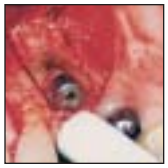
Relocation of a Malpositioned Maxillary Implant with Piezoelectric Osteotomies: A Case Report



*Claudio Stacchi, DDS**
*Fulvia Costantinides, DDS**
*Matteo Biasotto, DDS, PhD***
*Roberto Di Lenarda, DDS****

Implant relocation is a new surgical technique for correcting the alignment of malpositioned implants by mobilizing them with the surrounding bone until the desired position is achieved. In this case report, a 25-year-old woman was treated for the malposition of an implant in the maxillary left canine site. The use of a piezoelectric scalpel permits narrow, precise, and safe osteotomies, thus preventing involvement of the soft tissue and producing better healing potential compared to burs or saws. The results suggest that inadequately axially inclined implants can be successfully reconfigured using segmental piezoelectric osteotomies. (Int J Periodontics Restorative Dent 2008;28:489–495.)

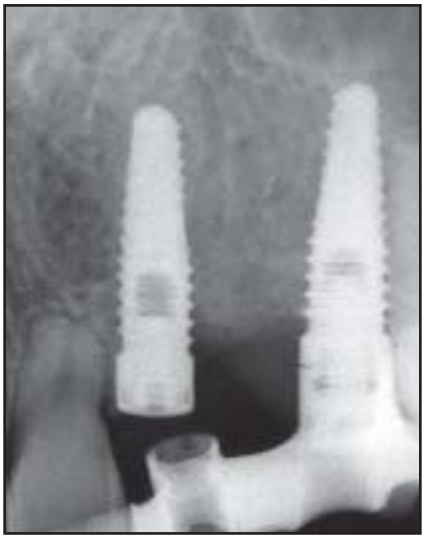
*Department of Biomedicine, Division of Dentistry and Biomaterials, University of Trieste, Italy.
**Research Associate, Department of Biomedicine, Division of Dentistry and Biomaterials, University of Trieste, Italy.
***Professor and Director, Department of Biomedicine, Division of Dentistry and Biomaterials, University of Trieste, Italy.

Correspondence to: Dr Claudio Stacchi, Corso Italia 121, 34170 Gorizia, Italy; e-mail: claudio@stacchi.it.

If an osseointegrated implant is poorly positioned, it is difficult to achieve satisfactory prosthetic outcomes, especially in esthetic areas. Limited options are available to overcome such a problem. The implant may be left "sleeping" under the soft tissues if its support is not necessary for rehabilitation, or it can be surgically removed and then replaced. In the case of removal, defects in hard and soft tissues may often jeopardize placement of a new implant. A third option is to move the implant with the surrounding bone into a better position. This technique is performed either by removing the implant and the surrounding bone using trephine drills and then replacing it in a new location[1,2] or by mobilizing the implant with peri-implant osteotomies with burs or saws and stabilizing it in the new position.[3–9]

The aim of this case report is to describe the relocation of a severely malpositioned single maxillary implant with a segmental osteotomy technique using a piezoelectric surgery system.

Figs 1 and 2 *Initial situation. The implant in the canine site is too apical and too buccally angled.*



Figs 3 and 4 *Clinical and radiographic views of the fixation appliance in place, showing the discrepancy between the actual and desired position of the implant.*

Case report

Presurgical evaluation and preparation

A 25-year-old woman with two implants replacing the maxillary left canine and first premolar was evaluated for prosthetic restoration. The second-stage surgery was already completed and the two implants were osseointegrated. The soft tissues appeared healthy. The implant in the canine site was severely malpositioned and thus was deemed unsuitable for prosthetic treatment (Figs 1 and 2).

Presurgical evaluation included periapical radiographs, study casts, and diagnostic waxing. Radiographs indicated that there was very little space between the lateral incisor and the implant to relocate; however, it was sufficient to perform the osteotomies and to allow movement. Using a sectioned stone cast and diagnostic waxing, the movement of the implant was simulated, and a four-unit cast metal prosthesis was prepared to be screwed to the implant and bonded to the adjacent teeth (Figs 3 and 4).

Fig 5 (left) *The implant to be treated was osseointegrated and exhibited a buccal dehiscence defect with five exposed threads.*

Fig 6 (right) *Two complete osteotomies were performed.*

Fig 7 (left) *A greenstick fracture of the palatal plate was accomplished with a spatula osteotome, and the implant was carefully mobilized until the desired position was achieved.*

Fig 8 (right) *After 4 months, the prosthetic fixation was stable and the soft tissues appeared healthy.*

First-stage surgery

A full-thickness mucoperiosteal flap was elevated only on the buccal side under local anesthesia (4% articaine with epinephrine 1:100,000, Septanest). The implant to be treated exhibited a buccal dehiscence defect with five exposed threads (Fig 5). The distance between the malpositioned implant and the root of the lateral incisor was 1.3 mm. The distance between the implant to be relocated and the implant in the premolar site was more than 4 mm. An OT7 piezoelectric scalpel with a thickness of 0.5 mm (Piezosurgery, Mectron Medical) was used to perform two complete osteotomies parallel to the long axis of the implant through the buccal and palatal cortical plates to a length of 15 mm (2 mm apical to the top of the implant). With the same technique, a horizontal osteotomy was performed involving only the buccal cortical plate and connecting the vertical cuts over the top of the implant (Fig 6). A greenstick fracture on the palatal plate mobilizing the implant with surrounding bone was accomplished with a spatula osteotome. The fixation appliance was bonded to the lateral incisor and second premolar and connected to the implant in the first premolar site. The mobilized implant was partially screwed to the fixation to move it palatally and vertically up to the correct position (Fig 7). The holes and screw-access channels in the prosthesis were completely filled with flowable composite resin (Tetric Flow, 3M ESPE). From the buccal plate already exposed by the flap, cortical bone chips were harvested with an OP3 piezoelectric scalpel to fill the vertical and horizontal osteotomic cuts. The surgical site was sutured with 5-0 expanded polytetrafluorothylene (e-PTFE) sutures (Gore-Tex). The patient was prescribed amoxicillin (1 g twice a day for 5 days), nimesulide (100 mg twice a day for 3 days), and 0.12% chlorhexidine gluconate rinses (twice a day for 14 days). The sutures were removed after 7 days, and the patient was evaluated every 2 weeks for the entire healing period. No problems were encountered during this period (Fig 8).

Figs 9 and 10 *The implant relocated to a more favorable position. The osteotomic cuts were completely closed and the untreated dehiscence defects remained unaltered.*

Figs 11 and 12 *Clinical and radiographic views of the implants restored with two custom abutments.*

Second-stage surgery and prosthetic treatment

At 4 months, radiographs showed no discontinuity between the mobilized block and adjacent bone. A second surgery was performed to connect the healing abutments to the implants and clinically evaluate the bone healing. The three osteotomic cuts appeared completely closed, the untreated buccal dehiscence with five threads exposed remained unaltered, and the implant appeared clinically osseointegrated (32 N inverse torque test) (Figs 9 and 10).

Two healing abutments were connected, and the flap was closed with 5-0 e-PTFE sutures. After 4 weeks, the implants were restored with two titanium-ceramic custom abutments (Figs 11 and 12) and two provisional acrylic resin crowns. After 6 months, the treatment was finalized with two zirconia-ceramic crowns luted to the abutments (Figs 13 and 14).

Figs 13 and 14 *Treatment was finalized with two zirconia-ceramic crowns luted to the abutments.*

Discussion

As reported by Kim,[4] the inadequate angulation of an implant is a common and sometimes unavoidable problem. In some cases, such as the one presented in this paper, the malposition may be so severe that it creates great functional and esthetic challenges for the prosthodontist.

If a problem related to implant position occurs, three types of surgical options are available: the implant can be "put to sleep," removed, or repositioned. The first choice is generally indicated in multiple-implant rehabilitations, in which it is possible to function without the support of the implant. Removal can also be considered, but this requires sufficient bone to allow placement of a new implant. Maxillary implant repositioning was recently introduced to correct the alignment of malpositioned implants.[1–9]

In the present patient, the implant in the premolar area was in a satisfactory position, but the location of the implant in the canine position was too apical and too buccally angled to obtain an acceptable functional and esthetic result.

Leaving the implant "sleeping" and maintaining a natural soft tissue appearance would have been a difficult challenge, and the final prosthetic restoration would have produced an unpredictable biomechanical outcome (especially considering the poor periodontal support of the lateral incisor). Further, clinical and radiographic findings suggested that removal of the implant would result in significant ridge deformity and require transverse and vertical ridge augmentation prior to new implant placement. The surgical options were presented to the patient and the decision was made to relocate the implant.

The technique modifies the segmental osteotomies used in orthopedic and orthodontic surgery[10–12] proposed by a few authors in recent years.[3–9]

The flap, elevated only buccally, allows clinicians to leave the periosteum and vascularization of the palatal side undisturbed, reducing the risk of necrosis.[11] The implant with the surrounding bone was mobilized with two complete vertical osteotomies through the buccal and palatal cortical plates and one horizontal osteotomy involving

only the buccal cortical plate and connecting the vertical cuts apically to the implant. The limited distance from the implant to the lateral incisor root (1.3 mm) supported the need for a bone osteotomy that used a piezoelectric technique. The Piezosurgery System allows for micrometric cutting with maximum intraoperative control, thus preventing unpredictable involvement of the soft tissues.[13–15] Further, the bone healing response following piezoelectric surgery seems to be more favorable compared with cuts performed using burs or saws.[16,17]

The final mobilization of the segment was obtained by carefully producing a greenstick fracture of the palatal plate using a spatula osteotome. The stabilization of the mobilized block was obtained with a screwed and luted cast metal framework.[18] This is easily and completely removable at the end of the healing period and ensures bone stabilization without screwing plates to the bone.

Finally, because of its shape based on the diagnostic waxing, the prosthesis helps clinicians guide the movement of the block into the final position. To obtain the best results with this type of technique, a minimum number of teeth is needed, and at least one stable implant should be connected to prevent the influence of micromovements that could interfere with the healing of the mobilized bony block.

Acknowledgment

The authors thank Mr Marco Bonino for fabricating the fixation appliance and definitive prosthesis.

References

1. Hallman M, Carlsson B. Surgical correction of malpositioned implants: A case report. Clin Oral Implants Res 1996;7: 316–319.
2. Watanabe F, Hata J, Mataga I, Yoshie S. Retrieval and replacement of a malpositioned implant: A clinical report. J Prosthet Dent 2002;88:255–258.
3. Kassolis JD, Baer ML, Reynolds MA. The segmental osteotomy in the management of malposed implants: A case report and literature review. J Periodontol 2003;74: 529–536.
4. Kim SG. Inadequate implant angulation resulting from oroantral fistula: Case report. Implant Dent 2001;10:103–107.
5. Martin RJ, Goupil MT, Goldschmidt M. Single-implant segmental osteotomy: A case report. Int J Oral Maxillofac Implants 1998;13:710–712.
6. Poggio CE, Salvato A. Implant repositioning for esthetic reasons: A clinical report. J Prosthet Dent 2001;86:126–129.
7. Storum K, Carrick JL. Implant-osseous osteotomy for correction of the misaligned anterior maxillary implant. Dent Clin North Am 2001;45:181–187.
8. Svensson B, Adell R, Swartz B. Correction of implant misalignment by segmental osteotomy: A case report. Int J Oral Maxillofac Implants 1992;8:459–463.
9. Warden PJ, Scuba JR. Surgical repositioning of a malposed, unserviceable implant: Case report. J Oral Maxillofac Surg 2000; 58:433–435.
10. Bell WH. Biologic bases for maxillary osteotomies. Am J Phys Anthropol 1973; 38:279–289.
11. Bell WH, Schendel SA, Finn R. Revascularization after surgical repositioning of one-tooth dento-osseous segments. J Oral Surg 1978;36:757–765.
12. Burk JL Jr, Provencher RF Jr, McKean TW. Small segmental and unitooth ostectomies to correct dento-alveolar deformities. J Oral Surg 1977;35:453–460.
13. Vercellotti T. Piezoelectric surgery in implantology: A case report—A new piezoelectric ridge expansion technique. Int J Periodontics Restorative Dent 2000; 20:359–365.
14. Vercellotti T. Technological characteristics and clinical indications of piezoelectric bone surgery. Minerva Stomatol 2004;53: 207–214.
15. Robiony M, Polini F, Costa F, Vercellotti T, Politi M. Piezoelectric bone cutting in multipiece maxillary osteotomies. Technical note. J Oral Maxillofac Surg 2004;62: 759–761.
16. Preti G, Martinasso G, Peirone B, Navone R, Manzella C, Muzio G, Russo C, Canuto RA, Schierano G. Cytokines and growth factors involved in the osseointegration of oral titanium implants positioned using piezoelectric bone surgery versus a drill technique: A pilot study in minipigs. J Periodontol 2007;78:716–722.
17. Vercellotti T, Nevins ML, Kim DM, Nevins M, Wada K, Schenk RK, Fiorelli JP. Osseous response following resective surgery with piezosurgery. Int J Periodontics Restorative Dent 2005;25:543–549.
18. Bays RA. Rigid stabilization system for maxillary osteotomies. J Oral Maxillofac Surg 1985;43:60–63.