

Clinical experience with a new implant in a minimally invasive procedure

Bilateral sinus floor elevation and simultaneous implantation

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In the following article, the author describes his clinical experience with a new implant that allows for augmentation of the maxillary sinus floor by hydraulic elevation of the Schneiderian membrane.

When dental implants are required in the maxillary molar region, a sinus floor augmentation procedure is indicated in 50 per cent or more of cases [1] due to pneumatization of the maxillary sinus and atrophy of the alveolar ridge [2]. The common procedure in most cases is the open sinus lift, first presented by *Boyne and James* [3] and subsequently by *Tatum* [4].

However, the open sinus elevation involves complications [5-9], significant trauma to the patient and usually a long recovery time involving pain, swelling and bleeding in the facial area, resulting in the loss of a number of work days [10]. A common complication is the perforation of the Schneiderian membrane [2,8,9].

A relatively new alternative for safely elevating the Schneiderian membrane is the hydraulic sinus elevation, or hydraulic sinus condensing [11,12]: After careful drilling into the sinus floor without damaging the mucosa, the operator uses a liquid (*Chen* [11] uses an air/water aerosol emitted from a dental turbine) to create a hydraulic pressure that detaches the Schneiderian membrane from the floor of the sinus and forms a space under it. Bone substitute is inserted into the resulting space, followed by a dental implant. Hydraulic elevation is a safer method for detaching the membrane, as the pressure is evenly spread over the membrane surface [13].

The cases presented here used a new dental implant (iRaise, Maxillent, Israel). This implant applies the principle of hydraulic elevation using an internal channel within the implant, which allows for the injection of saline to accomplish the membrane elevation. Thereafter, the saline is removed and a bone graft with a gel-like consistency is inserted into the newly formed sub-Schneiderian space; finally, the implant is fully inserted into the bone. The L-shaped internal channel (Fig. 1) is designed so that there is



Fig. 1
Sinus lift
implant and
internal channel.

no connection between the prosthetic interface and the duct, so bacteria from the oral cavity are blocked from reaching the bone after implantation.

Case studies

This article describes two cases of bilateral sinus floor elevation, for a total of four sinus floor augmentation procedures. All four procedures were carried out in a similar manner. Two of the procedures are described below in detail – one for each patient.

First patient

The first patient was a 64-year-old woman who took metamizole for thyroid dysfunction but was otherwise healthy. Clinical and radiological examination showed teeth 16, 17, 26 and 27 to be missing in the region of the maxillary sinuses. The residual bone height on both sides was up to 4 mm, requiring bilateral sinus floor elevation as a prerequisite for an implant-supported restoration. The two sinuses appeared to be normal in a CT scan. Sinus floor

*Figs. 2 and 3
Insertion of the
implant, attach-
ment of a con-
nector on the
implant.*



*Figs. 4 and 5
Saline slightly
mixed with
blood after
extraction from
the sinus; inser-
tion of bone
substitute
through the
implant.*



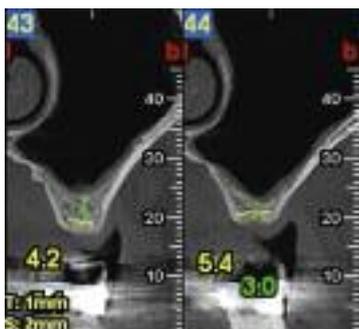
elevation and simultaneous implant insertion at site 16 and another conventional implant insertion at site 17 were carried out, and sinus floor elevation and simultaneous implant insertion were performed at sites 26 (sinus lift implant) and 27 (conventional implant). The method provides for augmentation of a whole sinus using a single implant. If additional implants are required in the treated sinus, conventional implants of any manufacture may be placed within the elevated space that already contains bone graft material. In the cases described here, the conventional implants were iSure implants by Maxillent.

Before treatment, the patient received prophylactic antibiotics (amoxicillin and clavulanic acid, 875 mg) and performed a mouthwash (chlorhexidine gluconate 0.12%). A full-thickness mucoperiosteal flap

was raised by crestal incision, without release incisions. An osteotomy was prepared at site 26, and the sinus floor was identified using a flat bur that provides for tactile sensation of the hard cortical bone of the sinus floor, without any risk of rupture. After widening the bore, the sinus floor was weakened using a specialized diamond bur. At this stage the implant was inserted into the bore. A tube connector was attached to the implant to enable the injection of fluids (Figs. 2 and 3).

The membrane was elevated by hydrostatic pressure by injecting 3 cm³ of normal saline solution through the implant. The saline was removed from the sinus by withdrawing the syringe plunger and appeared to be mixed with a little blood (Fig. 4), a clinical indicator for the saline having come in contact with the Schneiderian membrane, breaching the small blood vessels between the membrane and the sinus floor. Next, 3 cm³ of synthetic bone substitute were inserted (MBCP Gel, Biomatlante, France) (Fig. 5), selected because it is easily injected through the implant and is fairly radiopaque, allowing it to be identified on post-operative X-rays.

The connector was removed and the implant fully inserted into the bone. Beside the sinus lift implant at site 27, a conventional implant was placed using a standard drilling protocol. This osteotomy was drilled directly into the sinus, inside the bone graft beneath the elevated membrane. Figures 6 and 7 show X-ray images before and after the treatment.



Figs. 6 and 7 CT scan before the treatment, periapical X-ray image after the treatment. iRaise is the left implant in the images.



*Figs. 8 and 9
Verification of
reaching the
sinus floor by
periapical X-ray
image with a
depth gauge.*

Second patient

The second patient was a 56-year-old man who had had bypass surgery and took low-dose aspirin prophylactically. Clinical and radiological examination showed teeth 16, 17, 26 and 27 to be missing, with approximately 4 mm of residual bone height bilaterally. The sinuses appeared normal in the CT scan. On the right side, sinus floor elevation was performed using the sinus lift implant at site 17. An additional conventional implant was inserted at site 16. On the left side, the elevation and implantation were performed at site 27, and an additional conventional implant was inserted at site 26. On both sides, the sinus lift implants were positioned in the distal locations, due to the flat angulation of sinus floor, as opposed to a more angulated anatomy at sites 16 and 26.

The procedure on the left side is described in the following. The patient received antibiotic prophylaxis before the treatment (amoxicillin and clavulanic acid, 875 mg). A flap was raised by crestal incision at sites 26 and 27, and preparatory osteotomies were performed until the identification of the hard bone of the sinus floor using a flat bur. The position of the osteotomy with respect to the sinus floor was confirmed by periapical X-ray image with a depth gauge (Figs. 8 and 9).

After widening the bore and weakening the sinus floor using a diamond bur, the implant was inserted. Blood was identified at the lateral opening of the implant, indicating that the end of the implant had



*Fig. 10
Insertion of the
implant into the
bore. Blood is
observed in the
lateral opening,
confirming that
the implant
touches the
membrane.*

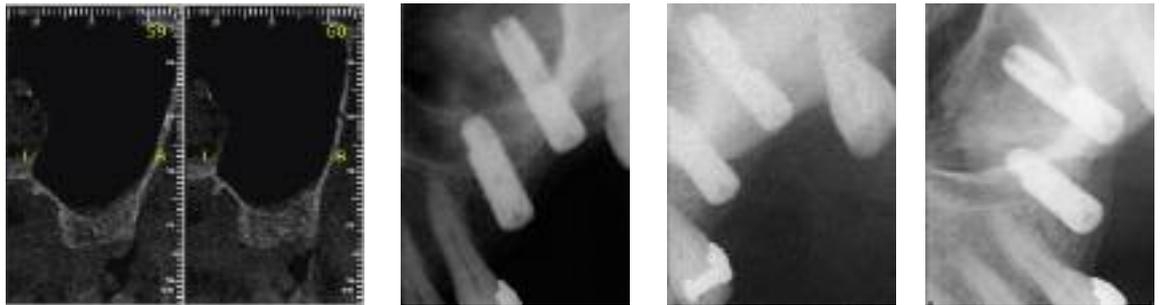
touched the Schneiderian membrane, detaching the blood vessels at its bottom (Fig. 10). A connector was attached to the implant, and the membrane was elevated by hydrostatic pressure through injected saline. The saline was drawn and fluid bone graft was inserted using three 1 cm³ syringes (Figs. 11 and 12).

Finally, the connector was removed from the implant and the implant was fully inserted into the osteotomy. An additional conventional implant was inserted at site 26. Figures 13 and 14 show a CT image before the treatment and a periapical X-ray image immediately after it. Figures 15 and 16 show the situation at the follow-up at four and at seven months.

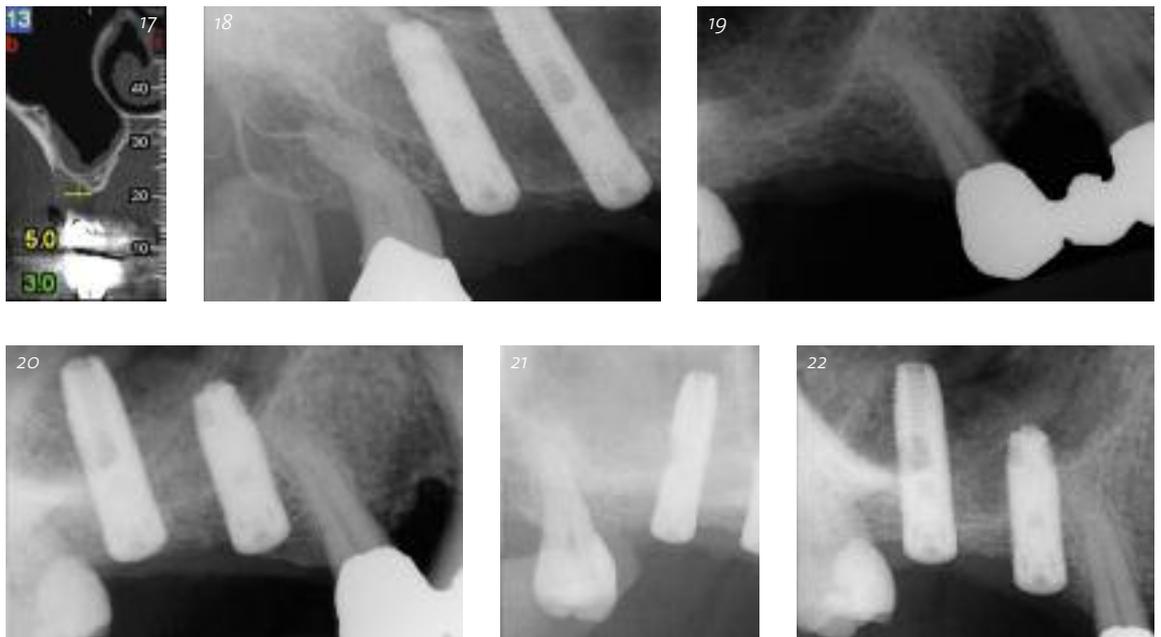
All four procedures were performed similarly to the two cases described here in detail. Pre- and post-operative X-ray images are provided for the two remaining cases (Figs. 17 to 22). Both patients immediately resumed full activity and did not report any pain, swelling or bleeding.



*Figs. 11 and 12
Insertion of 3 cm³
of bone graft
through the
implant.*



Figs. 13 to 16 CT image before the treatment, periapical X-ray image immediately after the treatment, at four months and at seven months (from left to right). iRaise is the right implant in the images.



Figs. 17 to 22 The two remaining cases in the X-ray image before and a periapical image after the treatment. Figures 17 and 18 show the right side of the first patient (pre-operative CT, post-operative periapical X-ray). Figures 19 to 22 show the right side of the second patient (pre- and post-operative periapical X-rays). Figures 21 and 22 show the situation at the follow-up at four months and at seven months.

Discussion

The cases presented in this article demonstrate a new alternative to the open sinus lift, which may potentially provide the advantages of a simpler surgical technique and reduced trauma and recovery time for the patient. It is based on a hydraulic elevation procedure, combined within a dental implant to allow a simultaneous elevation and implantation procedure.

The author's experience in the cases performed show that the technique is easy to implement and has a simple learning curve. The patients went through the treatment easily and simply, with a good treatment experience, without significant disruption to their daily routines.

These cases, however, represent preliminary experience with the surgical technique and are limited to two patients and to four procedures. Once additional patients have been treated, and with more extensive follow-up of the patients, the efficacy of the method may be examined on a greater sample of cases and the development of bone after the regeneration period examined. ■

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