Nonsurgical Management of Bilateral Mandibular Fractures Associated with Dental Implants: Report of a Case

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A case is presented in which bilateral fractures of the mandible occurred following placement of endosseous dental implants. The management, with approximately 7 years of follow-up, is described and the potential causes of such fractures and their treatment are discussed. INT J ORAL MAXILLOFAC IMPLANTS 2003;18:739–744

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Despite the large number of endosseous dental implants that have been placed over the years, only 10 cases of mandibular fracture following implant placement have been reported in the American literature.[1–7] Although not a commonly reported occurrence, it is a serious complication that needs to be considered, particularly in persons with an atrophic mandible. Therefore, it is important to understand the factors that can potentially contribute to such incidents so that they can be avoided. Moreover, it is also important to know how to treat such patients. However, because of the paucity of cases reported and the variations in how they were treated, it is difficult to determine the best way in which such fractures should be managed. The following report describes an unusual case of bilateral mandibular fracture that was successfully treated nonsurgically without implant removal. The potential causes of such fractures and their treatment are also discussed.

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CASE REPORT

The patient, a 57-year-old woman, presented on July 17, 1994, complaining of difficulty in wearing a mandibular partial denture and desiring dental implants. Her past medical history was unremarkable except for having cerebral palsy since birth. In June 1993 she had undergone a bilateral sagittal split osteotomy (BSSO) and setback for mandibular prognathism.

Clinical examination revealed that the patient was edentulous posterior to the mandibular canine on the right and the first premolar on the left. There appeared to be adequate width of the alveolar process for implants, but insufficient height. This was confirmed radiographically (Fig 1). The need for transposition of the inferior alveolar nerve was discussed with the patient and subsequently with her general practitioner.

The patient returned on October 7, 1994, stating that she had discussed the treatment options with her dentist and had decided to proceed with the nerve transposition and simultaneous implant placement. This procedure was performed on February 23, 1995. Under general anesthesia, a crestal incision was made from the right retromolar region anteriorly to the medial aspect of the canine, where an oblique releasing incision was made. A mucoperiosteal flap was reflected buccally and the mental nerve was identified and freed from the surrounding

Fig 1 Preoperative radiograph showing the bilateral edentulous areas in the mandible. Note the proximity of the screws used to fix the osteotomy on the left side to the proposed implant site.

soft tissues. A 701 fissure bur under saline irrigation was then used to decorticate the inferior alveolar nerve. This was initiated by freeing the mental nerve from the foramen and then removing a cortical block measuring approximately 1×3 cm extending posteriorly. The underlying cancellous bone was removed, freeing the inferior alveolar nerve, which was retracted laterally. A surgical template was inserted and a 15-mm-long, 4-mm-wide Calcitek Omnilok implant (Sulzer Medica, Carlsbad, CA) was placed distal to the canine, and a 10-mm-long, 3.5-mm-wide Calcitek Omnilok implant was placed in the first molar region. The defect was filled with particulate freeze-dried bone and covered with Vicryl mesh (Ethicon, Sommerville, NJ). The inferior alveolar nerve was then repositioned laterally, and the mucoperiosteal flap was approximated with interrupted 4-0 Vicryl mattress sutures and a continuous 4-0 Vicryl suture (Ethicon).

A similar incision was then made on the left side. The mucoperiosteal flap was reflected and the mental nerve was identified and freed. Because it appeared that the 2 anterior screws that had been placed for fixation of the BSSO might interfere with implant placement, they were removed. The inferior alveolar nerve was then exposed and lateralized in the same manner as on the right side. A 15-mm-long, 3.25-mm-wide Calcitek Omnilok implant was then placed in the second premolar region and a 13-mm-long, 3.25-mm-wide implant was placed in the second molar region. The anterior implant was noted to extend through the inferior border of the mandible. Freeze-dried bone and Vicryl mesh were placed prior to reapproximation of the mucoperiosteal flap.

The patient was seen postoperatively on February 28, 1995, at which time the incisions were healing normally and there were no signs of wound dehiscence. The patient had been wearing the mandibular partial denture and was advised to stop its use. She was given an appointment for follow-up in 3 weeks. At that time, the incisions were healed and the patient was given an appointment for 2 months later. However, on March 21, 1995, approximately 1 month postoperatively, the patient returned complaining of bilateral pain and swelling in the region of the antegonial notch of 10 days duration. Her dentist had placed her on amoxicillin, 250 mg 4 times daily, 8 days previous. Extraoral examination revealed small, firm, nontender areas of submandibular swelling bilaterally. Intraorally, there was no evidence of inflammation or swelling at the implant sites. A panoramic radiograph revealed a fracture on the right side (Fig 2a). No fracture was evident on the left side, but there appeared to be slight resorption of the cortex at the site where the anterior implant penetrated the inferior border of the mandible. Manipulation of the mandible did not reveal any preternatural movement at the fracture site and the occlusion was unaltered and repeatable. The patient was advised to eat a soft diet and apply moist heat bilaterally, and she was continued on amoxicillin, 250 mg 4 times daily, for 1 week.

The patient was again seen on May 19, 1995 (approximately 3 months postoperatively), at which time there was no evidence of extraoral swelling and the surgical sites had healed normally. However, the panoramic radiograph (Fig 2b) now showed that there had also been a fracture on the left side that was either undetected on March 21, 1995, or had occurred since that visit. The radiograph also showed increased radiolucency around the right posterior implant. Clinically, there were no symptoms on either side and no preternatural movement was detected.

The patient was again seen on July 21, 1995 (approximately 5 months postoperatively). Clinically she was asymptomatic. The panoramic radiograph (Fig 2c) showed healing of the bilateral fractures and decreased radiolucency around the right

Fig 2a Panoramic radiograph showing a fracture associated with the posterior implant on the right side *(arrow)*. The left side appears intact.

Fig 2b Panoramic radiograph showing a fracture of the mandible associated with the anterior implant on the left side.

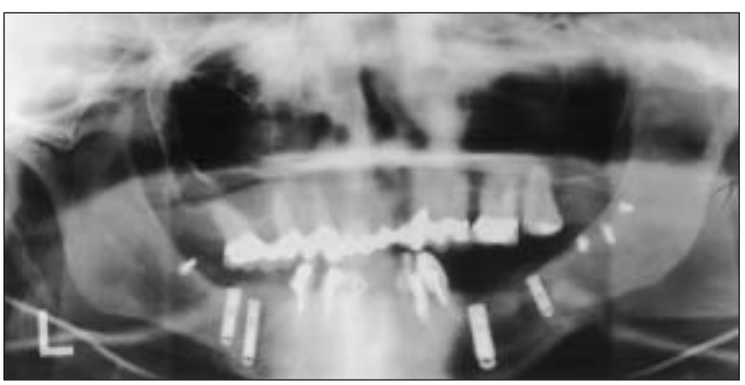

Fig 2c Panoramic radiograph showing callus formation in the fracture sites.

posterior implant. The patient was scheduled for uncovering of the implants 2 months later.

On September 26, 1995, the 4 implants were uncovered using crestal incisions and healing caps were placed (Fig 3). Clinical examination and percussion indicated that the implants were osseointegrated. The patient was given an appointment for examination in 1 week. However, 2 days later she reported that an implant had come out while she was sleeping. She was told it was probably the healing cap and was asked to come in for an examination the following day and to bring the healing cap with her. At that time it was evident that the anterior implant on the left side had exfoliated. The incisions were healing normally and there was no evidence of infection. The patient was reappointed for evaluation on October 11, 1995, at which time healing was still progressing normally. When seen again on November 21, 1995, the remaining implants were still integrated and the patient was referred to her dentist for their restoration (Fig 4).

The patient was not seen again until May 12, 1998, approximately 3 years after implant placement. Bilateral fixed prostheses had been placed, and these were clinically stable (Figs 5 and 6). There was no gingival inflammation around the implants. The patient was placed on a yearly recall and was last seen on April 9, 2002, approximately 7

Fig 3 Panoramic radiograph showing the healed fracture sites and the healing caps on the 4 implants.

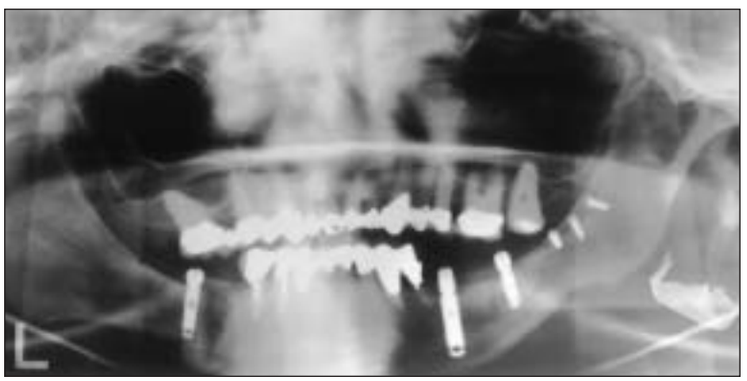

Fig 4 Panoramic radiograph taken approximately 9 months after placement, at the time the patient was referred for restoration of the 3 remaining implants.

Fig 5 Panoramic radiograph showing restoration of the implants. Note the remodeling of the fracture sites.

years postoperatively. At that time, radiographically the implants appeared to be integrated and the fracture sites had remodeled so that the mandible had a normal contour (Fig 7). The prostheses were stable and there was no gingival inflammation.

DISCUSSION

There are a number of factors that could potentially contribute to mandibular fractures associated with endosseous dental implants. These include: *(1)* decreased bone mass, particularly when the patient is also osteoporotic; *(2)* stress concentration at the implant site; and *(3)* external trauma.[2,3] In the atrophic mandible, with its already reduced bone mass, the implant site causes a further weakening of the region prior to the time that osseointegration occurs. Thus, although it is generally recommended that implants with maximum length and width be used, such sites have the greatest potential for fracture. Moreover, it is also recommended that implants be placed in the inferior cortex of atrophic mandibles to obtain maximum stabilization.[2] However, the strongest area of the atrophic mandible is weakened when the inferior cortex is penetrated. The importance of maintaining as much bone as possible in the implant site is emphasized by the fact

Figs 6a and 6b Clinical views of the implant restorations.

Fig 7 Panoramic radiograph showing the restored implants approximately 7 years following placement.

that 5 mandibular fractures have been reported in the healing period following implant removal.[3,7]

Because of the difference in the modulus of elasticity between an implant and the surrounding bone, stresses tend to concentrate in the region of the implant. Because of the reduced bone mass, there is also greater stress per unit area, especially prior to osseointegration. Thus, a fracture may occur even under conditions of relatively normal function and especially when there is external trauma.

Osteoporosis also makes an already atrophic mandible even weaker. The importance of this factor is indicated by the fact that 8 of the 10 reported fractures were in postmenopausal women.[1–7] The 2 exceptions were a man in whom the bone mass had been reduced by surgical transposition of the inferior alveolar nerve[6] and a 10-year-old girl in whom 7 implants were placed in a bone graft.[2] In the latter patient there was not only reduced bone mass, but also multiple implant sites, another factor that reduces the ability of the mandible to withstand functional stresses.

A number of the factors previously discussed can be implicated in the etiology of the fractures in the present patient. Although the mandible was not extremely atrophic, there had been some loss of mandibular width as a result of orthognathic surgery. Moreover, the patient was 57 years old, and therefore osteoporosis may have been present. Also, the already narrowed mandible was obviously further weakened by the bone removal associated with inferior alveolar nerve transposition. A similar situation was reported by Kan and coworkers.[6] In their case, the patient was allowed to wear his dentures 2 weeks following surgery, and in the present case the patient also wore her mandibular partial denture postoperatively. The fracture occurred approximately 1 month postoperatively, a time when there was still incomplete osseointegration and therefore a weakened implant site. Of the 10 reported cases, 5 occurred 3 to 4 weeks after implant placement.[3–7] In retrospect, all of these factors made this patient a good candidate for a potential mandibular fracture.

Because of the relatively small number of cases reported, there is still no consensus regarding the best way to manage postoperative fractures associated with endosseous dental implants. Treatments have ranged from leaving the implant in place and using antibiotics and a soft diet[2,3] or acrylic resin

splints,[2] to implant removal and closed[2–4] or open reduction and fixation,[2,6] including bone grafting.[7] Shonberg and associates[4] have suggested that the following factors should be considered when deciding whether to retain an implant in the line of fracture: *(1)* importance of the implant to the treatment plan, *(2)* the type of fracture (open or closed) and presence or absence of infection, and *(3)* mobility or immobility of the implant. Because most of these fractures occur after the mucosal incisions have healed, the implants are usually not exposed to the oral cavity and therefore are not infected. The submucosal location makes it impossible to determine whether the implant is mobile. However, despite the proximity of these fractures to the implant, it is probably safe to assume that most are still relatively stable. Thus, it is the degree of displacement of the fracture that should be the crucial factor in determining the treatment of choice.

When there is minimal or no displacement and relatively little mobility of the fracture, the implant should usually be maintained and the patient treated with a soft, non-chewy diet and antibiotics to prevent infection. If there is significant displacement, treatment should be based on whether or not closed reduction is possible. When there are sufficient teeth for establishing maxillomandibular fixation, or if splinting can be accomplished, closed reduction should be done and the implant retained. When this is not possible, the fracture will need to be treated by open reduction. However, if the implant is not displaced and exposed to the oral cavity, it should be left in situ and allowed to integrate if it is important for the treatment plan.

The present case is unique in that it is the only one reported in which bilateral fractures of the mandible have occurred. Because there were no teeth in the proximal segments and no mobility of the fractures, treatment with antibiotics and a soft diet alone was possible. Although 1 implant was eventually lost, successful restoration still occurred. This result and those reported by other authors using nonsurgical[2,3] and surgical management[3] indicate that implant removal is not always a necessary component of the treatment. They also indicate that all patients do not require management by open reduction and fixation.

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