Use of the Frontal Process of the Maxillary Bone for Implant Placement to Retain a Nasal Prosthesis: A Clinical Report

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Implant placement to provide support and retention for nasal prostheses has been described in the literature. The anatomic sites that have been utilized for implant placement are the nasal bones, the premaxillary area through the nasal fossae, and the anterior wall of the frontal sinus. In the patient described, after a presurgical computerized tomography scan to determine adequacy of bone volume, 1 conventional threaded hydroxyapatite-coated root-form implant, created for intraoral use, was placed in the frontal process of the maxillary bone and 2 additional conventional implants were placed in the premaxillary area through the nasal fossa. Six months after implant placement, second-stage surgery was completed. A single bar connecting the 3 implants was fabricated. The removable nasal prosthesis was retained on the bar with 2 clips. An examination 1 year postsurgery revealed no clinical signs of pathosis. Long-term clinical follow-up of this case should continue and a sufficient number of additional cases should be investigated before use of the frontal process of the maxillary bone for implant retention can be recommended on a routine basis. INT J ORAL MAXILLOFAC IMPLANTS 2004;19: 901–905

Key words: *craniofacial prostheses, extraoral implants, nasal prostheses, osseointegration*

Dental implants have become a predictable treatment option for the completely[1,2] or partially[3,4] edentulous patient. The concept of osseointegration has subsequently been applied to extraoral implant placement for the retention of craniofacial prostheses.[5–19] The application of craniofacial osseointegration to facial reconstruction was first reported in 1977, when an implant was placed in the cranial skeleton to retain facial restorations as well as a bone-anchored hearing aid.[5] Several studies have shown the efficacy of implant placement in extraoral locations.[8,10,11,13,15,16,18,19] Specially designed craniofacial implants have been used in areas lacking adequate bone volume for the placement of conventional implants designed for intraoral applications.[7,11,18]

Placement of implants to anchor a nasal prosthesis has been reported in the literature.[11,14–19] Typically, 2 implants are placed in the maxillary bone through the nasal fossa.[15,16,18] An increased failure rate has been reported when 2 implants are placed to anchor a nasal prosthesis.[11,15,17,18] Several authors have recommended using 3 implants to support a nasal prosthesis.[16,17,19] In the presented case, a conventional threaded hydroxyapatite (HA) -coated root-form implant was placed in the frontal process of the maxillary bone in addition to 2 implants placed in the maxillary bone through the nasal fossa to anchor a nasal prosthesis.

CLINICAL REPORT

A 67-year-old female patient presented at the Center for Prosthodontics and Implant Dentistry, Loma Linda University, to receive orofacial rehabilitation

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following total rhinectomy. The patient's nose had been resected 9 months previously because of squamous cell carcinoma. She had not received pre- or postoperative radiation therapy. The preoperative radiographic examination included a panoramic radiograph and computerized tomography (CT) scan (Fig 1). CT analysis revealed adequate bone volume in the frontal process of the maxillary bone for placement of a 3.25 × 8.00-mm conventional root-form implant.

A moulage impression was made of the patient's face with irreversible hydrocolloid impression material (Coe Alginate; GC America, Alsip, IL). The impression was poured with type III dental stone (Microstone; Whip-Mix, Louisville, KY). A wax pattern of the prosthesis was sculpted on the cast (Fig 2a), and a duplicate of the wax pattern was made using autopolymerizing clear acrylic resin (Ortho resin; C. P. Kaulk, Milford, DE) (Fig 2b). The acrylic resin duplicate was used as a template during implant surgery to assist in implant placement.

Implant surgery was performed under local anesthesia in December 1999. Skin incisions were made through the nasal fossae along the floor of the nose.[9] Two 3.25 × 8.00-mm threaded HA-coated root-form implants (Steri-Oss, Nobel Biocare, Yorba Linda, CA) were placed in the premaxilla (Fig 3a). A separate skin incision was made along the frontal process of the maxillary bone, and a third 3.25 × 8.00 mm

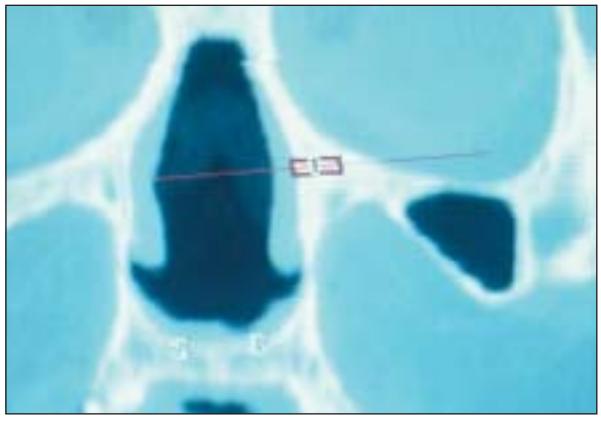

Fig 1 A CT scan demonstrating adequate bone volume along the frontal process of the maxillary bone for placement of an intraoral 3.25 × 8.00-mm implant.

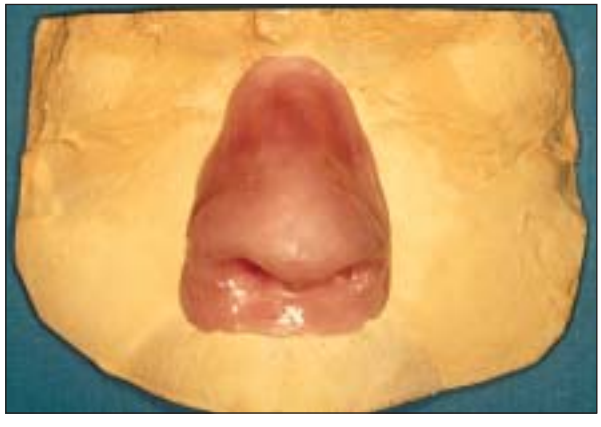

Fig 2a A wax pattern of the nasal prosthesis was sculpted.

Fig 2b The wax pattern was duplicated in acrylic resin to fabricate a surgical template.

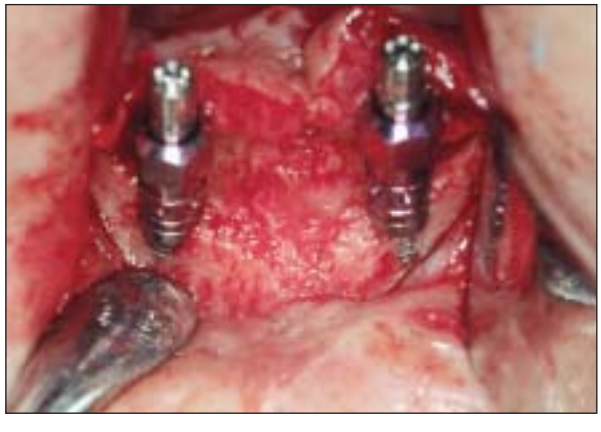

Fig 3a After making skin incisions, 2 intraoral implants were placed in the maxillary bone through the nasal fossae.

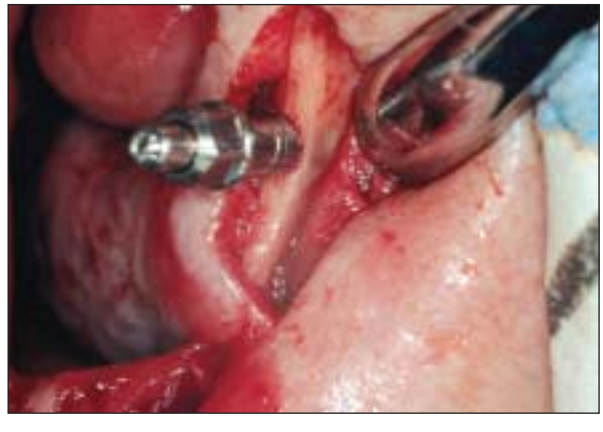

Fig 3b A 3.25 × 8.00-mm threaded root-form implant was placed in the frontal process of the maxillary bone.

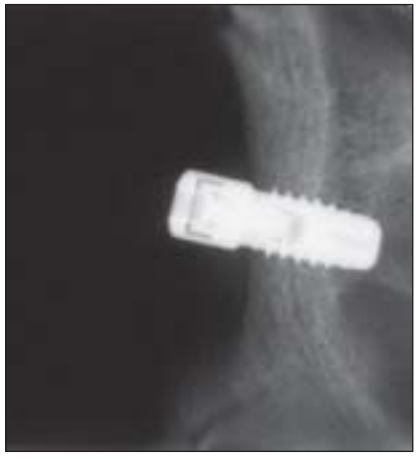

Fig 4 A radiograph of the implant placed in the frontal process of the maxillary bone taken 9 months after implant surgery.

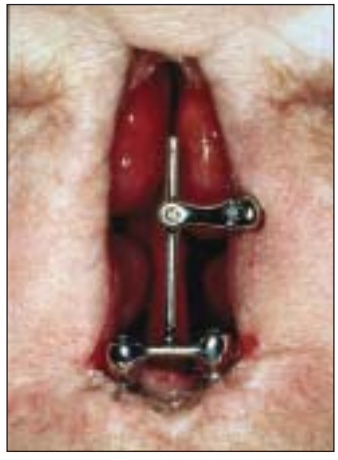

Fig 5a A screw-retained implant-supported bar was fabricated.

Fig 5b The definitive prosthesis in place.

Steri-Oss implant was placed (Fig 3b). Primary stability values of –3 were achieved and confirmed using the Periotest (Siemens, Bensheim, Germany).[20,21] Cover screws were placed, and the implants were submerged for 6 months before second-stage surgery.

Second-stage surgery was performed 6 months later. The Periotest was repeated; no signs of implant mobility were observed. A postoperative panoramic radiograph revealed no sign of pathosis. An intraoral film was used to obtain a radiograph of the implant placed in the frontal process of the maxillary bone (Fig 4). The patient held the film in place with her finger.

An impression of the implants was made by using a custom tray and additional silicone impression material (Aquasil HV; Dentsply International, Milford, DE). The impression was poured with additional type III dental stone. A screw-retained implant-supported bar was fabricated (Fig 5a). The fit of the bar was evaluated by using the alternate finger pressure[22] and the 1-screw tests.[23] Abutment screws were torqued at 20 Ncm, and the definitive nasal prosthesis (Fig 5b) was retained on the bar with 2 clips (Hader clips; Attachments International, San Mateo, CA).[17]

DISCUSSION

For this patient's prosthodontic rehabilitation, 3 implants were placed to support a nasal prosthesis. Reduced rates of implant survival have been reported for implants placed to anchor nasal prostheses compared to those placed to retain dental prostheses.[11,15,17,18] The lower survival rate is probably related to the thin cortical bone and soft tissue and poor bone density of the maxilla.[11,18] Tolman and Taylor[19] recommended placement of a minimum of 3 implants to retain a nasal prosthesis; however, others recommend using 2 implants placed in the maxillary bone through the nasal fossa.[11,14–16,18] The area of the nasal bones is the location most authors have used for placement of a third implant.[14,17]

Jensen and colleagues[14] studied the bone availability at different facial implant sites in dry skulls. The authors recommended placement of longer intraoral implants whenever possible; they also recommended using conventional implants instead of craniofacial implants in cases where adequate bone is available. They also devised a classification system for sites being considered for implant placement. According to their systen, alpha sites are the sites where a conventional implant can be placed for facial defects; they have the best prognosis. Beta sites offer 4 to 5 mm of bone, permitting the placement of 4-mm-long craniofacial implants or 5-mm-long conventional implants.[14] Delta sites have limited bone availability at the nasal bones, ie, 3 mm of bone or less. These sites have the least favorable prognosis.

Parel and Tjellström[11] reported that implants placed in the nasal bone had the highest failure rate for implants placed in nonradiated patients treated in the United States. In the current report, the frontal process of the maxillary bone, which could be classified as an alpha site, was used, allowing for placement of a conventional 3.25 × 8.00-mm implant.

Lundgren and coworkers[16] suggested that the anterior wall of the frontal sinus could be used for placement of a third implant to retain a nasal prosthesis. However, in most instances in their study, a 4-mm craniofacial implant was used to retain the superior margin of the nasal prosthesis.

In the current patient, implants designed for intraoral use were placed extraorally. Craniofacial implants have a flange around the neck. Should a small amount of bone loss occur, hygiene maintenance becomes more difficult and can result in chronic peri-implant inflammation.[18]

No adverse skin reaction was observed in the current patient. Tjellström[10] performed a study on skin healing around implants placed to support auricular prostheses. He presented a case series that included 303 implants placed in 94 patients. During the 10-year follow-up, 2,458 observations of skin surrounding the abutments were recorded. No adverse reaction was noted in 89.3% of these examinations. Slight redness of the skin was noted in 7%, redness with moisture in 2.7%, granulation tissue in 0.7%, and soft tissue reaction requiring removal of the abutment in 0.3%. Tolman and Taylor[19] reported on a patient investigation in which 66.1% of nasal prostheses had no skin reaction around the abutments, while 33.9% had skin redness around the abutments. Severe skin reactions around the abutments (eg, presence of granulation tissue or infection), a phenomenon observed with auricular and orbital prostheses, was not observed around implant-supported nasal prostheses.

In the patient under consideration, the nasal prosthesis was retained with a bar and clips. This prosthetic design was selected because it has been shown to result in fewer implant failures than attachments placed on nonsplinted implants.[17]

In the current situation, HA-coated implants were placed. It has been shown that HA-coated endosseous implants appear to be associated with more rapid osseointegration[24–26] and better maintenance of osseous crest height.[27,28] Some clinical case reports[29,30] have suggested that HA-coated implants may be more susceptible to infection; however, well-controlled animal studies have shown that HA-coated implants and uncoated implants are associated with similar rates of peri-implant infection.[31] No signs of HA degradation or dissolution have been observed in histologic examinations of HA-coated endosseous implants retrieved from humans after long-term function.[32–36]

An increased number of patients and long-term follow-up studies are needed before the frontal process of the maxillary bone can be routinely recommended for the placement of conventional endosseous implants to retain nasal prostheses.

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