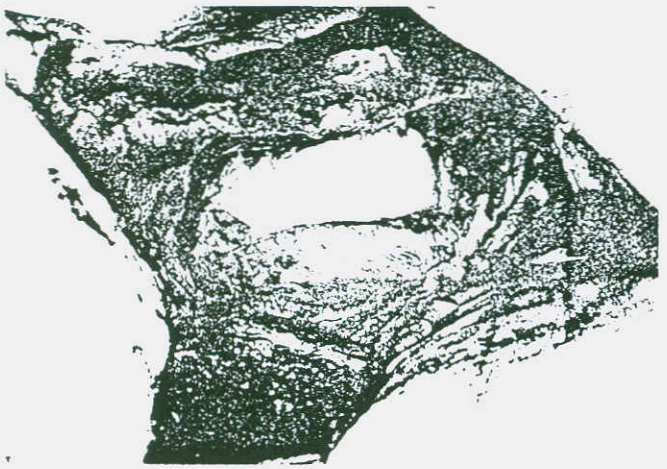
present in many cleft lip and palate patients challenge the dentist in establishing a stable and functional occlusion. It is theorized by Ricketts (1982) and others that these discrepancies in jaw relationships and shapes result from altered patterns of growth caused by altered local factors, such as mouth-breathing in cleft palate patients.

These problems, when present, often lead to poor denture retention, a lack of denture stability, malocclusion, and a loss of function for the patient. The ability to create a stable denture support and retention system with dental implants in the posterior maxilla—as described by Small *et al.* (1993), Misch (1987), Smiler (1987), and Bahat (1993)—opens up new possibilities in the treatment of the completely edentulous cleft palate patient.

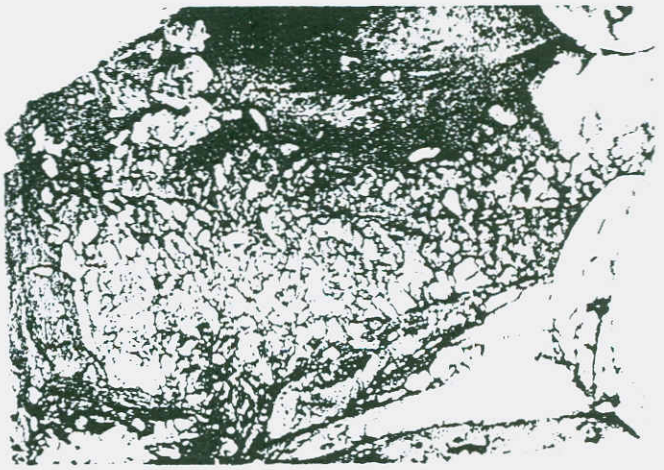
Cleft lip and palate maxillofacial prosthodontics is evolving and re-defining treatment approaches *via* the use of dental implants. A case report is presented demonstrating the use of the sinus lift procedure originally described by Tatum, the placement of osseointegrated root-form implants, and an implant-supported and -retained maxillofacial prosthesis.

Case Report

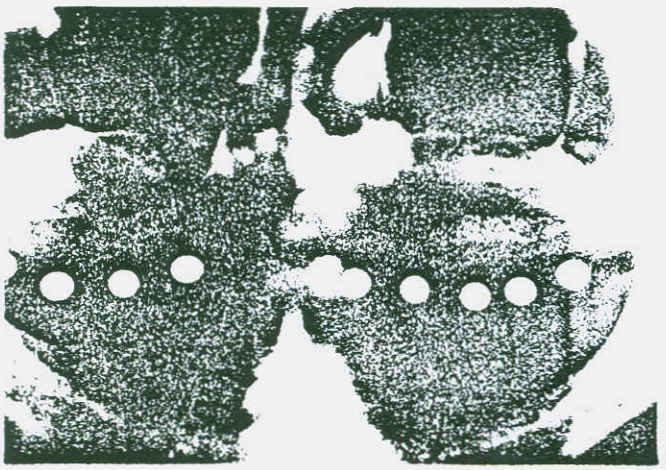
A 30-year-old completely edentulous female presented for prosthetic dental care. The patient reported that she was born with a cleft lip and palate. Surgical repair of the cleft lip was provided for the patient at the age of 3 months. A cleft palate condition persisted in the premaxillary area to the left of



(3E) Resorbable collagen membrane is placed over the Schneiderian membrane as a barrier prior to insertion of the bone graft.



(3F) A mixture of demineralized freeze-dried bone and resorbable hydroxylapatite are placed into the graft recipient site which has been created in the maxillary antrum.



(3G) A nine-month post-operative panoramic radiograph is made prior to placement of eight root-form implants. Note the increased quantity of bone in the posterior maxilla inferior to the maxillary sinuses. The grafted areas have a radiodensity similar to that of the surrounding bone of the maxilla.

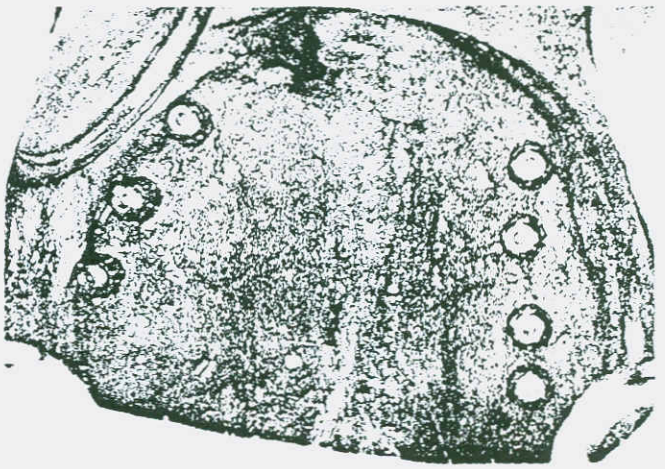


Figure 4A. Seven root-form implants have been placed in the posterior maxilla. The implants have been surgically exposed, and healing abutments have been placed.

the midline, with communication to the oral cavity and the anterior floor of the left nasal aperture. The patient reported that all of her teeth were removed at the age of 21 years, at her request. The patient's chief complaint at the time of initial examination was instability of the maxillary complete-denture prosthesis.

Dental examination revealed completely edentulous maxillary (Fig. 1) and mandibular arches in Angle class 3 skeletal relationship caused by a combination of maxillary retrognathism and mandibular prognathism. The existing dentures were fabricated in Angle class 1 dental relationship. The maxillary denture lacked posterior palatal seal and had an anterior vestibular extension of hard acrylic into the cleft palate defect. The posterior segments of the hard palate were movable and lacked bony support of the maxillary denture.

Radiographic examination revealed a maxillary ridge with a cleft palate defect (Fig. 2). The bone quantities for endosteal implant procedures were evaluated as Misch/Judy type C in the maxillary posterior and anterior regions (Misch *et al.*, 1993). The maxillary sinuses were quite large, with from 2 to 7 mm of available bone overlying the sinuses. The premaxilla presented with from 3 to 5 mm of available bone overlying the nasal fossae.

The treatment plan for the patient was as follows:

- Bilateral maxillary sinus lift procedures for the purpose of increasing the quantity of bone in the posterior maxillae.
- Placement of eight root-form implants in the

Figure 4B. Prosthetic abutments have been attached to the implants. The abutments were selected in various heights to approximate the level of the gingival margin surrounding each implant.

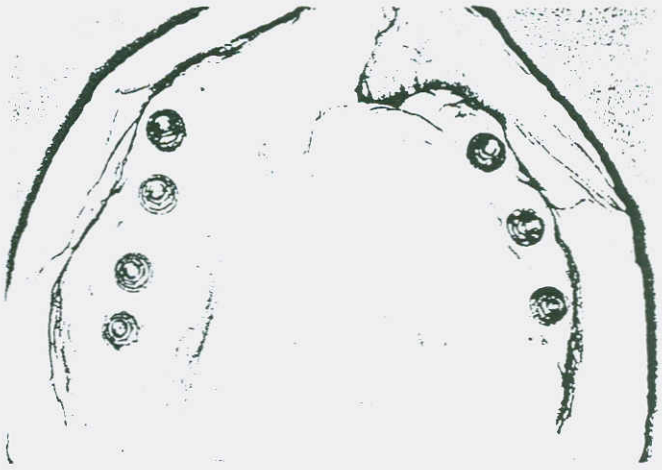


Figure 4C. The working cast has been made incorporating seven abutment analogs.

Figure 5A. Vertical dimension of occlusion, centric relation, and anterior tooth positions are established and prior to fabrication of the meso-bars.

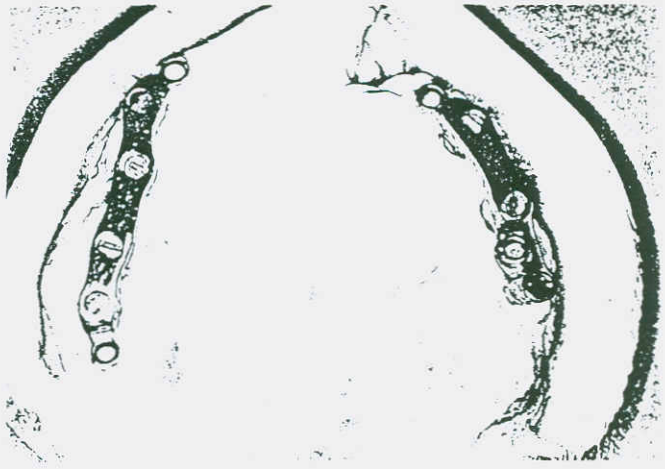


Figure 5B. Bilateral screw-retained meso-bars with four Stern ERA attachments are cast in the laboratory.

posterior maxillae.

• Maxillofacial prosthetic rehabilitation of the edentulous maxilla with an RP-4 (Misch *et al.*, 1993) implant-supported and -retained removable prosthesis. The prosthesis would incorporate an obturator for sealing of the cleft palate defect.

On 7/27/92, the patient presented for oral surgery. Bilateral Caldwell-Luc procedures were performed on the posterior maxillae for the purpose of maxillary sinus elevation procedures and bone grafting of the maxillary sinus compartments (Figs. 3A-3G). Surgical incisions were made in the areas of the right and left maxillary tuberosities and extended anteriorly to the areas that would normally be occupied by the canine teeth. The incisions were kept palatal to the crest of the maxillary ridges. Releasing incisions were carried laterally and the surgical flaps reflected to expose the lateral portions of the maxillae. The sinus compartments were entered *via* a Caldwell-Luc approach, and the Schneiderian membranes were dissected and displaced medially and superiorly with various molt-type curettes. Resorbable collagen membrane was placed over the sinus membranes as a protective barrier. The maxillary sinus compartments were filled with a mixture of demineralized freeze-dried bone and OsteoGen[5] resorbable HA, as described by Wagner (1991), which had been supplemented with 250 mg of Amoxicillin powder. The flaps were replaced and sutured with 00 vicryl suture. The patient reported with some post-operative edema and a temperature of 99.3°F two days post-operatively. The post-operative course was otherwise uneventful. A post-operative radiograph revealed radiopacity in

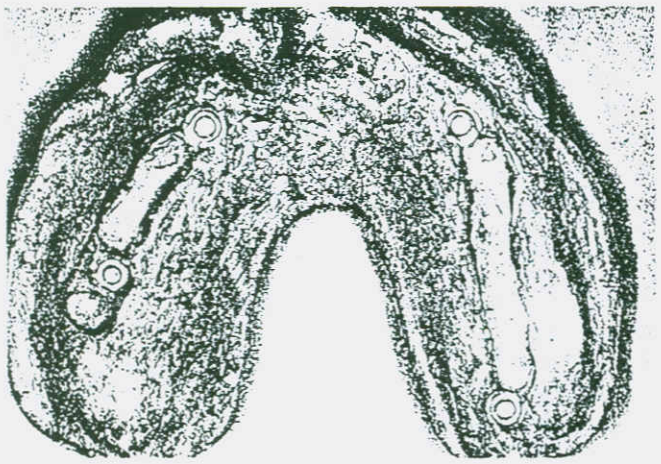


Figure 5C. Four Stern ERA attachments are incorporated into the trial denture base.

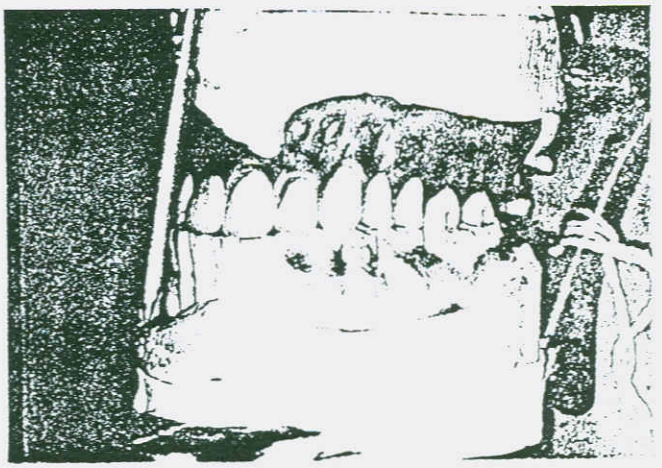


Figure 5D. The denture wax-up is finalized for a trial insertion.

Figure 6A. The bilateral meso-bars are attached to the maxillary implants.

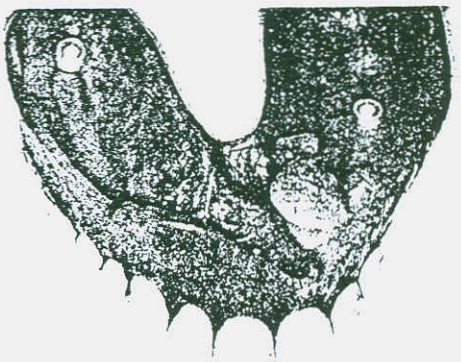


Figure 6B. The completed prosthesis. A silicone obturator is incorporated into the labial flange.

the areas previously occupied by the maxillary sinus membranes. Slight nasal bleeding was encountered during surgery.

Six months later, on 1/29/93, the patient reported for surgical placement of eight 4.0-mm-diameter maxillary HA-coated root-form implants, ranging in length from 10 to 16 mm, into the previously grafted maxillary sinus compartments. At the time of bone drilling, it was noted that the bone presented substantial resistance to the drilling procedure, and the bone was classified as type 2 (Misch *et al.*, 1993) in density. Slight nasal bleeding was encountered during surgery.

Four months later, on 6/4/93, the patient reported to the office for surgical re-entry and exposure of the maxillary implants. All eight implants were judged to be osseointegrated. The most posterior left implant was judged to be too posterior in position for placement of a screw and prosthetic abutment. Due to this inconvenience of access, this implant was left submerged and was not used in the prosthetic rehabilitation. Healing abutments were placed (Fig. 4A), and the patient's denture was re-lined with tissue conditioner for six weeks. The patient returned on 7/22/93 for the placement of 7 prosthetic abutments (Fig. 4B) and re-line of the maxillary denture.

On 7/30/93, polyvinyl siloxane impressions were made for the fabrication of an analog abutment cast (Fig. 4C) and prosthesis fabrication using a custom tray and impression pick-up pins. The patient returned two weeks later for occlusal records (Fig. 5A) and an abutment check verification. Bilateral bars were then cast using a high-noble alloy (Fig. 5B). Four Stern ERA retention devices were cast to the bars. The bars were verified for fit in the mouth (Fig. 6A), and tooth positions were verified orally on an acrylic base and wax rim (Figs. 5C,D). Once the positioning of the denture teeth was judged to be satisfactory, the maxillary denture was completed.