Closure of 1.5-cm Alveolar Oral Antral Fistula with Intra-alveolar Sinus Membrane Elevation and Bone Morphogenetic Protein-2/Collagen Graft Followed by Dental Implant Restoration: Case Report

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Closure of a 1.5-cm oral antral fistula was done in combination with sinus floor and extraction socket grafting using recombinant human bone morphogenetic protein-2 within a collagen sponge matrix. The approach to the sinus was transalveolar, with elevation of the sinus membrane done through a molar extraction socket. Following graft placement, soft tissue repair was done with a buccal advancement flap. A dental implant was subsequently placed and restored. Peri-implant bone and implant stability were well maintained at the 1-year follow up examination. Oral Craniofac Tissue Eng 2011;1:67–73

Key words: bone morphogenetic protein-2, combined socket–sinus floor repair, extraction socket augmentation, intra-alveolar sinus fistula repair, oral antral fistula, sinus bone graft

Closure of oral antral fistulae that are 1 cm or larger have been accomplished with various methods, including the use of local soft tissue flaps1–5 or distant site soft tissue flaps such as tongue flaps,6–8 the use of a buccal fat pad,9,10 application of alloplastic materials such as gold foil,11,12 bone grafting,13–15 local ostotomies,16 vascularized flaps,17 and even placement of a dental implant.18 The exact location of the fistula—palatal or buccal, posterior or relatively anterior, involving the antrum only or combined with the nasal cavity—can guide the clinician toward a specific technique.19–21 When the fistula is located intra-alveolarly, a situation that is most often caused by a dental extraction or loss of a dental implant, and if there is still some residual alveolar height, an intra-socket approach can be attempted.22 Intrsocket procedures work well when the communication is small, perhaps less than 5 mm,22 but when the sinus floor defect is large (ie, 10 mm or larger), intrasocket repair becomes more challenging. One reason for this may be that the exposed root surfaces of adjacent teeth and/or periodontal disease of adjacent teeth hamper repair potential.23,24

Another consideration is restoration of the bone defect. Most clinicians favor repairing the fistula first, following this later with alveolar bone grafting13,25; however, the tibial autograft has been used for combined sinus grafting and fistula repair.15

Reported here is the treatment of a patient who received combined oral antral fistula repair and grafting of a maxillary first molar site. The entire sinus floor had been lost following dental extraction, leaving a 1-cm fistula that had not closed after 8 months. The treatment involved sinus membrane elevation, grafting with recombinant human bone morphogenetic protein-2 (rhBMP-2) (1.5 mg/mL) within a collagen sponge matrix, and primary closure using a Burger flap advanced from the vestibule in conjunction with a palatal rotation flap to obtain tension-free primary closure.26 Intra-alveolar sinus membrane elevation was done to facilitate placement of the BMP-2/collagen graft.27

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A 52-year-old man presented with an oral antral fistula in the maxillary right first molar area that measured 1 cm in diameter (soft tissue). The patient had undergone dental extraction at another clinic 8 months previously. He had received several courses of antibiotics for sinus infection but no surgical attempts had been made to close the defect (Fig 1). The patient presented in no acute distress but with symptoms of chronic sinusitis. Exudate drained from the maxillary right first molar site, where a large sinus communication was evident (Fig 2). A screening computed tomographic scan revealed a clouded sinus.

The patient was prescribed antibiotics in conjunction with aggressive sinus hygiene, which cleared the sinus after 3 weeks. The ostium appeared patent.

The patient then underwent a surgical procedure in which a fistulectomy was performed, the bony defect was exposed, and the sinus was flushed of mucus and other debris with normal saline. The osseous defect measured 1.5 × 1.2 cm (Fig 3). An intra-alveolar approach was then used to elevate the sinus membrane circumferentially. This reduced the diameter of the sinus membrane perforation, as the membrane folded in upon itself. The perforation was then patched with a resorbable collagen membrane placed within the sinus cavity. BMP-2 within a...
collagen sponge carrier (Infuse, Medtronic) was fragmented and placed in layers to occlude the bony defect as well as serve as grafting material for the sinus floor (Fig 4). Tension-free primary closure was obtained by using a split-thickness palatal rotation flap based on the greater palatine artery in conjunction with a Burger buccal advancement flap based on the posterior maxillary vasculature. The two flaps provided double closure of the defect: the palatal flap was placed first, and the buccal advancement flap was sewed over the top following denudation of the epithelial layer of the deeper flap.

After 6 months, a computed tomographic scan indicated a clear sinus (Fig 5), with good bone consolidation in both the sinus floor and alveolus (Fig 6). Following administration of local anesthetics, through a crestal incision, the site was then exposed. There was no evidence of the residual defect; only natural bone was apparent. A wide-body implant (9 × 9 mm, Southern Implants) was placed with an insertion torque greater than 50 Ncm using a one-stage technique with placement of a healing screw. After 4 months, the implant was restored with a single crown. At the 1-year follow up examination, the implant was found to be in functional occlusion. A periapical radiograph showed that the peri-implant bone had been maintained (Fig 7).
DISCUSSION

The use of BMP-2 in a setting of chronic oral antral communication following fistulectomy and sinus membrane elevation is well within the parameters of the US Food and Drug Administration–approved use of this morphogen. BMP-2 consistently forms bone in the sinus floor, even when there are large perforations present following membrane reflection. In addition, BMP-2 has been studied and is approved for use in extraction socket bone grafting and was found to reform buccal and palatal walls and fill extraction site wounds with viable bone.

The present defect, then, was a combined site that was amenable to treatment using BMP-2/ACS (Fig 8a). Bone fill in this setting was consistent with the outcome following posterior maxillary alveolar split osteotomy combined with sinus floor grafting; the latter technique has been shown to work well but is done in a relatively sterile environment, in contrast to treatment of a long-standing oral antral communication.

Stem cells that may convert to bone-forming cells issue from the socket bone walls, the periosteum, the periosteal vasculature, and the sinus membrane itself (Fig 8b). Signal-enhanced grafting provides a...
way for localized as well as distant cell migration to the wound site to form bone as well as the supporting vasculature and associated soft tissues (Fig 8c).38–41 This de novo bone is of such high quality that it can support an implant on its own; no "native" bone is required for primary fixation or eventual osseointegration (Fig 8d).42

One other consideration for the use of BMP in relatively infected sites is its apparent suppression of infection in the grafting setting.43 Whereas the use of autogenous marrow or even a bone substitute may be considered, there is probably a greater risk of infection using osteoconductive agents than with the use of BMP-2 alone, as the incidence of infection of BMP-2 sinus or socket grafts is considerably lower.40–42 This has been demonstrated in animal studies, where healing occurred in infected sites treated with BMP-2. The mechanism for this is unclear but may be related to increased mRNA expression of bone formation genes.44

Other issues to consider when using a combined repair technique are the need to be certain of a patent ostium as well as an uninfected sinus prior to undertaking surgical closure.1,46
REFERENCES


