Sinus Lift Procedures: An Overview of Current Techniques

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KEYWORDS

• Sinus lift • Sinus reconstruction • Bone morphogenic protein
• Osteotomy

For more than 30 years the maxillary sinus augmentation graft has been a mainstay of implant-directed maxillary reconstruction.[1] The purpose of this article is to review the fundamentals of maxillary sinus reconstruction including anatomy and physiology of the sinus, indications for surgery, preoperative evaluation, surgical techniques, and management of complications.

ANATOMY AND PHYSIOLOGY

The paired maxillary sinuses are air-filled spaces lying within the bilateral maxillae, lateral to the nasal cavity, superior to the maxillary teeth, inferior to the orbital floors, and anterior to the infratemporal fossa (**Fig. 1**). These sinuses are the largest of the paranasal sinuses, measuring an average of 12.5 mL in volume.[2] The maxillary sinuses are lined with a thin bilaminar mucoperiosteal membrane known as the Schneiderian membrane, which comprises ciliated pseudostratified columnar epithelium (respiratory epithelium) on the lumen side and a single-cell osteogenic periosteal layer (cambium layer) on the bone side. The infraorbital nerve runs in a posterior-anterior direction in the middle of the maxillary roof. In most cases the canal floor is composed of thick bone; however, in some cases the canal floor is not present, leaving only a thin layer of mucosa between the nerve and the sinus cavity.[3] The sinus ostium, located in the superior aspect of the medial sinus wall superior to the uncinate process, opens into the ethmoid infundibulum located in the middle meatus along the lateral nasal wall. Thin, bony septae that span from the lateral sinus wall to the medial sinus wall may be present in up to 37% of patients with 22.5% of those in the anterior third of the sinus, 45.9% in the middle, and 31.5% in the posterior. One or two septae are present in 89% of patients with septae.[4] The presence and location of septae may

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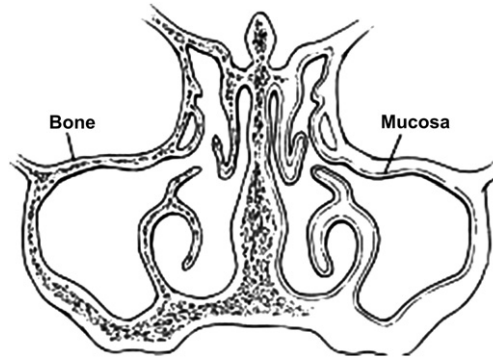

Fig. 1. Coronal view of the ostiomeatal complex. The uncinate process lies in a sagittal plane. The maxillary sinus ostium drains into the infundibulum. (*From* Flint PW, Haughey BH, Lund V, et al. Cummings otolaryngology head and neck surgery review. 5th edition. St Louis (MO): Mosby; 2011; with permission.)

affect a treatment plan, and failure to identify them preoperatively may result in perioperative complications, as discussed later.

Of physiologic importance is that the membrane cilia guide mucous discharge and debris toward the ostium so that in normal-functioning sinuses drainage is constantly maintained. Some conditions may predispose certain patients to chronic sinusitis. Allergic rhinitis causes inflammation of the mucosa at the ostium, leading to local swelling and subsequent blockage of the outflowing mucous discharge, resulting in painful sinus pressure as well as infection of the stagnant fluid. Dysfunctional sinus cilia may also lead to accumulation of mucus and debris, resulting in infection due to the inability of the sinus to clear normal discharge and associated debris.[5]

INDICATIONS AND CONTRAINDICATIONS FOR SINUS RECONSTRUCTION

The primary indication for sinus graft surgery is the planned implant reconstruction of the edentulous posterior maxilla afflicted with postextraction alveolar bone loss and sinus pneumatization, resulting in bone too atrophic for said implant placement (**Table 1**). Sinus graft surgery is indicated for single-tooth and multiple-teeth reconstruction as well as reconstruction of the completely edentulous posterior maxilla.

PREOPERATIVE EVALUATION

A comprehensive history and physical examination should be performed before initiating surgical treatment. Pertinent positives in the history such as recent upper respiratory infection, chronic sinus disease, chronic sinus/facial pain, otitis media, history of nasal/sinus surgery, history of prior attempts at maxillary reconstruction, and history of smoking are important to note. Research has shown that the complication rate for sinus lift grafts performed on smokers is similar to the complication rate for the general population. However, there is evidence that smokers with implants placed in sinus-grafted bone have an increased failure rate when compared with nonsmokers.[6,7] A preoperative computed tomography (CT) scan is recommended to assess the existing bone volume, rule out preexisting sinus disease, and evaluate for the presence of bony septae.[8]