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Orthodontic tooth movement through the maxillary sinus in an adult with multiple missing teeth

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This case report describes the successful orthodontic tooth movement through the maxillary sinus in an adult patient. A 41-year-old Asian woman had severe lip protrusion and multiple missing posterior teeth. Her orthodontic treatment included the extraction of 2 teeth, maximum retraction of the incisors using the extraction spaces and the existing spaces from the missing molars, and closure of all remaining spaces. Even though the treatment time was extended because of the anatomic and biologic challenges associated with moving posterior teeth over a long distance through the maxillary sinus, a successful outcome was obtained, with significant bone modeling of the maxillary sinus. The results demonstrate that a carefully selected force system can overcome the anatomic limitations of moving tooth against the cortical bone of the maxillary sinus wall in adult patients. (Am J Orthod Dentofacial Orthop 2014;146:493-505)

With increased demand for adult orthodontics, orthodontists are often faced with the challenge of correcting occlusal problems that are related to anatomic limits, such as atrophy of the alveolar process, extension of the maxillary sinus into the alveolar process, and periodontally compromised supporting tissues. These anatomic limitations are attributed to cortical bone. Moving teeth through cortical bone is difficult in adults because it increases treatment complexity and treatment time.[1-3] However, previous investigators and clinicians have demonstrated successful tooth movement "with bone" into the compromised bone by applying a carefully planned force system that resulted in bodily movement with frontal bone resorption, rather than indirect bone resorption.[1-4] Among dental professionals, this approach has been well established as a method to generate new bone for implant placement.[3] In addition, a maxillary sinus lift procedure is commonly recommended for implant placement when the maxillary sinus extends into the alveolar process because of the loss of maxillary posterior teeth.[5,6] Moving teeth through the maxillary sinus is considered one of the most challenging problems in orthodontics, since it requires compensatory new bone apposition, before bone resorption, in the direction of tooth movement to maintain the integrity of the sinus wall.[1-4,7] In addition, unknown side effects, such as root resorption, pulp vitality, and perforation of the sinus membrane, can cause additional complications.[8,9] Thus far, few reports are available in the literature.[1,4,7]

This case report presents the possibility of moving teeth over a long distance through the maxillary sinus to close posterior edentulous spaces. In addition, it demonstrates the generation of new bone after tooth movement, which, in turn, contributed to changes in the configuration of the maxillary sinus and the maxillary tuberosity region.

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Fig 1. Pretreatment facial and intraoral photographs.

DIAGNOSIS AND ETIOLOGY

A 41-year-old Asian woman came to the graduate orthodontic clinic, Arthur A. Dugoni School of Dentistry, University of the Pacific, in San Francisco, with a chief complaint of lip protrusion and difficulty in lip closure. She had no significant past medical history but had a moderately restored maxillary dentition with several missing molars. She received regular periodontal checkups, and her oral hygiene was well maintained.

The pretreatment facial photographs showed a convex profile and upper and lower lip protrusion with lip incompetence upon closure. Although a slight maxillary occlusal cant and a slight facial asymmetry were observed, the facial midline and dental midlines were coincident (Fig 1). Intraorally, the patient had normal overjet and overbite (4 and 3 mm, respectively), a Class II canine relationship bilaterally, a lingual crossbite, and a significant supraeruption of the maxillary right first molar because of the missing opposing mandibular right first molar (Fig 2). Loss of the mandibular right first molar also resulted in the mandibular right second molar's being mesially tipped and the mandibular right second premolar's being distally displaced toward the missing first molar space, which left about 6 mm of space. The loss of the maxillary left first and second molars resulted in a space of 16 mm, into which the maxillary left third molar was slightly mesially tipped. A moderate curve of Spee in the mandibular arch was observed.

Figure 3 shows the pretreatment lateral cephalometric and panoramic views from the cone-beam computed tomography (CBCT) images. They showed that the dentition was moderately restored, including root canal treatments on the maxillary central incisors and the maxillary right second molar. The lateral cephalometric tracing and analysis (Table) demonstrated normal anteroposterior (ANB, 2°) and vertical (normodivergency; MP-SN, 28°; FMA, 21°) relationships relative to the cranial base with severe proclination of the