Peri-implant Bone Loss: Management of a Patient

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This clinical report presents the prosthodontic management of early peri-implant bone loss in a partially edentulous patient. Two narrow Brånemark implants (3.3 mm in diameter) were placed to retain a mandibular implant prosthesis in the area of the mandibular left second premolar and first molar. Two weeks after the prosthesis was put into function, the distal implant exhibited soft tissue reactions. Radiographically, bone corresponding to 4 threads and 7 threads was lost at the mesial and distal sites, respectively. After occlusal load reduction was made to the existing prosthesis, bone was observed to have regenerated sufficiently to restore the defect radiographically, though not to the original level. The bone remained at a similar level at 36 months after treatment. (INT J ORAL MAXILLOFAC IMPLANTS 2001;16:273–277)

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Osseointegrated implants have been used successfully in the treatment of edentulous patients, with predictable long-term results.1,2 Studies have indicated that comparable results can be obtained in treating partially edentulous patients, both in short-term3–6 and long-term perspectives.7–9 The high success rate depends on careful patient selection and treatment planning.

However, complications are not uncommon. Various categories of complications have been described by a number of investigators.1,10,11 Soft tissue reactions were reported to be associated with 2% of the implants in one survey12 and 21% of the treated arches in another.13 In a retrospective study by Lekholm and coworkers, 107 of 285 implants showed various amounts of bone loss; 8 implants had lost up to the fifth thread by the first annual check-up.14 The authors suggested that the different degrees of bone resorption must have occurred during the first year in function, rather than as a result of progressive remodeling. This was substantiated by a classic study, which emphasized that most failures occurred within the first year of implant placement.1

In the following clinical situation, early peri-implant bone loss was suspected to be the result of overloading. The prosthesis was modified to reduce occlusal loading, and bone regeneration was observed radiographically.

PATIENT REPORT

A healthy 31-year-old male attended the university hospital and requested replacement of the missing teeth in his left mandible. The teeth (mandibular left second premolar and first molar) had been extracted 12 years previously because of nonrestorable caries. The edentulous ridge had been graded as 3 and B, respectively, at both sites.15 The widest part of the ridge measured 4 mm. Standard-sized implants of 3.75-mm diameter were therefore not applicable. A periapical radiograph of the site showed no existing bone pathology (Fig 1).

Two 10-mm Brånemark System implants (Mk II, 3.3-mm, Nobel Biocare, Göteborg, Sweden) were placed in the area of the second premolar and first molar. The surgical procedure was carried out according to standard Brånemark System protocols.1 The surgery was uneventful.
After a 10-month undisturbed healing period for osseointegration to occur, the implants were exposed, and MirusCone abutments (Nobel Biocare) were fitted on both implants with a torque of 20 Ncm. A periapical radiograph was taken to verify the seating of the abutments to the implants (Fig 2a). It also revealed that the bone level was above the first thread at the mesial and distal aspects of both implants. No radiolucency was observed around the implants. A 2-unit porcelain-fused-to-metal restoration was fabricated. Passivity of fit was checked clinically and the prosthesis was screwed into place (with a torque of 10 Ncm) following standard prosthodontic procedures (Fig 2b).

At the first follow-up appointment, 2 weeks after prosthesis connection, it was noticed that the gingiva peripheral to the mandibular molar replacement appeared severely inflamed and granulomatous (Fig 3a). Bleeding on probing was detected, and the probing depth was 6 mm at all sites around the involved implant. In spite of this, plaque accumulation was minimal. The gold screws were tight and the prosthesis was not mobile. Radiographic examination revealed a crater-like radiolucency at the coronal portion of this implant (Fig 3b). The radiolucency involved 4 threads and 7 threads at the mesial and distal sites, respectively (Fig 3b). The implant replacing the mandibular premolar was relatively unaffected.

The prosthesis was temporarily removed and healing screws were placed. A course of clindamycin was prescribed (150 mg daily for 1 week). The patient was also instructed to rinse daily with chlorhexidine.

When soft tissue healing was achieved, the original prosthesis was re-inserted after the occlusal table was adjusted to a smaller buccolingual dimension. Additionally, the occlusion was adjusted so that there were only light contacts of opposing teeth with the prosthesis (Fig 4a). The gingival condition...
was maintained at a satisfactory level on subsequent review appointments. A periapical radiograph, taken 1 year after re-insertion of the implant prosthesis, showed that bone had refilled the defects (Fig 4b). However, 2 threads were lost at the distal site and 1 at the mesial. The bone remained at the same level at the 4-year annual checkup (Fig 5).

DISCUSSION

Bone loss at the coronal portion of the implant is one of the first signs of peri-implantitis. This phenomenon could be caused by microdamage in the bone that exceeded its repair potential, leading to replacement of the bone-implant interface with a soft tissue layer.17 Crater-like peri-implant bone loss is believed to happen during the period when fracture is occurring and is a reaction to percolation of inflammatory infiltrate from repeated micro-openings of initial

Fig 3a  After removal of the prosthesis, the gingiva surrounding the first molar implant appeared red and swollen.

Fig 3b Two weeks after implant prosthesis placement, crater-like bone loss was evident at the first molar implant.

Fig 4a The modified implant prosthesis was replaced, with the lingual aspect reduced and the occlusion adjusted.

Fig 4b Radiograph taken at 12 months after modification of the implant restoration. Radiolucency at the previous defect sites was not seen.

Fig 5 Radiograph obtained after 48 months, following re-seating of the modified restoration.
fatigue cracks.\textsuperscript{18} It may continue to the stage where osseointegration is lost or the implant fractures. As a consequence, such an implant would be indicated for removal.

The cause of peri-implant bone loss can be multifactorial. Bacterial infection and biomechanical overloading have been suggested to be the 2 major etiologic factors associated with resorption of crestal peri-implant bone tissue,\textsuperscript{1,7,18–20} although proof of etiologic factors associated with resorption of crestal overloading have been suggested to be the 2 major removal.

The posterior regions of partially edentulous arches have inherent anatomic and biomechanical differences in prosthetic loading conditions. This region of the jaw is characterized by less favorable bone quality and smaller bone volume than the anterior region. Implants placed in the premolar or molar regions are generally shorter than those placed in the canine and incisor regions, because of the presence of the inferior dental nerve. The occlusal load is constantly high.\textsuperscript{8} The less favorable distribution of partially edentulous ridge restorations does not permit cross-arch stabilization.\textsuperscript{12} Furthermore, the in-line placement of the implants leads to a susceptibility to implant bending. This increased bending load exerted on the implants has been identified as the main reason for overload.\textsuperscript{23} In the present patient situation, the risk of overloading was increased by the fact that narrow-diameter implants were used. Small-diameter implants inherently have lower mechanical strength than large-diameter implants. Because of a smaller implant diameter, the mechanical strength and surface area of narrow-platform implants are both reduced by 20 to 25%.\textsuperscript{24} This implies that the present implants were probably subjected to a higher load per unit surface area.

After loading was reduced, a periapical radiograph showed increased radiopacity at the defect site. It was assumed that bone was regenerated in the defect. This regenerated bone appeared homogenous to the surrounding bone.

**CONCLUSION**

A correct diagnosis to the pathologic etiology is essential in the management of complications in implant therapy. The possibility of overloading should always be considered and prompt prosthodontic treatment provided, as in the present patient, to stop the progress of peri-implant tissue breakdown and allow bone regeneration to take place.

**REFERENCES**