Surgical Implant Repositioning: A Clinical Report

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Esthetically compromised or nonrestorable implants present major clinical problems. Of 3,850 implants placed, 10 osseointegrated implants in 6 patients were surgically repositioned using maxillary or mandibular osteotomies and rigidly fixated, under intravenous sedation. The segments were predictably changed in a vertical, anteroposterior, transverse, or axial inclination manner. Excellent healing of bone and soft tissue was observed. This simple, reliable technique allowed these 10 implants to be esthetically and functionally restored with permanent prostheses.
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Key words: bone healing, compromised implants, orthognathic surgery, rigid fixation, segmentalized osteotomies

Recent advances in implant surgery have made it possible to reconstruct alveolar bone, thereby enhancing the placement and utilization of endosseous implants.[1–12] Various researchers have addressed the surgical sequence and timing of bone grafting to avoid or predict associated progressive bone resorption and maintain the immediate postsurgical result for long-term service.[13,14]

Different diagnostic aspects play a role in the treatment planning of implants, especially in the anterosuperior region. It is essential that the treating team (prosthodontist, surgeon, periodontist, dental technician, and the patient) understand all the variables involved to avoid potential complications and/or failure. Poor planning has resulted in use of the following often unsatisfactory alternative treatment measures:

1. Angled abutments (up to 30 degrees).
2. Porcelain overcontouring.
3. Silicone removable gingivae.
4. Long crowns.
5. High crown-to-root ratio.
6. Secondary bone grafts.
7. Secondary soft tissue grafts.
8. Increased number of implants to accommodate occlusal forces.
9. Change from implant-supported to implant-mucosa–supported prosthesis.
10. Removal and replacement of implants.

Some compromised implants are restorable, and the result can be acceptable if they can be adjusted into a more ideal position. Orthognathic surgery pioneers, such as Hullihen,[15] Cohn-Stock,[16] Wassmund,[17] Schuchardt,[18] Kufner,[19] and others, have demonstrated that changing a tooth-bone segment position by segmental maxillary or mandibular osteotomies is completely feasible. Studies by Bell,[20,21] Bell and Levy,[22] and others have shown how to avoid avascular necrosis, nonunions, and fibrous unions by giving attention to the vascular supply, bone healing process, and stability. Animal research has indicated the need to perform an osteotomy 5 mm away from the tooth apices to ensure and maintain blood supply with positive pulp tests at 6 months after surgery.[21,22]

The possibility of using segmental maxillary or mandibular osteotomies to reposition an alveolar segment with its implants can be an effective, predictable technique for restoring implants in a highly compromised situation.

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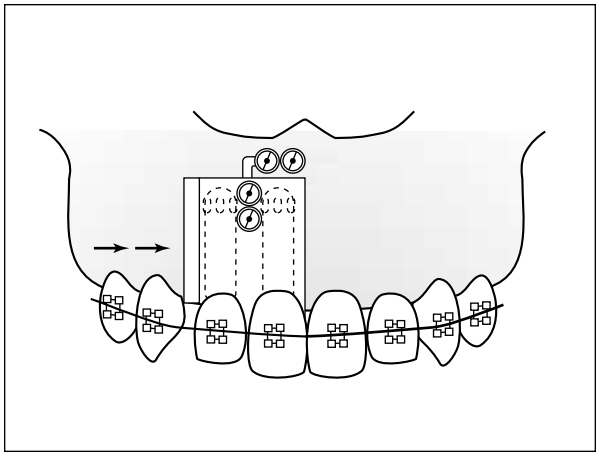


Fig 1a Surgical implant repositioning in the anterior maxilla.

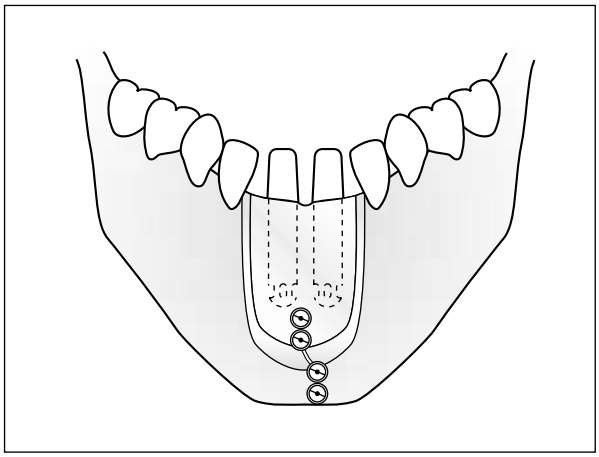
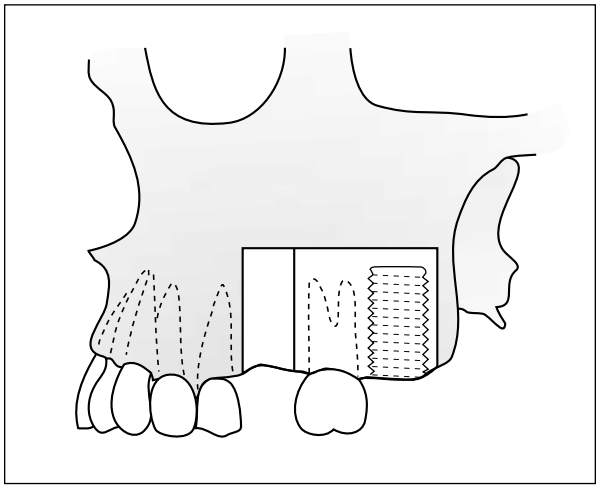


Fig 1b Surgical implant repositioning in the anterior mandible; a plate and 3 or 4 screws are used to fix the segment once it is mobilized into the ideal position.



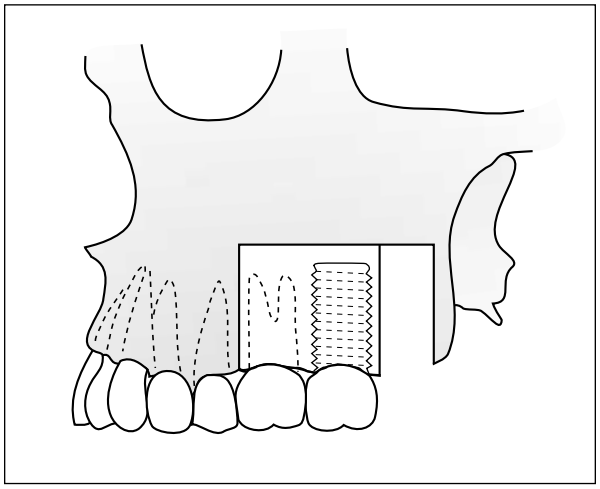


Fig 2 Immediate implant placement and segment repositioning is useful in a situation like this, where an implant is surrounded by high-quality, abundant bone.

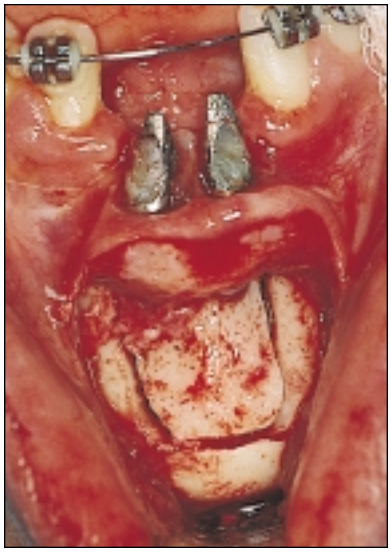
Materials and Methods

Six patients, 4 females and 2 males aged 15 to 38 years (mean 27.8 years), underwent surgical implant repositioning using maxillary or mandibular segmental osteotomies. The implants were rigidly fixed with microplates and microscrews (Fig 1).

The implants were repositioned to:

1. Improve vertical alveolar bone-implant relationship.
2. Change anterosuperior implant inclination.
3. Decrease crown-to-root ratio.
4. Improve crown-implant-upper lip relationship.
5. Immediately transpose an implant in a tuberosity into the second molar region (Fig 2).

Technique. Prior to surgery, the prosthodontist fabricates a crown restoration on a 0 degree abutment of the ideal shape, length, and inclination. This is facilitated by measuring the same tooth on the opposite side (when available) and making the individual crown's vertical and transverse dimension identical to that of the contralateral side. The cervical region is ideally contoured as well. The patient will likely have either an open bite or inadequate axial inclination of the implant



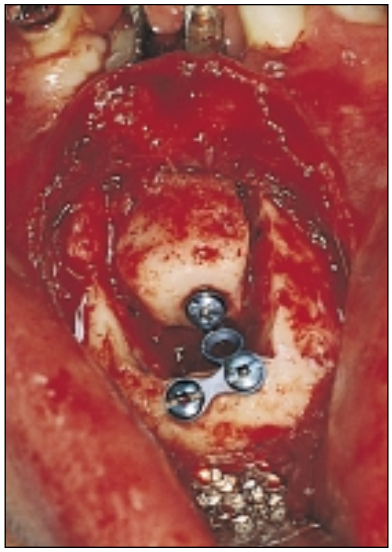


Fig 3a Surgical Technique. A horizontal incision is made at the depth of the vestibule, elevating a limited periosteal flap, avoiding vertical incisions or major periosteal degloving. A 701 bur in a straight handpiece is used for the horizontal cuts and to initiate the vertical cuts. A spatula osteotome is utilized to complete the osteotomy, and the soft tissues are protected with the forefinger.

Fig 3b Surgical Technique. Rigid fixation is used, plates (0.6 mm profile) with screws (5 or 7 mm long and 1 mm of diameter).

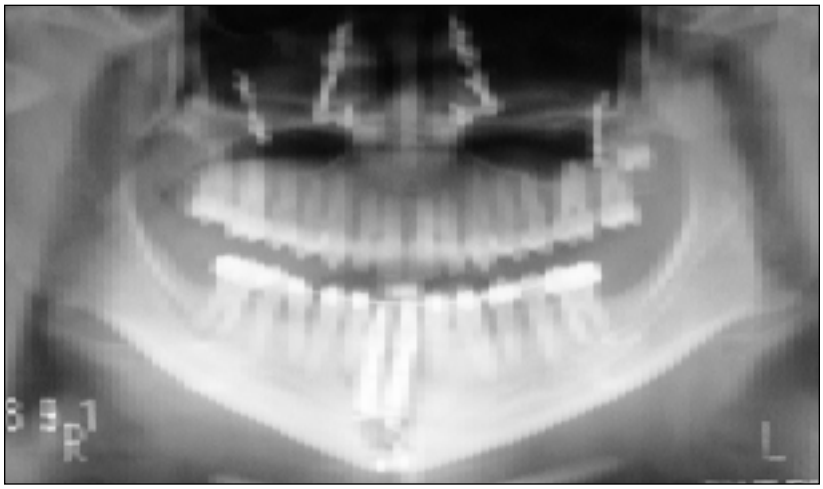


Fig 3c Radiograph indicating segmental repositioning.

crowns that are to be corrected by the surgical implant repositioning. A dental impression is made and casts are poured. They are mounted in an articulator, and cast surgery is performed, placing the segment in the ideal situation. The prosthodontist and surgeon must agree upon the final segment position. A surgical guide is then fabricated.

With the patient under intravenous sedation and prepared and positioned for orthognathic surgery, an incision is made at the depth of the vestibule, avoiding vertical incisions that would limit the blood supply and jeopardize the interdental papillae. A cautious minimal periosteal elevation is carried out to ensure good vascularization to the osteotomized segment. Copious irrigation is used at all times for the osteotomy to avoid bone overheating. A skin hook is used for the vertical osteotomy more than 2 mm away from the implant apex, and a 701 bur in a straight handpiece is used for making the horizontal and vertical cuts. The cuts are finished with a spatula osteotome, and the forefinger is used to protect the soft tissues on the lingual side. Once the segment is freed, it is carefully placed into the occlusal acrylic resin template. Microplates and microscrews (plates 0.6 mm in profile and screws 5 or 7 mm long and 1 mm in diameter) are used to secure the segment in the ideal position and the wound is closed in layers (Fig 3).

Once the segment is adequately fixed, the temporary crowns are removed, the abutments are replaced with healing caps for 4 months of healing, and a temporary prosthesis is fabricated.

Fig 4a Nonrestorable implants.

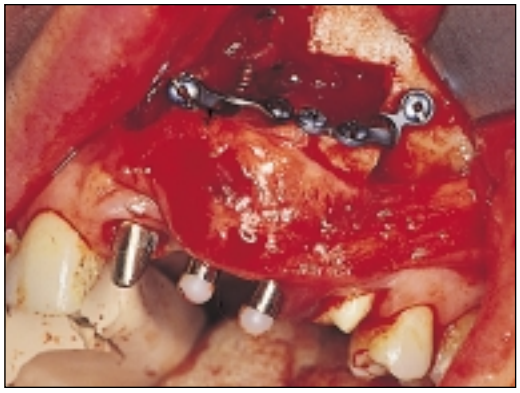


Fig 4b Vertical, transverse, and axial surgical implant repositioning.

Fig 4c Posttreatment intraoral photographs.

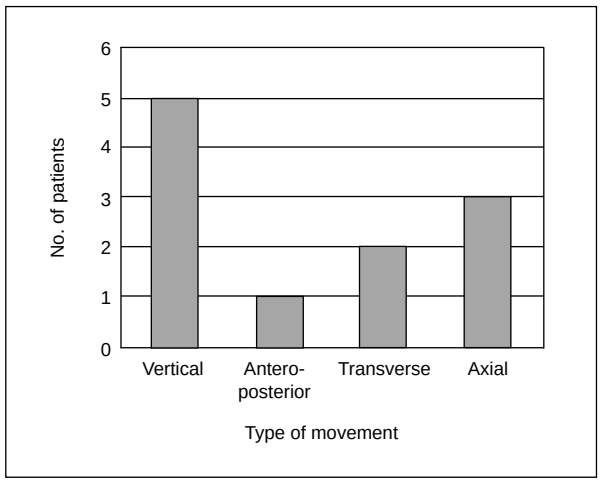


Fig 5 Number of patients and type of movement. In most patients, there was a combination of movement types.

There are 4 possibilities for temporary prostheses at this time: *(1)* a removable restoration; *(2)* crowns incorporated in a Hawley orthodontic retainer; *(3)* orthodontic arch with brackets fixed to a temporary resin tooth; or a *(4)* bonded prosthesis.

Antibiotics, steroids, and analgesics are routinely indicated. Postoperative radiographs are ordered immediately after surgery to check the osteotomies and verify the position of the screws and plate. A new radiograph is obtained 4 months after surgery to follow the bone healing, just before the patient is referred to the prosthodontist for final prosthetic treatment (Fig 4).

Results

Ten implants were surgically repositioned by means of segmental maxillary or mandibular osteotomies and fixed with microplates and microscrews (Table 1). The soft tissue followed the bone level at a 1:1 ratio, mainly because the periosteum was not detached at the cervical region. One year after surgery, there were no positional changes from the immediate surgical result. Five segments were vertically repositioned 1 to 7 mm (mean 4.8 mm), and 3 were axially repositioned (2 superior and 1 inferior). In the first 2, the angle (SN-1) was changed from 110 and 112 degrees to 102 degrees. In the inferior segment the cephalometric incisor inclination varied from 82 to 90 degrees. One segment was moved anteriorly 10 mm (implant in the tuberosity) and 2 had horizontal movement of 2 and 4 mm, respectively (Fig 5).

There were no incidences of necrosis, gingival recession, implant loss, inadequate nasal changes, functional alterations, or postoperative infections. The patients accepted the procedure well, with minimal morbidity and discomfort (Fig 6).

Table 1 Surgical Implant Repositioning

Patients	Age	Sex	Implant position	Type of Movement			
				Vertical	Transverse	Anteroposterior	Axial
1.–Z.V.	28	F	Maxillary left second molar			10 mm	
2.–J.A.	35	F	Maxillary right central incisor, maxillary right lateral incisor	1 mm	4 mm		
3.–M.R.	38	F	Maxillary left lateral incisor, maxillary left canine	7 mm	2 mm		110–102 degrees
4.–L.D.	15	F	Mandibular left central incisor, mandibular right central incisor	6 mm			82–90 degrees
5.–J.G.	36	M	Maxillary right central incisor, maxillary right lateral incisor	5 mm			112–102 degrees
6.–A.C.	15	M	Mandibular left central incisor	5 mm			

Fig 6a Preoperative implant surgery.

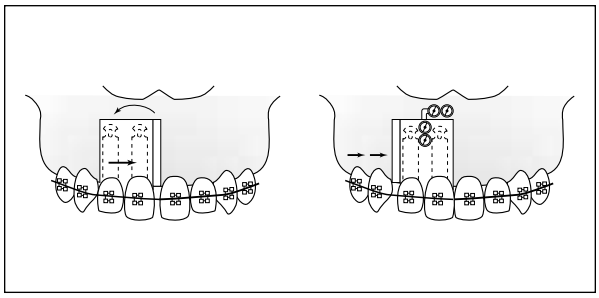
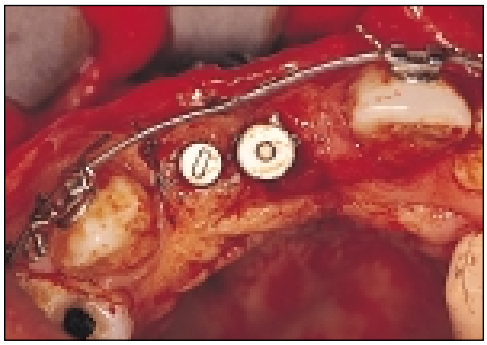
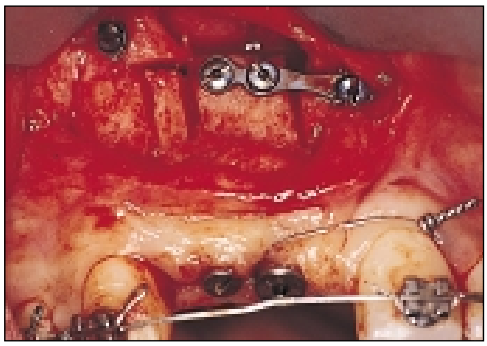


Fig 6b Maxillary surgical implant repositioning was used to vertically and transversely reposition the segment. A medial strip of bone was transplanted lateral to the segment, and plate and screws were used to fixate the bone-implant area.





Figs 6c and 6d Segmental repositioning and plate fixation.

Fig 6e Posttreatment intraoral view of completed restorations.

Two patients showed marked erythema in the maxillary mucosa above the implant level for about 3 months after surgery secondary to bone healing, but the tissue eventually returned to a normal color.

Discussion

Among the different situations in implant surgery, 3 have been particularly challenging: a well-integrated nonrestorable implant, an inadequately inclined implant whose life span after occlusal loading is limited, and a good bone area away from the ideal implant position.

Clinical alternatives for inadequately placed implants include: a high crown-to-root ratio, which limits implant life, sometimes with unesthetic, long crowns; overcontouring the porcelain, which complicates hygiene; silicone removable gingivae, which are uncomfortable and retain food during mastication; 30- to 40-degree abutments with detrimental axial occlusal forces that damage the peri-implant bone and possibly osseointegration; removal of implants and future replacement, if possible; banking the implants; or finally, selecting another prosthetic option.

Surgical implant repositioning using segmental maxillary or mandibular osteotomies and rigid fixation into the ideal position with microplates and microscrews can be an alternative for improving clinical situations that previously have been managed with mediocre results or without implants at all. The procedure requires delicate surgery with minimal stripping of the periosteum to ensure good blood supply to the segment, which promotes faster healing and discourages necrosis, fibrosis, or malunions. Vertical incisions are not used; this enhances the vascularization of the soft tissues and avoids compromising the interdental papillae. The titanium material used for rigid fixation is microsized and placed strategically in a position that does not require postsurgical removal.

The surgery is performed under intravenous sedation in an ambulatory setting to reduce time and costs. A 4- to 6-month bone healing period has been adequate in this patient population, but if any movement of the segment occurs after this period, a longer period of immobilization is indicated and the occlusion should be checked to eliminate any premature contact. Temporary prostheses have been used for the 4- to 6-month healing period; permanent restorations are then fabricated in the conventional manner.

Conclusions

Surgical implant repositioning is a simple, reliable, predictable method of correcting implants that are malpositioned vertically, anteroposteriorly, transversely, or axially. No necrosis, malunions, fibrosis, or infections were seen in this population sample.

The segments were stripped only minimally to enhance vascularization, and surgery was performed under copious irrigation to avoid bone overheating. All patients were managed under intravenous sedation in an ambulatory setting.

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