Maxillary Insufficiency Implant and Tooth-Retained Maxillary Overdenture: A Clinical Case Report

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KEY WORDS

Maxillary hypoplasia
Mandibular prognathism
Cephalometric radiographic analysis

The following represents a clinical case report of a maxillary insufficiency implant and tooth-retained maxillary overdenture. The case required surgical and prosthetic treatment and was successfully completed over a 2-year time. A combination of dental implant techniques were utilized to achieve form, function, comfort, and aesthetics. These techniques included ridge modification with bone grafting, endosseous root and blade form implant surgical placement, and the construction of a bar-retained overdenture on a severe hypoplastic maxilla.

INTRODUCTION

A 50-year-old man presented to our office in pain with an existing maxillary fixed prosthesis. His medical history was unremarkable except for hypothyroidism; the patient takes thyroid hormone supplementation.

A panoramic radiograph was taken and revealed an extensive breakdown of the minimal and inadequate maxillary fixed prosthesis and dentition (Fig 1). Clinical evaluation revealed epulic and granulomatous inflammatory hyperplasia (Fig 2). The patient’s chief complaint was of pain associated with these chronically inflamed areas and the looseness of the fixed prosthesis. The fixed prosthesis was removed. Temporary posts and composite core build-ups were completed prior to re-cementing with polycarboxylate cement (Durelon, ESPE, Seefeld, Germany).

Initial treatment consisted of controlling the infectious processes and the construction of a transitional maxillary denture. The patient’s infection was controlled with antibiotics. An appropriate local anesthetic was delivered. Incision and drainage of the right buccinator space, right canine space, and the left anterior premaxilla were completed with suturing of iodoform gauze. Impressions were taken of the maxilla with the fixed bridge intact and of the mandibular teeth, which were to be used as a countermodel. A wax bite relationship was also taken. The patient was rescheduled for the drains and the upper fixed bridge to be removed. Extraction of the upper right premolar, canine, and the upper left central incisor, along with insertion of a transitional maxillary partial denture, were also scheduled. The patient was prescribed oral antibiotics consisting of clindamycin, 150 mg to be taken three times a day for 10 days. Vicodin ES was given as an oral analgesic.

The impressions were sent to the
dental laboratory for construction of a transitional immediate full-palatal coverage partial denture with retention of the upper left second molar (Harrison Dental Laboratory, East Orange, NJ). The crown was left intact, to be used later for retention with a wrought iron clasp. The dental laboratory was asked to set the maxillary teeth in a class III relationship to enhance the patient's support. The denture was processed and returned to us for insertion.

**CASE REPORT**

**Transitional prosthesis**

Drains were removed 3 days later, after appropriate local anesthetic was delivered. Extraction of the remaining maxillary dentition, excluding the upper left second molar, was accomplished. Degranulation of all infected areas was completed. Bone grafting of these sites was accomplished with a combination of freeze-dried demineralized cortical bone (Michigan Tissue Bank, Lansing, Mich); osteogen (2 hydroxyapatite; Impladent Ltd, Holliswood, NY); soluble clindamycin, 150 mg (Upjohn Pharmaceutical, Kalamazoo, Mich); and blood collected from the surgical site. Sutures were placed to create primary closure.

The maxillary transitional partial denture was tried in and the occlusion was adjusted. Periodontal packing (Coe-Pak periodontal dressing, Alisp, Il) mixed with tetracycline antibiotic powder from a capsule (Halsey Drug Co Inc, Brooklyn, NY) was used as a reline material. The packing was utilized as a surgical dressing material, to act as a tissue conditioner during healing, and to aid in retention of the denture. Suture removal was scheduled. Healing was uneventful.

**Treatment planning**

The suture removal appointment allowed us to introduce the patient to the feasibility of dental implant surgical and prosthetic treatment.

A cephalometric radiograph was taken to assess and evaluate the degree of maxillary insufficiency. The cephalograph revealed very thin, knife-edged bone. Placement of the minimum required number of implants would be difficult or impossible without additional osseous augmentation.

Implant treatment evaluation also consisted of determining what type of permanent prosthesis would best serve the patient in light of the severe maxillary insufficiency and the very obvious mandibular prognathic skeletal relationship. It was decided that an overdenture would be the prosthetic choice in this case because of the limited bone and the forgiving nature of an overdenture versus any consideration of fixed-implant-retained prosthetic reconstruction.

The overdenture would be forgiving because of two very significant factors. First, the overdenture enables the distribution of functional forces as tissue born, as well as implant born. Specifically, it is desirable to create a tri-podal soft tissue support structure to minimize torque on the implant/bar design. This would be accomplished by way of a combination of bilateral support from the tuberosities and from the pre-maxilla, both facial and palatal. The patient's lip would also aid in soft tissue support. The second factor is the tolerance afforded by the combination of retentive elements, namely the Hader bar clips and the "O" rings. This combination allows adequate retentiveness, and yet is resilient enough not to burden the implants with undue mechanical load. This is of particular concern when one considers that the masticatory forces would not be axial with such a prognathic skeletal relationship.

**Implant surgical report I**

The patient returned for phase I implant surgery. Ibuprofen 800 mg was given before surgery. Nitrous oxide and oxygen analgesia were delivered via a nasal hood at a concentration of 60% N₂O and 40% O₂. A normal saline drip was started. The patient was given the following intravenous medications: Cleocin, 600 mg; Toradol, 60 mg; Decadron phosphate, 12 mg; midazolam, 5 mg; diazepam, 10 mg, and Sublimaze (fentanyl citrate injectable), 50 µg. The patient was continuously monitored with a Criticare 5075 unit (Criticare Systems Inc, Waukesha, Wis) which displayed blood pressure, oxygen saturation, pulse, and electrocardiogram. Bilateral local anesthetic was delivered to anesthetize the posterior, middle, and anterior superior alveolar nerves. Bilateral palatal infiltrations were also completed.

A midcrestal incision was carried from the upper right tuberosity to the mesial of the upper left second molar circumscibing the incisive papilla facially to avoid the nasopalatine neurovascular bundle. Full-thickness mucoperiosteal flaps were raised to expose the maxilla bilaterally. The exposed bone was very thin. The upper right posterior maxilla had adequate room for only three endosseous root form implants to be placed. The remaining bone bilaterally was much too thin to consider root form endosseous implant placement. Consequently, it was decided that it would be necessary to widen and bone graft the maxilla anterior to the placement of the root form im-

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Figures 1–9. Figure 1. Panoramic radiograph at the initial consultation. Figure 2. Clinical preoperative appearance. Figure 3. Postsurgical panoramic radiograph. Figure 4. Prosthetic wax setup displaying positive overbite and over jet ready for try in. Figure 5. Cephalometric tracings; left: post-treatment; middle: pretreatment; right: soft tissue differential. Figure 6. Rigid splinting of implants and tooth with bar overdenture complex. Figure 7. Completed prosthesis, postoperative appearance. Figure 8. Panoramic radiograph with bar. Figure 9. Post-treatment cephalometric radiograph.

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plants and along the entire left maxilla. Bone expansion would allow for future placement of additional root form implants after adequate healing time had elapsed. Osteotomy sites were prepared initially for three implants. Three 13-mm-long, hydroxyapatite-coated, 3.25-mm-wide microvent implants (Dentsply, manufactured by Core Vent, Las Vegas, Nev) were coated, 3.25-mm-wide microvents prepared initially for three implants. Osteogen HAs resorbable, a synthetic, freeze-dried demineralized cortical bone (Michigan Bone Bank) along with osteotomes were used with a surgical mallet to carefully green-stick-placed in the right posterior maxilla.

Osteotomes were used with a surgical mallet to carefully green-stick-fracture and widen the buccal-facial basal bone in the right anterior maxilla and the entire left maxilla up to the retained second molar. A combination of freeze-dried demineralized cortical bone (Michigan Bone Bank) along with Osteogen HAs resorbable, a synthetic, nonceramic hydroxyapatite osteoconductive implant material 300–400 μm in size (Impladent Ltd) and soluble clindamycin were utilized to fill the areas between the buccal and palatal bone and into an aborted osteotomy site in the right posterior maxilla. It was hoped that indeed the bone would be wide enough, after an adequate healing period, to allow for further endosseous root form implant placement. Primary closure was accomplished with 000 black silk suture material.

Appropriate antibiotics and analgesics were prescribed. After recovery and before dismissal of the patient, we explained that the bone was indeed not adequate enough for placement of all the implants that would be necessary to allow us to create the bar to retain an overdenture. Since discussion of this potential risk had been thorough and an alternative treatment had been approved before the surgery, the patient was satisfied with the treatment that was completed. Suture removal was scheduled. Healing was uneventful.

**Implant surgical report II**

The patient was prepared and draped for surgery as previously outlined. The healed ridge looked sufficiently wide enough for our proposed treatment, with one exposed first-stage healing screw having dehisced. A midcrestal incision was made as in the previous surgery. Mucoperiosteal flaps were raised to expose adequate bone for placement of one additional endosseous root form implant in the right anterior maxilla. The left maxilla, though, still did not have adequate bone width, after proposed osteoplasty, to house root form implant modalities of any significant length. The upper left maxilla was therefore prepared for the placement of a two-stage sinus blade form implant. The placement of the blade implant was done in the usual manner. Appropriate bone grafting was completed with freeze-dried demineralized cortical bone along the exposed osteotomy after placement of the blade implant. Primary closure was accomplished with suture material. Soft reline material was replaced in the transitional partial denture. The patient was dismissed ambulatory with his escort. Healing was uneventful. A panoramic radiograph was taken at the suture removal appointment 2 weeks later (Fig 3).

**Implant uncovering and prosthesis fabrication**

Second-phase surgical uncovering was completed 6 months later under local anesthetic. All implants displayed osteointegration. Radiographic evaluation was positive. Screw-retained impression copings, TT3s, were inserted into the implants and an impression was taken of the maxilla, along with a lower arch alginate impression. Second-stage titanium healing caps were inserted into the root form implants. The blade form implant surgical healing screws had dehisced during healing, as is often seen, and only required minor tissue recontouring (gingivoplasty) prior to future impressions.

Impression copings, TT3s, threaded transfer copings for 3.5-mm-diameter implants, were inserted into the implant analogs, IA3s (Dentsply Implant Division, Encino, Calif), and placed into the impression. A model was fabricated. The threaded transfer copings were removed and straight abutments, titanium coping inserts for 3.5-mm-diameter implant collars, TCTs, were placed into the implant analogs (IA3s) and preliminarily prepared to an estimated height and position for a future bar construction impression.

The patient returned for the final impression. The preliminarily prepared abutments, TCTs, were screwed into place and prepared to an ideal position intraorally. The blade form second-stage abutments were also screwed onto the implant heads and prepared with a high-speed drill and copious water. The upper left second molar was also prepared. The transitional partial denture was converted into a full overdenture. The tissue-bearing surface received a soft reline. The class III relationship of the transitional denture was retained.

An Impregum impression (Premier, ESPE, Seefeld, Germany) was taken and sent to the laboratory for construction of a bar with Hader type bar attachments and O ring retention as prescribed. The bar was waxed, cast, and returned for initial try-in.

We received the model with the cast bar. An all-wax occlusal rim was fabricated at the angulations that were required to create adequate aesthetic labial drape with positive overbite and overjet. The patient returned for the try-in of the bar and to take a bite relationship at the appropriate vertical dimension. The bar fit well and the appropriate relationships were taken. Verification of bar placement accuracy was achieved with an acrylic stent fabricated on the model. The lower model was articulated with the wax rim and returned to the lab for construction of a chromium cobalt substructure, and a set-up of teeth in wax was requested.

The case was returned articulated, with teeth set in wax for try-in. The prosthesis revealed inadequate labial drape, which required the anterior maxillary teeth to be set lower and more facial. A wax set-up was returned for verification once again. The setup was prepared as requested with proper
labial drape, and positive overbite and overjet (Fig 4).

Appropriate vertical dimension was phonetically verified. The occlusion was verified intraorally and found to be well intercuspated and very aesthetic. The facial profile was also evaluated and found to be very aesthetic. Comparison of the pretreatment and posttreatment cephalometric tracings reveal the advantageous soft tissue contour changes, that were achieved with the final prosthesis (Fig 5). The case was sent back to the laboratory for processing.

Insertion was completed with minimal occlusal adjustment after cementation of the bar with Panavia Cement (J. Morita USA Inc, Tustin, Calif; Fig 6). The processed maxillary overdenture had good form and aesthetics. Function was restored. Intraoral and extraoral photographs were taken. Retentiveness was extremely good (Fig 7).

Postoperative radiographs were taken, which included a panoramic radiograph with the bar cemented on the abutments (Fig 8), a posttreatment panoramic radiograph with prosthesis, a cephalometric radiograph with the cemented bar, and a cephalometric radiograph with the prosthesis.

Cephalometric analysis

A Bjork cephalometric analysis was performed on lateral cephalometric radiographs (Fig 9). This particular analysis was chosen for its ability to assign morphologic discrepancies in cases with significant skeletal aberrations from the norm. The assessment of this patient's sagittal class III presentation reveals a combination of mandibular prognathism as well as maxillary insufficiency. Although some maxillary insufficiency is obviously associated with anterior alveolar ridge atrophy secondary to tooth loss, there is also significant retro positioning of the basal bone of the maxilla, and indeed the entire midface. The mandible has the typical prognathic morphology, that is, obtuse gonial angle producing a steep mandibular plane and a vertically long lower anterior face height. It is also important to note that in all cases, the edentulous presentation of the maxilla produces a severely diminished vertical dimension with loss of upper lip support. This is the result of overclosure or autorotation of the mandible. The devastating effect of this is that it further advances the sagittal position of the mandible and worsens the prognathic appearance of the soft tissue profile. The cephalometric tracings, after the placement of the completed prosthesis, show the mandible at its proper vertical position, being autorotated down and backward. This produces significantly better facial aesthetics by the backward movement of B point and also by causing the relaxation of the mentalis muscle at the patient's postural position with the lips at repose. The upper lip position improves directly as the result of the support from the prosthetic incisors, as well as the release from its redundant, collapsed position, which resulted from the mandibular overclosure. The total differential effect is quite a significant change. Comparison of profile photographs and the view of the frontal photograph depicted the improved soft tissue changes that were obvious on the cephalometric radiographs.

The fundamental prosthetic dilemma, however, then becomes the steepness of the occlusal plane. This unfortunately is the unavoidable consequence of the inherent morphology of the skeletal pattern in addition to the backward rotation of the mandible.

The nonaxial forces that are the result of this is the most significant consideration in the design of the bar and prosthesis. The collective force distribution of the constructed bar, as well as an occlusion in equilibrium, are important factors that have been successfully addressed to significantly diminish these nonaxial (shearing) forces exerted on the implant system.

Discussion

This is an example of treatment of a complex dental implant restorative case. Treatment variables forced us to deviate from our original treatment plan in a manner that still allowed this case to be successfully completed.

Implant dental treatment is an art form that requires special training and experience. It is also of great benefit if the implant dentist can perform both the surgical and prosthetic care of the patient in most cases. It is realized that cases are done today very successfully with the team approach. Unfortunately, unusual cases or unusual circumstances that develop during surgery limit the proper communication between the surgeon and prosthodontist. This can create significant changes in treatment reconstruction, delay the treatment, incur extensive unnecessary cost, and can often create a chasm between the patient and treating doctors, as well as between the practitioners themselves, which may not be easily repaired.

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Cephalometric analysis was completed by Dr Peter Antonellis, Orthodontist, Independence Dental Associates, Hackettstown, NJ.

Bibliography