Surgical Relocation of a Malpositioned, Unserviceable Implant Protruding Into the Maxillary Sinus Cavity. A Clinical Report

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Malpositioned implants always result in significant mechanical and aesthetic restorative challenges. This case report describes the correction of position of an unserviceable osseointegrated implant also protruding into the maxillary sinus cavity. This surgical technique facilitated the relocation of an implant-bony segment into a more favorable aesthetic and biomechanical position in a single stage surgery.

Key Words: implant relocation, malpositioned implant, piezoelectric osteotomy, stereolithography

INTRODUCTION

Severe implant malpositions can be an insurmountable barrier in achieving a satisfactory esthetic and functional prosthetic outcome. Sometimes the problem can be masked by custom prosthetic abutments, but in severe cases, especially in esthetic areas, it is very often impossible to reach an acceptable result. In these situations the implant may be left submerged under the soft tissues, giving up its support for the prosthetic rehabilitation, or it can be surgically removed. In this last case, frequently, the implant removal results in hard and soft tissue defects requiring corrections with advanced regeneration procedures prior to inserting a new fixture. An alternative option, as described in a few case reports,[1,2,3,4,5,6,7,8] is to mobilize the malpositioned implant and the surrounding bone with segmental osteotomies and relocate the block in the correct position. This surgical technique derives from segmental osteotomy procedures used in orthodontic and orthognathic surgery[9,10,11] to release and reposition impacted ankylotic maxillary canines,[12] close single-tooth diastemas,[13] and close multiple-tooth diastemas.[14] This paper presents a clinical report describing the relocation of a malpositioned implant, complicated by its protruding into the maxillary sinus, into a more favorable position.

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Figure 1. Initial situation with severely malpositioned implant and an inadequate prosthesis luted to the cuspid and screwed to the fixture.

Materials and Methods

Presurgical evaluation

A 65-year-old female patient, a nonsmoker, in good general health, and without any contraindication to the surgery presented for evaluation. She presented with a severely malpositioned implant in the maxillary second right premolar site, connected with a screw to an inadequate 3-unit fixed prosthesis luted to the cuspid (Figure 1). The patient's chief complains were the poor esthetics and, above all, frequent bridge decementations and screw loosenings. The computerized tomography (CT) scan showed that the malpositioned fixture was osseointegrated in a narrow bony architecture and that the top of the implant was protruding 2 mm into the maxillary sinus cavity (Figure 2). The imaging evaluation suggested that removal of the fixture would result in significant ridge deformity and would necessitate regenerative surgery to augment the crest before considering a new implant treatment. The clinical examination, including prosthetic workups, confirmed that the implant was unserviceable to support a functional and esthetic prosthetic restoration.

The patient was presented with the following treatment options: (1) removal of the implant and rehabilitation with a crown on the canine and a posterior removable prosthesis, (2) removal of the

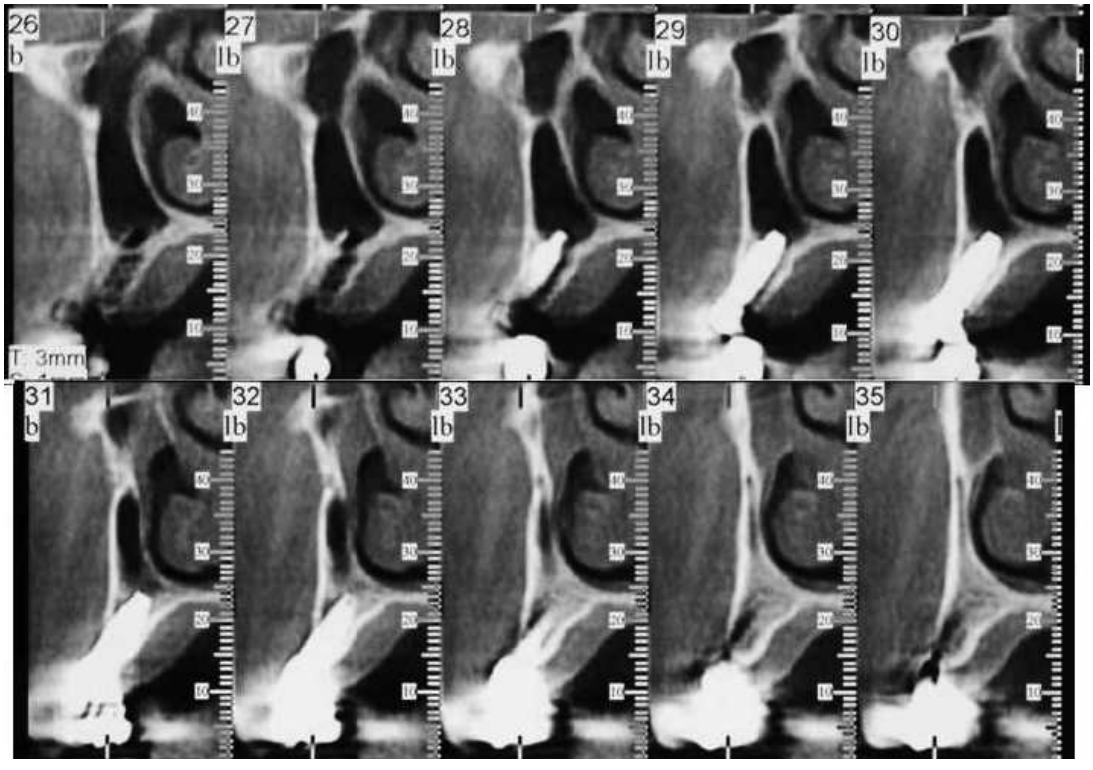

Figure 2. A computerized tomography scan showing the malpositioned fixture osseointegrated in a narrow bony architecture with the top of the implant protruding 2 mm into the maxillary sinus cavity.

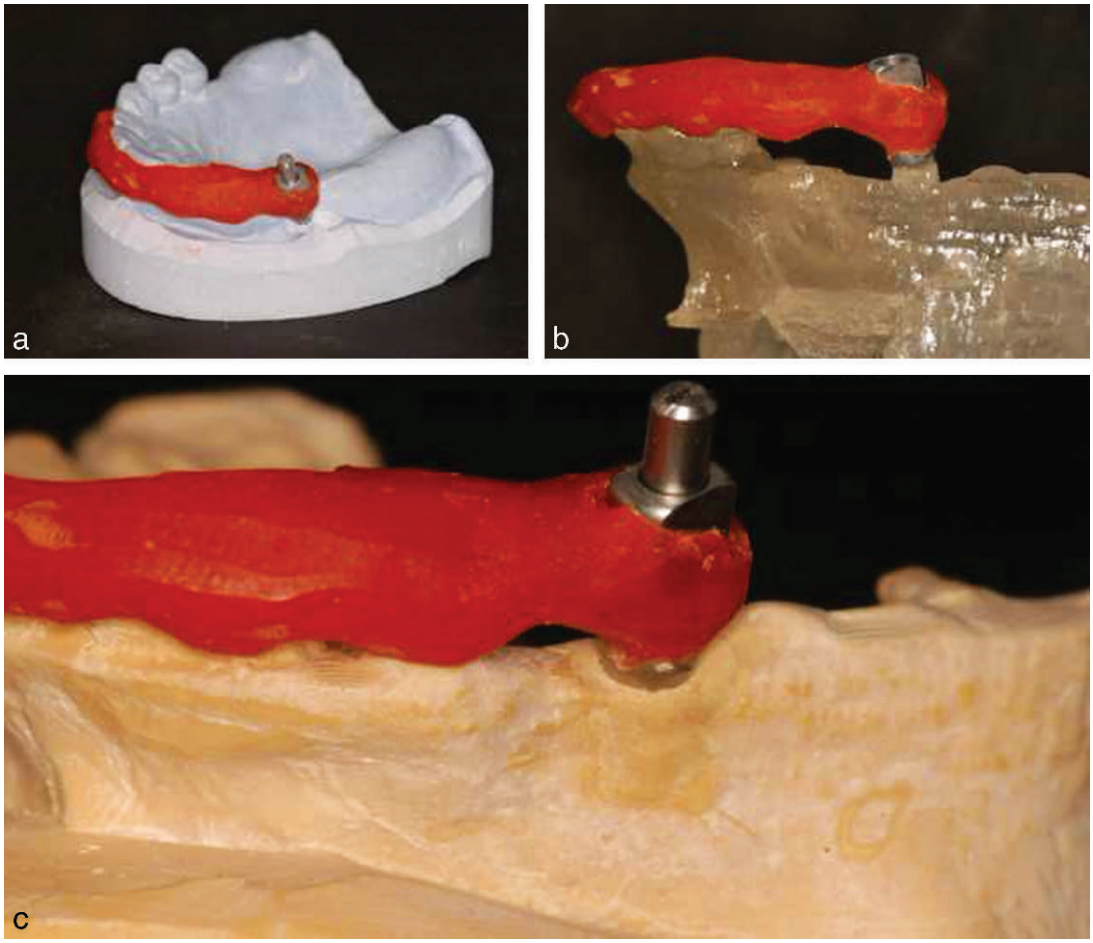

Figure 3. (A) Master model with vestibular resin transfer template including a pickup coping. (B) Adaptation test of the transfer template on the stereolithographic model. (C) Transfer template on the stone cast duplication of the stereolithographic model after the implant analog insertion.

implant and regenerative surgery to reconstruct the ridge in order to insert other implants, or (3) relocation of the malpositioned implant and insertion of a new fixture in the first premolar site, followed by prosthetic restoration.

The patient, after collecting other professional opinions, decided for the implant relocation option and signed a written informed consent form.

Using Digital Imaging and Communications in Medicine data collected from the CT scan, it was processed with a rapid prototyping technique, a 3-dimensional resin stereolithographic replica of the maxillary bone (Biosolutions, Fagnano Olona, Italy). This replica was duplicated in a stone cast model on which, using a vestibular resin template, it was transferred to the position of the implant from the master model (Figure 3A through C). After evaluating diagnostic waxing and measurements taken from the CT scan and periapical radiographs, the movement necessary to relocate the implant in a serviceable prosthetic position was simulated by sectioning the stone cast stereolithography duplicate. Once the desired position was reached, a custom titanium fixation plaque was prepared using a castable abutment (Figure 4), to be screwed to the implant and fixed to the bone adjacent to the block with miniscrews. The titanium appliance was carefully polished on the outer side to reduce dental plaque adhesion and to favor patient hygiene.

Figures 4–9. Figure 4. Titanium fixation plaque screwed to the implant relocated in the desired position. **Figure 5.** Piezoelectric full-thickness osteotomies parallel to the long axis of the implant through the buccal and palatal cortical plates and through the floor of the maxillary sinus. **Figure 6.** Titanium plaque in place, fixing the mobilized bone block in the preprogrammed position. **Figure 7.** Detail of the top of the implant (arrow), protruding into the maxillary sinus, after the block shifting. **Figure 8.** Reentry after 2 months: at clinical observation, the osteotomic cuts are completely closed and the block is firmly stabilized in the new position. Some particles of β-tricalcium phosphate are still recognizable in grafted areas (arrows). In the same surgery it was inserted a second implant in first premolar site. **Figure 9.** Clinical control of the screw retained zirconia-ceramic crowns 1 year after the finalization.

Surgical procedure

The patient was asked to rinse with chlorhexidine mouthwash 0.2% (Corsodyl, SmithKline Beecham, Brentford, UK) for 30 seconds and then draped to guarantee maximum asepsis. The perioral skin was disinfected using iodopovidone 10% (Betadine, Purdue Pharma, Stamford, Conn). Under local anesthesia (articaine HCl 40 mg/mL with epinephrine 1:100 000) (Alfacaina, Weimer Pharma, Rastatt, Germany), a

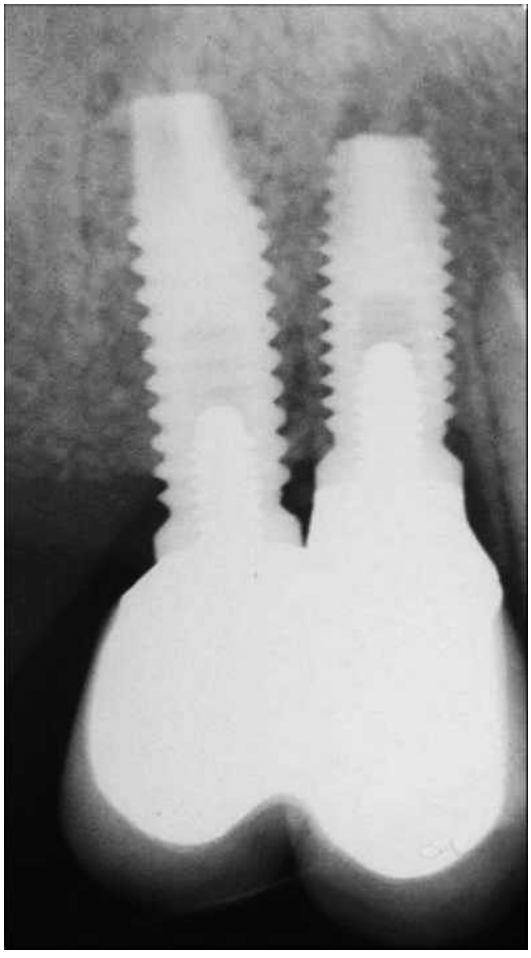

Figure 10. Radiographic control after 1 year of function.

full-thickness mucoperiosteal flap was elevated only on the buccal side, leaving the palatal aspect undisturbed. Using piezoelectric specific inserts (Piezosurgery, Mectron, Carasco, Italy), a window was opened on the lateral wall of the maxillary sinus and the schneiderian membrane was carefully elevated to create space for the periimplant osteotomies. The preexisting membrane perforation created by the implant protruding into the sinus cavity (3 mm diameter) was isolated and protected by a collagen sponge (Gingistat, GabaVebas, Rome, Italy). An OT7 piezoelectric insert with a thickness of 0.5 mm was used to perform 2 longitudinal osteotomies parallel to the long axis of the implant through the buccal and palatal cortical plates and through the floor of the maxillary sinus (Figures 5 and 6). The custom fixation appliance was then screwed to the implant (20 N/cm torque) and a green-stick fracture was carefully created with a spatula osteotome to mobilize implant-bony segment. The block was relocated palatally until the wings of the fixation appliance lay down on the buccal plate, indicating that the programmed position was reached; then it was fixed in place with titanium miniscrews (SQ 17, Geass, Pozzuolo del Friuli, Italy) (Figures 7 and 8). The antrostomy area, the osteotomic cuts, and the preexistent small dehiscence defect were grafted by β-tricalcium phosphate (Cerasorb, Curasan AG, Kleinostheim, Germany) and the mucoperiosteal flap was sutured with multiple horizontal mattress and single sutures. Amoxicillin/clavulanate potassium (875 + 125 mg) tablets (Augmentin, GlaxoSmithKline, Brentford, UK) (1 tablet 3 times a day) and ibuprofen (Brufen, Abbott Laboratories, Abbott Park, Ill) (600 mg twice a day) were prescribed for 1 week. Sutures were removed 10 days after surgery. Postsurgical visits were scheduled every 15 days to check the course of healing.

Results

After 8 weeks the fixation appliance was removed and a healing abutment was connected to the implant. At clinical observation, the osteotomic cuts were completely closed and the block was firmly stabilized in the new position. In the same surgery a second implant was inserted in the first premolar site (Nanotite, Biomet 3i Implant Innovations, Palm Beach Gardens, Fla) (Figure 9). After 3 months the 2 implants were restored with screw-retained zirconia ceramic crowns. At 1-year follow-up, clinical and radiographical findings confirmed an acceptable functional and esthetic result (Figures 10 and 11).

Discussion

The accurate placement and alignment of implants is a crucial factor in obtaining a

satisfactory functional and esthetic prosthetic result. It is often necessary to augment hard and soft tissues prior to inserting the implants to allow for correct emergence profiles and proper anterior-posterior prosthetic position. Inappropriate presurgical planning can lead to inadequate implant placement, resulting in a final poor emergence from the soft tissues, often very challenging to treat. When a mild implant malposition occurs, it can be sufficiently corrected with a prosthetic alteration using esthetic custom abutments to achieve an acceptable outcome. However, more severe cases require a direct intervention on the fixture: the malpositioned implant can be left "sleeping" or removed and then replaced with another one. If it's impossible or not convenient to elect one of these options, an implant relocation technique offers an alternative method of salvaging malpositioned implants.

Some anatomic and technical factors are to be considered in programming an implant relocation surgery. The space between the implant to move and adjacent teeth or fixtures must be sufficient to safely perform the osteotomies without damaging the roots or the implant itself. The piezoelectric bone scalpel, with its micrometric cutting, offers a better operative control and requires less space than burs.[8–17] Success of implant relocation procedures is strictly dependent on the preservation of the blood supply for the mobilized block. For this reason, the palatal flap is not elevated and the periosteum is left undisturbed on the bone; the use of piezosurgery, safe on the soft tissues,[18] is an important help in preventing unpredictable involvements on the palatal side. Further, the bone healing potential following piezoelectric osseous surgery seems to be more favorable if compared to bone cuts performed using burs or saws.[19,20]

Once in the final position, the distance between the mobilized block and the adjacent bone is a critical factor for the type of healing[21–23]: a space $\leq$2 mm appears to have the highest potential for healing through osseous union.[24–26] Also, the stabilization of the mobilized segment emerges as a crucial moment in promoting osseous repair[27–29]: mobility can result in scar formation, encapsulation, and/or sloughing of the segment. Precise and narrow osteotomies and firm immobilization of the relocated segment are the key factors in minimizing transient ischemia of the bone block, favoring clot stabilization and osseous repair. The presurgical simulation made on a stereolithographic replica allows for a precise visualization of the spatial movements of the implant–bony segment in order to reach the desired final location. With this procedure it is possible to program exact positions, length, and depth of the osteotomies as well as modeling a custom fixation plaque for the block. This titanium appliance, during the surgery, will guide the block movement until the planned position is reached and will ensure a firm fixation of the mobilized segment to the adjacent bone.

Conclusions

Implant relocation is a surgical technique for correcting the alignment of osseointegrated malpositioned implants by mobilizing them with the surrounding bone until the desired position is achieved. This case report illustrates the application of this procedure to correct the spatial orientation of a malpositioned fixture also protruding into the maxillary sinus cavity. The results suggest that inadequately axially inclined implants can be successfully relocated in a more convenient position using segmental piezoelectric osteotomies. The use of stereolithography in presurgical planning allows the clinician to build custom fixation plaques that are helpful in guiding the surgical movement and subsequent fix of the relocated block in the proper preprogrammed position.

Abbreviation

CT: computerized tomography

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