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Aesthetic improvement by conventional orthodontic devices following segmental osteotomy in the treatment of mal-positioned implants –Technical note-

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Abstract

Correction of implant position after an implant had been fixed with alveolar bone has at times been necessary. Generally, alveolar bone augmentation using bone graft or distraction osteogenesis is performed at first. However, the use of orthodontic device after segmental osteotomy including single implant has made it possible to reposition malaligned osseointegrated endosseous implant into a more favorable and biomechanical position. After osteotomy, segments including implants could be moved 3 dimensionally using orthodontic treatment devices. At the same time vertical and horizontal bone regeneration and an esthetic gingival shape could be obtained. These findings suggest that this method is very useful for improving the shape and position of implants including the surrounding alveolar bone.

Key words:

orthodontic, segmental osteotomy, implant

Introduction

Resorption or mal-positioning of a residual alveolar bone ridge hinders ideal implant placement. When there is vertical bone loss, an implant is positioned more apically, resulting in aesthetic and biomechanical complications such as elongated clinical crowns. However, there are some techniques for bone augmentation that can be used to resolve this problem. The crestal split technique is efficient in lateral widening but not vertical augmentation.¹ The onlay bone graft or guided bone regeneration (GBR) technique is especially useful for augmenting ridge width but, to some extent, has limited advantages in increasing ridge height.²⁻⁵ The various bone graft techniques can lead to wound dehiscence, infection, and possibly total failure of bone graft due to lack of appropriate soft tissue coverage in those traumatized areas.¹⁻⁶ On the other hand, distraction osteogenesis (DOG) is another recently proposed principle with significant advantages in increasing bone height^{7,8} but occasional complications and expensiveness of the commercial device sometimes hinder the general acceptance of its clinical use.⁹ Implantation of fixtures after such bone augmentation had been achieved was desirable. However, if the implant is placed in an inappropriate position, it may be unrestorable.^{10,11} The endosseous dental implant has no periodontal ligament like the ankylosed tooth and so cannot be repositioned by orthodontic treatment. The dento-alveolar osteotomy was designed to correct a malpositioned dental unit that could not be treated orthodontically.¹²⁻¹⁵ The purpose of this report was to describe a technique for the correction of malpositioned endosseous implants by anterior dento-alveolar osteotomy with conventional orthodontic devices.

Case 1

A healthy 36-years old male presented for evaluation of a malpositioned dental implant with mandibular prognathia. Two endosseous implants had been placed in the region of the previously extracted maxillary central incisors and left lateral incisor. If the final prosthetic treatment was performed, the patient would not be able to accept the unsightly appearance of the anterior teeth due to a long crown height. However, this patient wanted to correct the mandibular prognathia at the same time, thus, a comprehensive dental treatment including orthodontic treatment and orthognathic surgery had to be planned.

Preoperatively, two abutments were placed on the implants, and temporary crowns of the maxillary central incisors and left lateral incisor were made in accordance with the crown height of the right lateral incisor. Orthodontic brackets were also fixed at the labial aspect of the temporary crowns.

Bilateral sagittal split ramus osteotomy was performed under general anesthesia. The setback amount was right 7 mm and left 7 mm and rigid fixation with titanium plates were carried out. The anterior overlapping region of the proximal segment between the segments was harvested to graft the space of the anterior segmental region.

Segmental or dento-osseous osteotomy following a gingival margin (full-thickness intrasulcular) incision along the anterior teeth and implants, involve canines from the labial side that are positioned to hide the subsequent scars. No palatal incision was made to preserve the palatal blood supply.

The vertical osteotomy and horizontal osteotomy were carried out buccally and labially with a sagittal saw. The horizontal osteotomy line was determined under the anterior nasal spine. The hard palatal region of the maxillary anterior segment was fractured with a curved osteotome from the anterior site. Following complete and adequate mobilization of the maxillary anterior segment, the segment was aligned 4 mm toward the lower position and held in the desired position with a pre-formed squared arch wire tied to multi-brackets with ligature wires and an elastic power-chain. Rigid bone fixation by titanium plate was not used. The harvested bone was grafted into the space of the upper region of the segment. After the flap was repositioned, suturing was carried out securely at every inter-dental region.

Immediately after surgery, elastic traction was performed using the surgical hooks attached to the main orthodontic wire, although inter-maxillary fixation was not performed. The purpose of the elastic traction was not only to provide stability of the mandible, but also to pull down the anterior segment of the involved implants continuously. Finally, approximately 6 mm of movement of the segment was obtained.

After 1 year, the orthodontic treatment was completed and osseous healing could be recognized at the maxillary anterior region as well as the mandibular ramus region. The final prosthetic treatment of the implants including gingival tissue was satisfactory esthetically and facial skeleton and occlusion were stable.

Case 2

A 70-year-old female was referred for evaluation and treatment of malpositioned endosseous implants. Three implants were placed at the region of the right canine and premolar. The anterior implants at the region of the canine and premolar were inclined with straight abutments buccally and the patients showed class II deep-bite tendency. When the final prosthetic treatment was performed, the right canine and premolar were also positioned buccally and the lower canine and premolar were positioned lingually so that the ideal occlusion could be obtained.

Preoperatively, straight abutments were fixed and temporary crowns were made. An orthodontic band was fixed on the most posterior implant of the right maxilla and temporary crowns of the left maxillary canine and premolar were used as anchors of the palatal arch wire.

Dento-alveolar osteotomy was performed, following a gingival margin (full-thickness intrasulcular) incision along the implants, under local anesthesia. The vertical osteotomy and horizontal osteotomy were carried out buccally and labially with a sagittal saw. The hard palatal region of the maxillary anterior segment was fractured with an osteotome from the anterior site. Following complete and adequate mobilization of the maxillary anterior segment, the segment was aligned more towards the palatal side and moved to the desired position gradually using a pre-formed squared arch wire tied to multi-brackets with ligature wires. After healing of the gingival mucosa completed, two implants were pulled more towards the palatal side using a ligature wire with a lingual arch that had been prepared in advance. After 3 months, bone healing was recognized, and the final prosthetic treatment was performed.

Desirable occlusion could be established at the right canine and premolar, and esthetic gingival tissue could be also obtained.

Discussion

Correction of dentofacial deformities by surgical-orthodontic approaches has become common. For segmental and dento-osseous osteotomies, many articles have described various surgical techniques, case reports, and animal studies confirming the vitality and uneventful healing of the segments involved, as well as the predictable function and esthetic results of surgery¹²⁻¹⁹. Anterior segmental osteotomies have been used to release and reposition impacted ankylosed maxillary canines, close single-tooth diastemas, and close multiple-tooth diastemas.

Warden and Scuba have reported on the successful use of this orthognathic approach in the correction of malpositioned dental implants.²⁰ In their method, corticocancellous bone harvested from the genial region was placed over the segment to restore the contour of the piriform rim, after the segment containing the implant was repositioned. In the report of Kassolis et al.,²¹ after the segment containing the implant was repositioned and fixed with a cast-metal fused-to-porcelain superstructure and semifinal cement, a mixture of freeze-dried bone allograft (FDBA) and platelet rich plasma (PRP) was used to fill the voids secondary to site preparation. In the report of Martin et al., stabilization of the segment was achieved by fixing the removal partial denture (RPD) with interdental wires. In these reports, bone graft or some alternative

material were used to fill the space made by the repositioning of the segment and to fix the segment.

Success of the segmental osteotomy is critically dependent on optimal preservation of blood supply to the mobilized alveolar segment. Therefore, periosteal attachment to a mobilized segment is preserved wherever possible. Regardless of surgical design, assurance of adequate collateral circulation to the segmented portion is considered essential. Ahmed described the Cuper technique, which included elevation of a mucoperiosteal flap to accomplish the buccal osteotomies, whereas selective tunneling was used to establish the palatal osteotomies with minimal disruption to blood supplies. In most of the cases in the previous report and the present cases, gingival sulcular incision and full-thickness mucoperiosteal flap elevation were made from the buccal or labial side without elevation of the palatal flap. Therefore, the amount of movement of the segment was limited because of the tensile stress of the palatal gingival tissue, if the blood supply from the palatal side was preserved.

On the other hand, distraction osteogenesis is a well-documented procedure based on sound biologic principles, and its effectiveness has been proven over time.^{7,8} Conventional bone distractors with plate and screw-retained activated devices cause discomfort to patients. The vertical portion of such devices emerges from the oral mucosa and is difficult to cover; evidence of exposure through the perioral tissues has also been documented.^{22, 23}

Gotta et al.,²⁴ demonstrated a surgical technique that allows the use of distraction osteogenesis in combination with conventional orthodontic treatment to get 3mm movement of the segment. They stated that the possibility of generating distracting

forces by means of implants and orthodontics substantially improves patients comfort during the distracting period. Moreover, as opposed to conventional alveolar distractors, which are univectorial, the technique is multi vectorial and allows for buccal movement, reducing bodily movement of the block and even correction of the implant's axial position by torquing it.

In case 1, movement amount of anterior maxillary segment containing implants was approximately over 6 mm so that palatal gingival tissue could not stretch during operation. Although harvested bone from the mandibular ramus was grafted, the subsequent continuous inter-maxillary traction and orthodontic force enabled a successful vertical movement of the segment, and stretch of the surrounding gingival tissue. In case 2, the inclination of the implant was changed by segmental osteotomy. The most distal implant at the right maxillary molar and palatal arch played an important role in forming a rigid anchor. The continuous traction to the palatal arch could incline the implant in the segment to the palatal side. This movement allowed a favorable postoperative occlusion, without removal of the implant.

In conclusion, movement of segments that involves the implant using a conventional orthodontic device following segmental osteotomy was very useful to improve the shape and position of implants including the surrounding alveolar bone.

References

- 1) Palti A. Ridge splitting and implant techniques for the anterior maxilla. *Dental Implantol update* 2003; 14; 25-32.
- 2) Keller EE, Tolman DE, Eckert S. Surgical-prosthetic reconstruction of advanced maxillary bone compromise with autogenous onlay block bone grafts and osseointegrated endosseous implants: a 12-year study of 32 consecutive patients. *Int J Oral Maxillofac Implants* 1999; 14: 197-209.
- 3) Verhoeven JW, Cune MS, Terlouw M, Zoon MA, de Putter C. The combined use of endosteal implants and iliac crest onlay grafts in the severely atrophic mandible: a longitudinal study. *J Oral Maxillofac Surg* 1997; 26: 351-7.
- 4) Astrand P, Nord PG, Branemark PI. Titanium implants and onlay bone graft to the atrophic edentulous maxilla: a 3-year longitudinal study. *Int J Oral Maxillofac Surg* 1996; 25: 25-9.
- 5) Simion M, Jovanovic SA, Tinti C, Benfenati SP. Long-term evaluation of osseointegrated implants inserted at the time or after vertical ridge augmentation. A retrospective study on 123 implants with 1-5 year follow-up. *Clin Oral Implants Res* 2003; 12: 35-45.
- 6) Oikarinen K, Kainulainen V, Kainulainen T. A method harvesting corticocancellous bone chips for reconstructive maxillofacial surgery. *Int J Oral Maxillofac Surg* 1997; 30: 510-7.
- 7) Block MS, Chang A, Crawford C. Mandibular alveolar ridge augmentation in the dog using distraction osteogenesis. *J Oral Maxillofac Surg* 1996; 54: 309-14.

- 8) Block MS, Almerico B, Crawford C, Gardiner D, Chang A. Bone response to functioning implants in dog mandibular alveolar ridges augmented with distraction osteogenesis. 1998; 13: 342-51.
- 9) Saulacic N, Zix J, Iizuka T. Complication rates and associated factors in alveolar distraction osteogenesis: a comprehensive review. *Int J Oral Maxillofac Surg* 2009; 38: 210-7.
- 10) Guerrero C. Esthetic implant surgical repositioning. *J Oral Maxillofac Surg* 1996; 54: 75.
- 11) Svensson B, Adell R, Swartz B. Correction of malalignment by segmental osteotomy: A case report. *Int J Oral Maxillofac Implants* 1993; 8: 459-463.
- 12) Bell WH, Condit CL: Surgical-orthodontic correction of adult bimaxillary protrusion. *J Oral Surg* 28: 578, 1970
- 13) Bell WH, Dann JJ: Correction of dentofacial deformities by surgery in the anterior part of the jaws. *Am J Orthod* 64: 162, 1973
- 14) Burke JL, Provencher RF, McKean TW: Small segmental and unitooth osteotomies to correct dentoalveolar deformities. *J Oral Surg* 35: 453, 1977
- 15) Epker BN, Paulus PJ: Surgical-orthodontic correction of adult malocclusions: Single tooth dento-osseous osteotomies. *Am J Orthod* 74: 551, 1978
- 16) Hall D, West R: Combined anterior and posterior maxillary osteotomy. *J Oral Surg* 34: 126, 1976
- 17) Kent JN, Hinds EC: Management of dentofacial deformities by anterior alveolar surgery. *J Oral Surg* 29: 13, 1971

- 18) Merrill R, Pedersen G: Interdental osteotomy for immediate repositioning of dental-osseous elements. *J Oral Surg* 34: 118, 1976
- 19) Peterson LJ: Immediate surgical closure of multiple maxillary diastema. *J Oral Surg* 31: 522, 1973
- 20) Warden PJ, Scuba JR: Surgical repositioning of a mal-posed, unserviceable implant: Case report. *J Oral Maxillofac Surg* 2000; 58: 433-435.
- 21) 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.
- 22) Martin RJ, Goupil MT, Goldschmidt M: Single-implant segmental osteotomy: A case report. *Int J Oral Maxillofac Implants*. 1998; 13:710-712
- 23) Ahmed MM. Long-term stability of anterior segmental maxillary osteotomy. *Int J Adult Orthodon Orthognath Surg*. 1999; 14: 297-303.
- 24) Günbay T, Koyuncu BO, Akay MC, et al. Results and complications of alveolar distraction osteogenesis to enhance vertical bone height. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2008; 36: 6-10.
- 25) Mazzonetto R, Allais M, Maurette PE, Moreira RW. A retrospective study of the potential complications during alveolar distraction osteogenesis in 55 patients. *Int J Oral Maxillofac Surg* 2007; 36: 6-10.
- 26) Gotta S, Sarnachiaro GO, Tarnow D. Distraction osteogenesis and orthodontic therapy in the treatment of malpositioned osseointegrated implants: A case report. *Pract Proced Aesthet Dent* 2008; 20; 401-405.

Legend

Fig.1a Pre-operative occlusion. Maxillary incisors were covered by temporary crowns.

Fig.1b Intra-operative finding. Harvested bone from mandibular ramus was grafted between the maxillary anterior segment and bone of nasal floor.

Fig.1c Post-operative occlusion after the final prosthetic treatment.

Fig.2a Pre-operative occlusion. Abutments of implants at the right maxillary pre-molar inclined to the buccal side.

Fig.2b Intra-operative finding. Two alveolar segments containing implants were made

Fig. 2c Immediately after operation. Two alveolar segments containing implants were fixed with orthodontic devices.

Fig.2d The inclination of the straight abutments improved.

Fig.2e Post-operative occlusion after final prosthetic treatment.



Fig. 1a

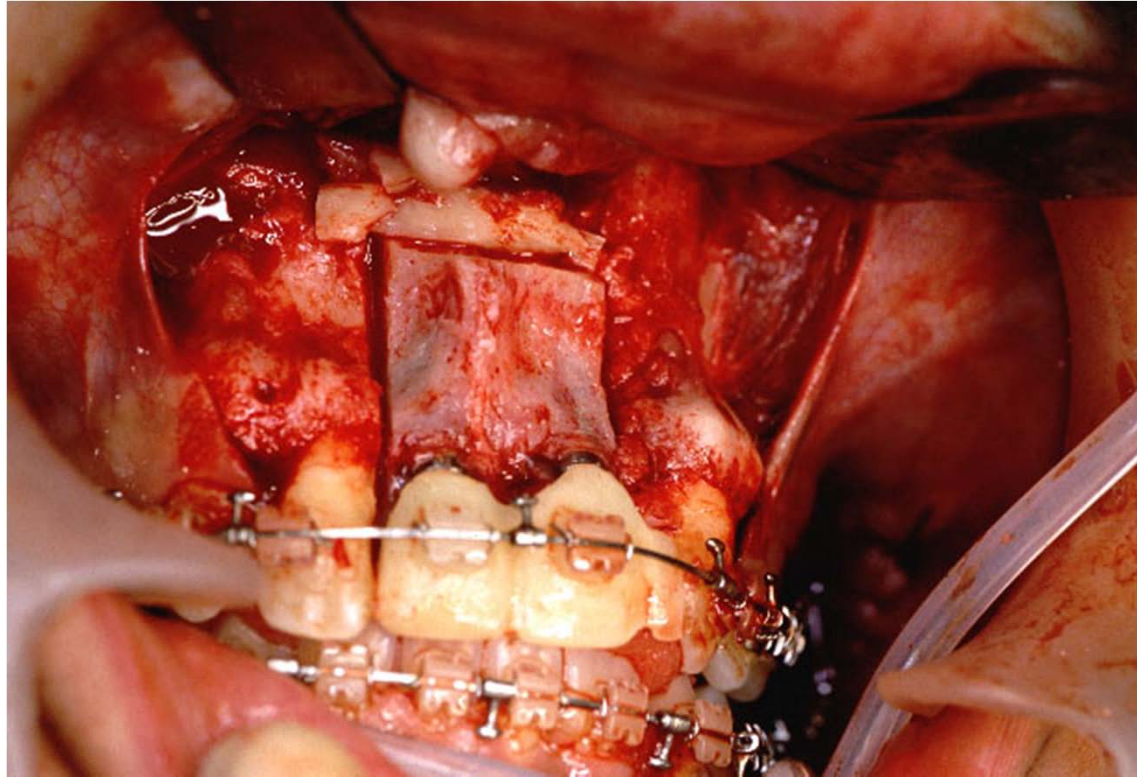


Fig. 1b



Fig. 1c



Fig. 2a

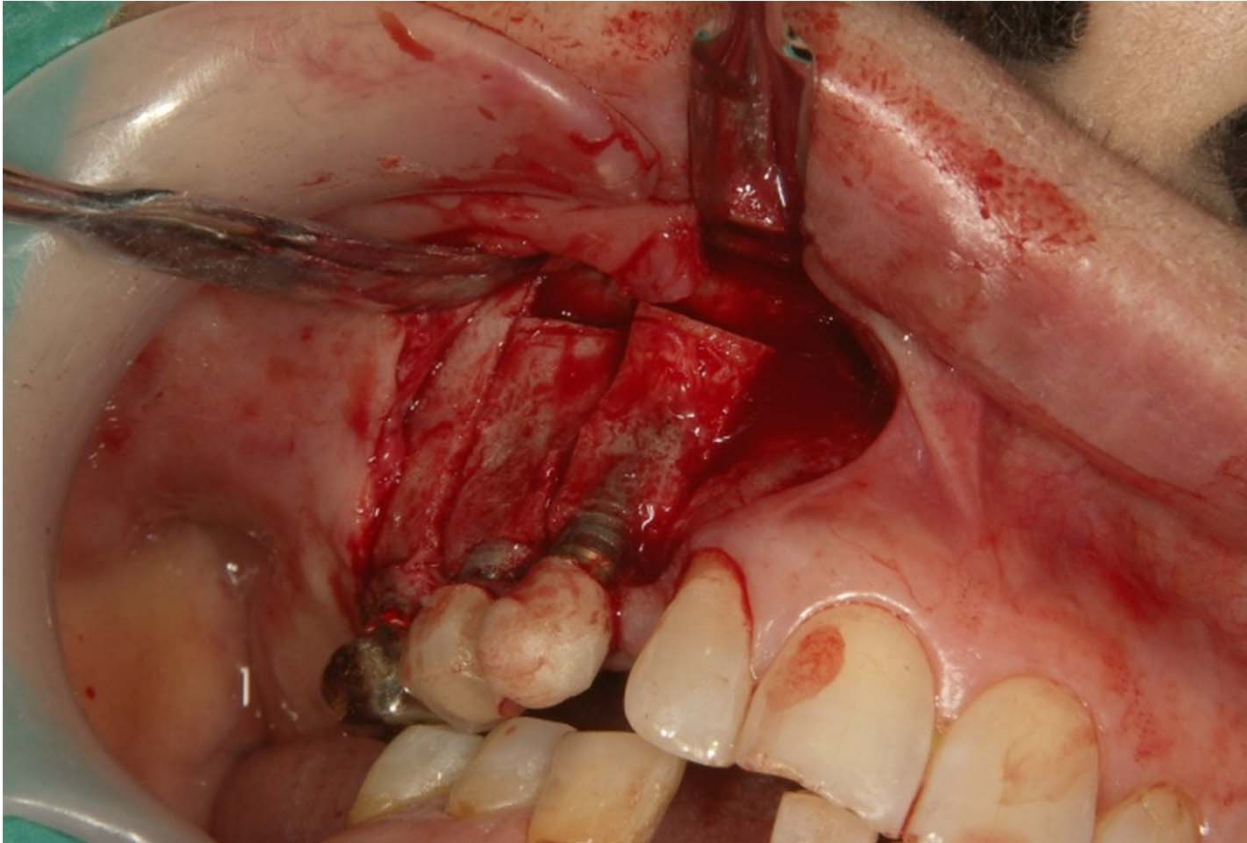


Fig. 2b



Fig. 2c



Fig. 2d



Fig. 2e