

# Crestal sinus lift combined with single and multiple implant placement using a new atraumatic technique. Report of two cases

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## ABSTRACT

**Aim** The aim of this study was to report and compare two cases with a significant atrophy of the posterior maxillae treated with an atraumatic, innovative procedure for maxillary sinus lift by crestal approach.

**Materials and methods** Two patients with partial edentulism in the posterior maxillae with inadequate bone volume were treated with SinCrest<sup>®</sup> procedure (Meta, Reggio Emilia, Italy). The sinus lift was performed with the simultaneous placement of the implants (three in the first case, one in the second), and after 6 months an X-ray was taken to assess the success of the treatment.

**Results** SinCrest<sup>®</sup> proved to be a mini-invasive atraumatic procedure, efficient in sinus floor elevation for the placement of single or multiple implants. Moreover, it showed a good crestal bone increase particularly with multiple implants, comparable to that obtained with a lateral window approach.

**Conclusions** This technique resulted to be a valid alternative for sinus floor augmentation thanks to its mini-invasive, atraumatic and safe procedures in cases of residual alveolar bone of at least 3 mm height.

**KEYWORDS** Atraumatic; Crestal bone; Implant, transcristal sinus floor elevation; Sinus lift.

## INTRODUCTION

Implant placement in the posterior maxilla is a common problem due to the frequent lack of enough bone volume in this area. This is the result of bone resorption after tooth loss and pneumatization of the maxillary sinus (1, 2).

In the literature different solutions have been described to overcome this problem: short implants, tilted implants or maxillary sinus floor elevation (3, 4).

Sinus floor augmentation is a well-accepted, widely performed and highly predictable procedure (5); nowadays the most used techniques for surgical approach to the sinus for the elevation of the floor are lateral window technique and the crestal technique (6). The lateral window technique was first presented by Boyne and James (1980), who performed an osteotomy in the lateral wall of the sinus in order to lift the Schneiderian membrane and add the bone graft (7).

The transalveolar technique described by Summers in 1994 is indicated for a flat sinus floor when residual bone height is at least 3–5 mm and crest bone width is adequate for implant placement (8).

This procedure does not include the use of drills and it can approximately elevate the sinus floor for 3–5 mm.

Summers used progressive osteotomes of increasing diameter to prepare the implant site by pushing bone apically and displacing laterally the buccal and palatal bones. In this way sinus floor elevation is achieved by its greenstick fracture, achieved by the sharpened end of the first osteotome that is able to progressively compact the bone graft. Osteotomes 2 and 3 perform the ridge expansion (9, 10).

This technique, less invasive and traumatic, can be performed simultaneously with implant placement; the disadvantages are the uncertainty of perforation of the

sinus membrane, ridge fracture and patient discomfort caused by tapping. It is contraindicated in patients with vertigo and inner ear complications, retinal detachment or with an oblique sinus floor ( $>45^\circ$  inclination) (9).

In 1996 Davarpanah et al. proposed the "modified osteotome technique": the implant site is drilled up to 1 mm below the sinus floor and the resorbable graft material is introduced into the surgical site before using the osteotomes. The advantages are that it is more conservative and faster technique and enables placement of implants measuring 10 mm or longer (11). Sotirakis and Gonshor subsequently introduced the crestal sinus floor elevation with hydraulic pressure, pumping sterile saline solution with a fitted syringe (12). Another surgical crestal approach has been described by Cosci et al. who modified Summers' technique using a specific sequence of drills shaped to prevent membrane perforation and gently remove the cortical bone of the sinus floor without fracture (13).

As shown, the crestal sinus floor lift technique has evolved through the years and many authors produced several modifications in order to find a safer and more efficient procedure as a valid alternative to the lateral window technique for multiple implant placement. Recently a new atraumatic device (SinCrest® Meta, Reggio Emilia, Italy) has been adopted for maxillary sinus membrane elevation by crestal approach. This device is adopted to obtain a controlled fracture of the cortical bone through a specific drilling system that advances progressively of 0.5 mm: the residual strength of the maxillary sinus floor is in fact continuously checked by a sensor so that the risk of tearing the Schneiderian membrane is highly reduced. Moreover with this technique the use of osteotomes is no more necessary

and the complications of percussion and vibration are therefore limited (14).

The aim of this study is to present two cases treated with SinCrest® device for maxillary sinus lift by crestal approach. The purpose is to compare the result of crestal bone regeneration in single and multiple implant placement.

## MATERIALS AND METHODS

### Case 1

A 56-year-old male patient came to the observation at Istituto Stomatologico Italiano (University of Milan, Italy). He referred no systemic diseases and no allergies, declared he did not take any medications and had no smoking history.

Teeth 1.4, 1.5, 1.6 were missing and the residual bone crest in this area was 4,5 mm high (Fig.1, 2).

It was decided to perform a transcristal sinus floor elevation with SinCrest®(Meta, Reggio Emilia, Italy) and simultaneous implant placement in area 1.4, 1.5 and 1.6. The oral cavity was disinfected (chlorhexidine 0.2%) and local anesthesia was performed (articaine 40mg/ml + adrenaline 1:200.000).

The flap design consisted of an incision along the alveolar crest and the subsequent elevation of the buccal and palatal aspects (Fig. 3).

The first drill used was the Locator Drill (working length 3.5 mm) to remove the cortical bone; then, using the Probe Drill (diameter 1.2 mm) the implant site was prepared to a distance of 1 mm from the sinus floor. This drill works only in tip to keeps the site's axis. Stopper n° 5 directly inserted on the drill (1 mm shorter than



FIG. 1



FIG. 2



FIG. 3

FIG. 1, 2 The X-ray of 1.4, 1.5 and 1.6 sites showed inadequate bone volume for implant placement.

FIG. 3 Clinical view of the surgical site.



**FIG. 4** The handle of SinCrest® Osteotome was rotated by half a turn firstly counterclockwise and then clockwise, applying a slight axial pressure.



**FIG. 5** The implants were inserted and the flap was sutured.



**FIG. 6** Intraoral postoperative X-ray showed the correct execution of sinus lift procedure and the implant placement.



**FIG. 7** X-ray 8 months after surgery showed a satisfying bone augmentation.

residual bone height) guarantees the correct depth of the site. In the protocol the subsequent drill is the Guide Drill (diameter 3 mm and working length only for the last 2 mm). Finally the SinCrest® Drill was used to make a 3-mm hole.

The SinCrest® device was placed until the achievement of the desired depth (shown by means of a white stripe on the device handle) and rotated by half a turn, firstly counterclockwise and the clockwise, applying a slight axial pressure in order to produce a fracture in the sinus floor (Fig. 4).

The residual strength of the sinus floor could be verified by slightly pushing the probe. The disappearance of the white stripe confirmed the elevation of the Schneiderian membrane. To ensure the correct working depth, a graduated probe (Sin Probe) was used.

The last step of the procedure consisted in the detachment of the sinus membrane with EndoSINUS Probe (Maxil, Omnia) in order to adapt the graft avoiding the risk of perforation.

To ensure the mucosa integrity the Valsalva manoeuvre was performed.

Anorganic bovine bone (Bio-Oss granules 0.25-1 mm/0.25 gr, Geistlich Pharma AG Wohlhusen, Switzerland) was positioned as a graft and then it was possible to insert three implants (Straumann, 4.1Ø 10 mm, 4.1Ø 10 mm, 4.8Ø 10 mm).

A cover screw was tightened and a silk suture 4/0 was applied (Fig. 5).

## Case 2

A 51-years-old male patient was visited at Istituto Stomatologico Italiano (Milan, Italy), presenting an edentulous area in the posterior maxilla due to the lack of tooth 2.6. He denied any systemic and oral diseases and didn't have a smoking history. He also declared no allergies.

Intraoral X rays were performed and revealed a consistent resorption of the alveolar bone: the residual bone crest resulted 3 mm high (Fig. 8).

It was decided to perform a sinus lift with crestal approach using SinCrest® device with the simultaneous placement of an implant in area 2.6 (Fig. 9-14). After 6 months the X-ray showed a final crestal bone height of 7 mm.



**FIG. 8** The X-ray of 2.6 site showed inadequate bone volume for implant placement.





FIG. 9 Clinical view of the surgical site.



FIG. 10 Local anesthesia was performed in 2.6 area.



FIG. 11 Sin Probe was used to ensure the correct working depth.



FIG. 12 The handle of SinCrest® Osteotome was rotated by half a turn firstly counterclockwise and then clockwise, applying a slight axial pressure.



FIG. 13 Bone substitute commercially available (Geistlich Bio-Oss® granules 0.25-1 mm/0.25 g) was gently pushed into the site using a body-lifting instrument. This step was repeated until the site was filled with the graft.



FIG. 14 The implant was inserted and the flap was sutured.



FIG. 15 Sin Probe was used to ensure the correct working length.



FIG. 16 Sinus membrane detachment performed with EndoSinus Probe.



FIG. 17 The handle of SinCrest® Osteotome was rotated by half a turn firstly counterclockwise and then clockwise, applying a slight axial pressure.



FIG. 18 Intraoral postoperative X-ray showed the correct execution of sinus lift procedure and the implant placement.



FIG. 19 X-ray 8 months after surgery showed a satisfying bone augmentation.

## RESULTS

Intra-oral x-rays of the implant sites were performed in both cases respectively 8 and 6 months after surgery. In case 1 the x-ray showed an alveolar bone increase of 5.5 mm (the final height of the bone crest was 10 mm) (Fig. 6, 7).

In case 2 the final height of crestal bone was 7 mm (bone increase resulted in 4 mm).

## DISCUSSION

Inadequate bone volume in the distal maxillae is a frequent problem that the clinician has to solve, in particular if the patient refuses a removable prosthetic solution and requires an implant-supported prosthesis. For dental implants to be successful, the jawbone must have enough bone to support them. If possible, it is better to "rebuild" the lost bone so that it can support an implant (15). Many types of surgical procedures can be used to build bone for implant placement. The sinus lift is a well-accepted technique to treat the loss of vertical bone height in the posterior maxilla. The traditional surgical approach to the sinus is the lateral access as described by Boyne. Following the creation of a window in the buccal side of the sinus, the Schneiderian membrane is elevated prior to bone placement to increase bone volume. This procedure has the advantages of allowing the input of large amounts of grafting material and providing excellent visibility during surgery. In fact, the lateral approach proposed by Boyne allows a remarkable bone increase (up to 10 mm or more) (10).

The main disadvantages of the lateral sinus elevation are the invasiveness of the operation, with substantial post-operative effects, the risk for perforation of the membrane and the epithelial invasion of the graft through the lateral window (16).

Summers introduced an alternative surgical technique by crestal approach and, in the literature, no statistical differences are observed between traditional and crestal sinus lift procedures regarding implant stability (17). The lateral approach could be compared with the Summer technique in terms of implant survival rate and success of bone augmentation. The survival rates for the Summer's technique are strictly linked to the residual bone height, starting from 96% when 5 mm or more of bone is present, dropping to 85% when 4 mm or less is present (18, 19).

The crestal technique is a less invasive surgery with smaller flap design and less extensive osteotomy than the lateral approach. As a consequence, the patients tolerate better the crestal surgery than lateral sinus access and complications are less likely to occur. Even though the transcresal sinus lifting procedure is blindly performed, the frequency of sinus membrane

perforation has been reported as less frequent than the lateral approach (20). Membrane perforation can be avoided by gently detaching the membrane and checking, before the graft insertion, its integrity with the Valsalva manoeuvre (21).

However, the technique, as described by Summer, may present complications such as headache and paroxysmal positional vertigo (22). The reason for this side effect is the detachment of otoliths from their normal location due to percussive and vibratory forces stemming from the preparation of the implant site using a surgical hammer (23).

SinCrest is a new device which represents a valid alternative to osteotomes in crestal sinus lift. This device allows to approach the sinus floor gradually and to maintain the correct axis for implant insertion. The shape of the drill was projected to prevent accidental perforation of Schneiderian mucosa while the stops available in different lengths avoid any drill overextension. The manually screwing of SinCrest device permits more precision and accuracy during cortical approach, while the built-in sensor make it possible to check the residual strength of the sinus floor, the achievement of Schneiderian membrane and its elevation. The advantages of SinCrest are that is an atraumatic technique due to the absence of adverse effects such as headache and paroxysmal positional vertigo due to hammering with osteotomes; it is safe, fast and easy to perform because it does not depend on the clinician's skills or experience: following the surgical protocol step-by-step it is possible to have a total intra-operative control in each stage of the procedure. Moreover, transcresal sinus floor elevation is mini-invasive because during surgery, a small flap design and a limited osteotomy are required. This means less time for wound healing and more comfort for the patient, both during and after the surgery (Fig. 15-19).

The transcresal sinus lift using SinCrest can be performed successfully for single or multiple sites in which the bone height is insufficient. As reported in this study, the bone height gain is greater in multiple sites than in single sites: in case 1 crestal bone gain resulted 5.5 mm, while in case 2 it was 4 mm. This fact can be explained because an increased number of insertion sites increases the membrane elevation height, thus increasing the elastic properties of the Schneiderian membrane. For this reason, the height of bone gain, in particular in multiple sites, is comparable to the one achieved with lateral approach while having the advantage of a less invasive approach with less post-operative morbidity.

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