Development and Treatment of Retrograde Peri-implantitis Involving a Site with a History of Failed Endodontic and Apicoectomy Procedures: A Series of Reports

Lilibeth Ayangco, DMD[1]/Phillip J. Sheridan, DDS, MS[2]

Osseointegrated implants provide predictable restorative support for crowns, restorations, prosthesis abutments, and removable dentures. Their widespread use in recent years has produced different types of complications. Retrograde peri-implantitis, a lesion occurring at the periapical area of an osseointegrated implant, has recently been described. This paper presents a series of reports describing the occurrence and management of retrograde peri-implantitis involving implants replacing teeth with histories of failed endodontic and apicoectomy procedures. (INT J ORAL MAXILLOFAC IMPLANTS 2001;16:412–417)

Key words: *apicoectomy, debridement, dental implants, endodontics, retrograde peri-implantitis, tetracycline*

Dental implants have become an integral part of rehabilitative therapy. Long-term studies have confirmed their predictability in restoring partially and completely edentulous arches. With increased utilization of endosteal implants, clinicians are facing problems similar to those they have confronted with natural teeth.

Retrograde peri-implantitis is the occurrence of periapical lesions involving implants.[1] It has been proposed that the most likely causes of these periapical lesions are: *(1)* bacterial contamination or involvement from either extracted natural teeth or through a seeding mechanism from the remaining natural teeth[1–4]; *(2)* excessive heating of bone during the creation of the osteotomy site[5,6]; *(3)* microfractures in the bone from overloading, loading too soon, or lateral forces[1]; and *(4)* residual bone cavities created by the placement of implants that are shorter than the prepared surgical sites.[7]

The purpose of these patient reports was to present the occurrence and clinical management of retrograde peri-implantitis that developed in sites where teeth were extracted because of failed endodontic and apicoectomy procedures. The authors believe that this may be the first series of reports to document the occurrence and successful treatment of implants demonstrating periapical radiolucencies in sites with a previous history of failed endodontic and apicoectomy procedures.

[1]Resident, Periodontics, Department of Dental Specialties, Mayo Clinic, Rochester, Minnesota.
[2]Director, Periodontics, Department of Dental Specialties, Mayo Clinic, Rochester, Minnesota.

Reprint requests: Dr Lilibeth Ayangco, Mayo West 4, 200 First Street SW, Rochester, MN 55905. Fax: (507) 284-8082.

PATIENT REPORTS

Patient 1

A 74-year-old female patient presented with a problematic maxillary left first premolar. This tooth was an anterior abutment for a 3-unit fixed partial denture (FPD). Clinical and radiographic examination revealed recurrent decay beneath the crown margins, internal resorption, and a persistent periapical radiolucency. The tooth had previous endodontic and apicoectomy procedures. It was determined at the time of consultation that the best treatment option was to extract the tooth and place 2 implants to replace it and the second premolar. Extraction was accomplished and healing was uneventful.

Two Brånemark System implants (Nobel Biocare, Göteborg, Sweden) were placed 9 weeks later at the first (4×15 mm) and second premolar (4×13 mm) sites. At the time of implant placement, a resorbable membrane was placed at the apical half of the second premolar site and coronal third of the

first premolar site on the buccal aspect to cover and try to regenerate bone on implant threads that were exposed as a result of bony fenestrations in these areas. Healing was uneventful, and an implant-supported prosthesis replacing the first and second premolars was placed 8 months later.

Eighteen months after the implants were loaded, the patient was referred to the clinic by her general dentist regarding a swelling in her left anterior maxilla. The general dentist had started the patient on a course of antibiotics. Clinical examination revealed a draining fistula in the mucosa between the maxillary left canine and implant site (Fig 1a). The canine tested vital. A periapical radiograph revealed a radiolucency at the apex of the implant at the first premolar site (Fig 1b). Surgical exploration and debridement were recommended.

Surgical Procedure. A flap was elevated facial to the canine and the implants replacing the premolars (Fig 1c). Granulation tissue and purulent material were removed from a bony defect approximating the apex of the implant in the first premolar site (Fig 1d). Necrotic tissue was removed from the open vent at the apex of the implant. The bony defect, the implant apex, and the mid-lingual aspect of the canine were thoroughly debrided of granulation tissue (Fig 1e). The implant apex and the bony defect were then coated with tetracycline paste (250 mg powder mixed with sterile water to form a paste) (Fig 1f). The tetracycline paste was left in place for about a minute, and the area was then rinsed and flushed. This procedure was repeated twice. After thorough irrigation (Fig 1g), the flap was repositioned and sutured with a 4-0 plain gut suture (Fig 1h). Eight months after the surgical treatment, the implant was in function and symptom-free. A periapical radiograph taken at this time shows partial resolution of the peri-implant radiolucency (Fig 1i).

Patient 2

A 56-year-old female patient was seen with an abscess pointing to the buccal of the maxillary left second premolar. The tooth had had endodontic therapy and multiple apicoectomy procedures. In view of the repeated treatment failure and the persistent infection, removal of the second premolar and restoration with an FPD or dental implant was suggested. The patient preferred to have the tooth replaced with a dental implant. The second premolar was extracted using a forceps technique, chronic inflammatory tissue was curetted, and the socket was thoroughly debrided. Healing was uneventful. A 4×13-mm Brånemark System implant was placed 4 months after the second premolar was removed. Healing occurred without incident. An implant-supported restoration to replace the second premolar was delivered 9 months later. Nine months after implant loading, the patient presented with a complaint of tenderness upon touching the face opposite the apical area of the implant at the second premolar site. Clinical examination revealed no tenderness to palpation, no significant probing depth, and an apparently stable implant. A periapical radiograph revealed a radiolucency involving the apex of the implant (Fig 2a). It was suggested to the patient that the area be surgically explored and debrided.

Surgical Procedure. A sulcular incision was made buccally in the area of the premolars and first molar. A vertical releasing incision was made in the interproximal area between the canine and first premolar, and a full-thickness flap was reflected. Upon flap elevation, a small perforation of the buccal plate of bone was noted at the apical area of the implant. A high-speed round bur was used to remove the bony buccal plate to enlarge the opening and provide better access to the apex of the implant. Granulation tissue was curetted from the bony defect surrounding the implant. The vent at the apical area of the implant was thoroughly debrided as well. A tetracycline paste (250 mg powder mixed with sterile water to form a paste) was placed into the defect and around the implant. The area was then rinsed and irrigated copiously. This procedure was repeated. The flap was then repositioned and sutured using a 4-0 plain gut suture. Amoxicillin (500 mg 3 times daily for 7 days) was prescribed. A periapical radiograph taken 8 months after surgical treatment shows a slight resolution of the peri-implant radiolucency (Fig 2b). One year after the procedure was performed, the implant was asymptomatic and appeared to be stable and functioning well.

Patient 3

A 54-year-old female patient had histories of failed endodontic and apicoectomy procedures at multiple sites in the oral cavity. A Brånemark System implant (4×13 mm) had been placed in the area of the mandibular right canine, which had been extracted because of recurrent pain and discomfort following endodontic and apicoectomy procedures. One month after implant placement, the patient presented with throbbing pain in the mandibular right canine area. The patient stated that pain had started 24 hours prior to consultation. Clinically, the patient was tender to palpation buccal to the area where an implant had been placed 1 month previously. A periapical radiograph revealed a radiolucent area at the apical third of the implant (Fig 3a). The bone on the coronal two thirds of the implant appeared to be intact. It was decided to perform

PATIENT 1

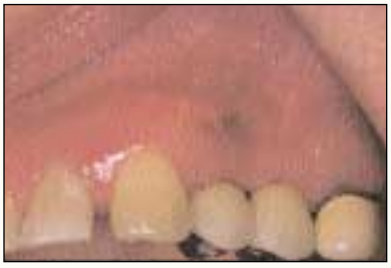

Fig 1a Patient 1. Note draining fistulous tract on the buccal attached tissue opposite the implant on area of the maxillary left first premolar.

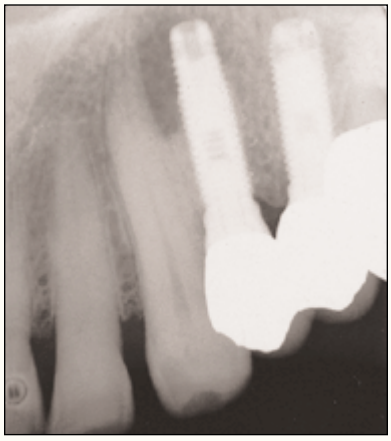

Fig 1b A periapical radiograph reveals a peri-implant radiolucency involving almost half the length of the implant.

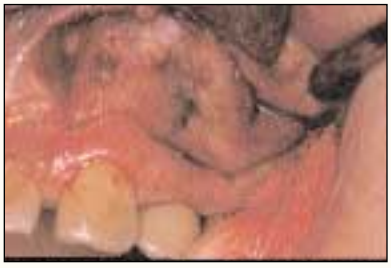

Fig 1c Flap elevation reveals what appears to be soft tissue in the area of the implant apex.

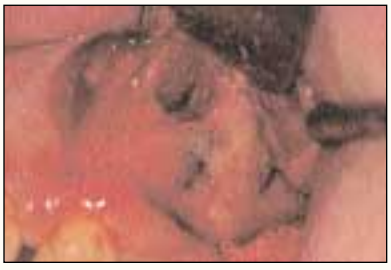

Fig 1d A bony defect is apparent after curettage and removal of infected tissue.

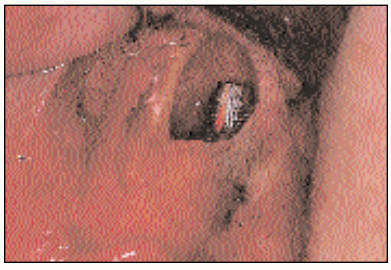

Fig 1e The bony defect and implant apex appear to be free of infected tissue after thorough debridement.

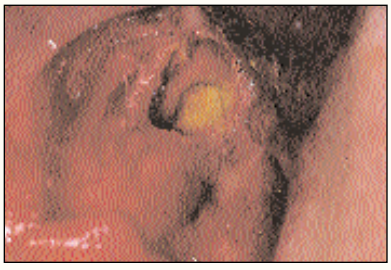

Fig 1f Tetracycline paste is placed in the area for 1 minute.

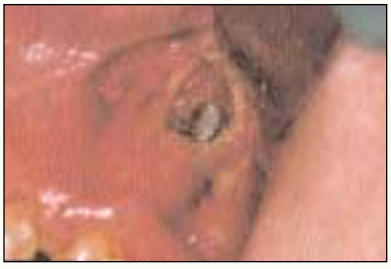

Fig 1g The area has been thoroughly rinsed and irrigated.

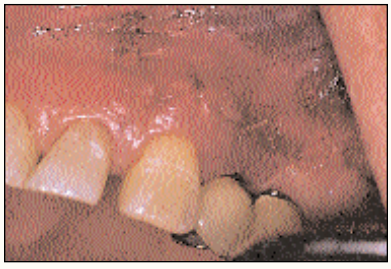

Fig 1h Flap closure.

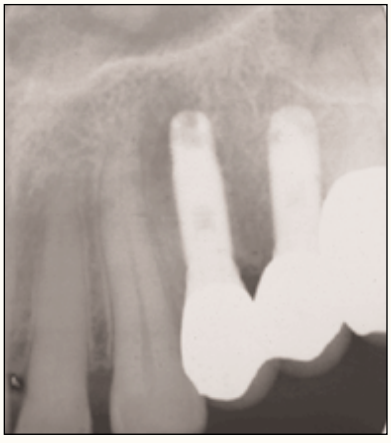

Fig 1i Eight months after treatment, partial resolution of the radiolucency can be noted.

PATIENT 2

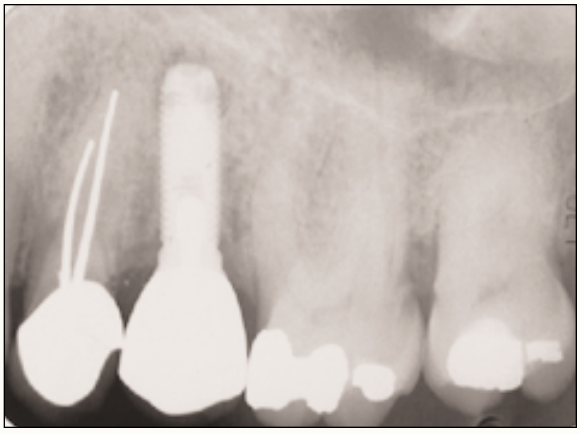

Fig 2a Patient 2. Note radiolucency surrounding the apical area of the implant.

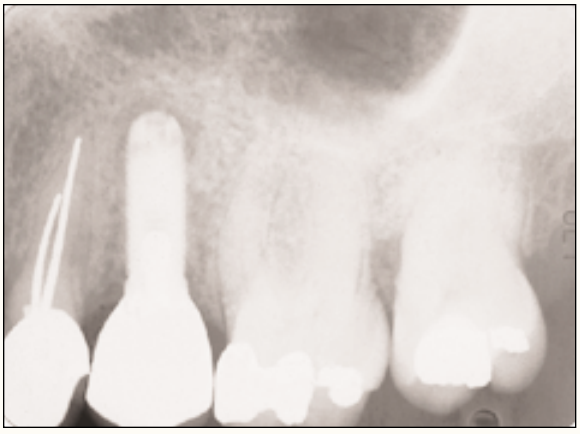

Fig 2b Periapical radiograph taken 8 months after surgery. Note partial resolution of the peri-implant radiolucency.

PATIENT 3

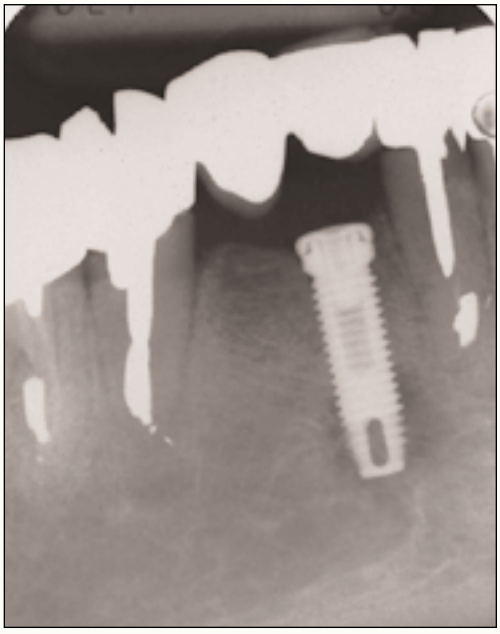

Fig 3a Patient 3. A periapical radiograph reveals radiolucency around the apex of the implant.

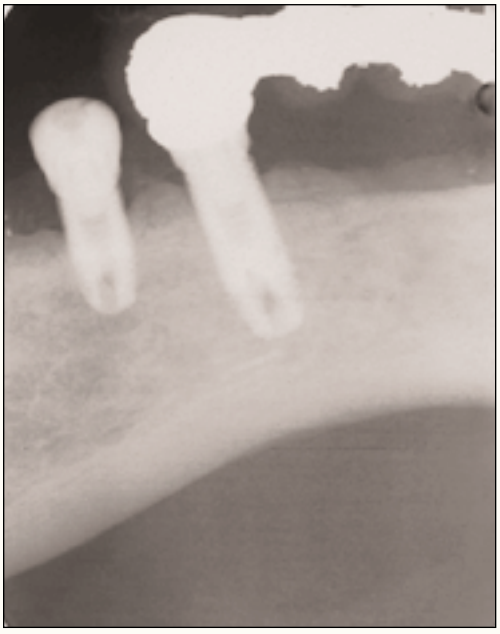

Fig 3b A radiograph taken 8 years after surgical treatment shows complete resolution of the peri-implant radiolucency.

surgical exploration and debridement in an attempt to salvage the implant.

Surgical Procedure. A flap was elevated buccal to the right lateral incisor, extending to the first molar area. A vertical releasing incision was made on the distofacial line angle of the right central incisor. The implant in the area of the canine appeared to be stable. A high-speed round bur was used to create an opening in the intact buccal plate of bone opposite the apex of the implant. Purulent material drained from a large bony defect approximating the apex of the implant. After adequate exposure, hand instruments were used to remove granulation tissue and infected material from the apical area and vent of the implant. The area was thoroughly irrigated. Tetracycline paste was introduced into the defect and applied to the exposed portion of the implant. The area was again thoroughly irrigated and the flap was repositioned and sutured with 4-0 Vicryl sutures. Since the procedure, the implant has been stable, loaded, and in function for 8 years without any further symptoms (Fig 3b).

DISCUSSION

The literature appears to be showing a gradual shift of the attention of the scientific community from descriptions of success rates to a detailed analysis of complications and failures of implants.[8] The occurrence of an implant periapical lesion, also termed *retrograde peri-implantitis*, has been described in the literature. It has been further classified into inactive versus infected lesions. The inactive lesion is asymptomatic and may be similar to an apical scar, which is usually created by placing implants that are shorter than the prepared osteotomy site. Treatment usually consists of regular radiographic monitoring.

The infected lesion is a radiolucency at the apex of the implant seen on a periapical radiograph that is accompanied by symptoms of pain, tenderness, swelling, and/or the presence of a fistulous tract.[7] This could result from bacterial contamination,[1–4] overheating of the bone during osteotomy,[5,6] premature loading leading to microfractures,[1] or the presence of a pre-existing infection in the bone.[1,9] All 3 patients documented in this report had a history of failed endodontic and apicoectomy procedures, which led to extraction of the involved teeth and subsequent placement of implants after sufficient healing time. It would appear that even after thorough and vigorous debridement and irrigation of the extraction sockets and the passing of sufficient healing time, bacteria may have remained in the bone, which led to the initiation of the retrograde peri-implantitis. Aggressive management of the affected site is needed if resolution of the pathologic process and salvage of the implant are to be achieved.

Surgical intervention is aimed at the removal of inflamed granulation tissue and cleaning the implant surfaces of bacteria. The bone housing the defect should be thoroughly debrided to completely eliminate the necrotic tissues. Debridement is accomplished using conventional stainless steel surgical instruments. There is no need for concern about scratching or roughening of the titanium at the apical portion of the implant. Depending on the length, one may elect to cut off the apex of the implant with a tapered fissure bur under copious irrigation. This is indicated especially in cases where the implant extends into the maxillary sinus or nasal cavity, or in situations where retention of the apical part of the implant could obstruct complete mechanical debridement of the granulation tissue, which could then result in failure to eliminate the infection and eventual loss of the implant.

The affected area is detoxified by chemical means to further remove endotoxins and other surface contaminants. Several chemical techniques using citric acid, chlorhexidine gel, tetracycline, and/or hydrogen peroxide have been proposed to disinfect implant surfaces. A tetracycline paste (250 mg mixed with sterile water) was used to detoxify the affected sites for the patients presented in this article. Tetracycline has been suggested to be effective in the detoxification of infected implant surfaces.[4,10–13] Following surgical treatment, the patient should be put on systemic antibiotics for 7 to 10 days. Bacteria associated with failing implants have been found to be sensitive to the following antibiotics: penicillin G, amoxicillin, combination of amoxicillin and metronidazole, and amoxicillin-clavulanate.[14] With the exception of the chemical detoxification, the surgical technique is similar to that used for an apicoectomy. On the basis of a combined clinical experience in excess of 1,000 apicoectomies, the authors can state with confidence that there is no indication for grafting or the use of barrier membranes.

CONCLUSION

A series of patients have been presented to document the occurrence and successful management of infected implant periapical lesions arising in sites of extracted teeth with histories of failed endodontic and apicoectomy procedures. Therapy for infected failing implants should be immediate and aggressive. A combination of systemic and/or local antibiotics with surgical debridement would appear to be

a successful approach in the treatment of retrograde peri-implantitis. However, there is no conclusive evidence to support any specific approach.[15] The treatment of failing implants lacks systemic scientific validation and is based mainly on empirical experience and inference from in vitro findings. There is a need for well-designed clinical trials to achieve a well-defined therapeutic approach.

REFERENCES

1. Meffert RM. Periodontitis and peri-implantitis: One and the same. Pract Periodontics Aesthet Dent 1993;5(9):79–80.
2. Shaffer MD, Juruaz DA, Haggerty PC. The effect of periradicular endodontic pathosis on the apical region of adjacent implants. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998;86:578–581.
3. Mombelli A. Etiology, diagnosis and treatment considerations in peri-implantitis. Curr Opin Periodontol 1997;4: 127–136.
4. McAllister BS, Masters D, Meffert RM. Treatment of implants demonstrating periapical radiolucencies. Pract Periodontics Aesthet Dent 1992;4(9):37–41.
5. Eriksson RA, Adell R. Temperatures during drilling for the placement of implants using the osseointegration technique. J Oral Maxillofac Surg 1986;44(1):4–7.
6. Watanabe F, Tawada Y, Komatsu S, Hata Y. Heat distribution in bone during preparation of implant sites: Heat analysis by real-time thermography. Int J Oral Maxillofac Implants 1992; 7(2):212–219.
7. Reiser GM, Nevins M. The implant periapical lesion: Etiology, prevention and treatment. Compend Contin Educ Dent 1995;16:768–777.
8. Esposito M, Hirsch J, Lekholm U, Thomsen P. Differential diagnosis and treatment strategies for biologic complications and failing oral implants: A review of the literature. Int J Oral Maxillofac Implants 1999;14(4):473–490.
9. Balshi TJ, Pappas CE, Wolfinger GJ, Hernandez RE. Management of an abscess around the apex of a mandibular root form implant: Clinical report. Implant Dent 1994;3:81–85.
10. Meffert RM. How to treat ailing and failing implants. Implant Dent 1992;1:25–33.
11. Mellonig JT, Griffiths G, Mathys E, Spitznagel J Jr. Treatment of the failing implant: Case reports. Int J Periodontics Restorative Dent 1995;15:385–395.
12. Artzi Z, Tal H, Chweidan H. Bone regeneration for reintegration in peri-implant destruction. Compend Contin Educ Dent 1998;19:17–30.
13. Meffert RM, Langer B, Fritz ME. Dental implants: A review. J Periodontol 1992;63:859–870.
14. Sbordone L, Barone A, Ramaglia L, Ciaglia RN, Iacono VJ. Antimicrobial susceptibility of periodontopathic bacteria associated with failing implants. J Periodontol 1995;66:69–74.
15. Nevins M, Meffert R, Tarnow D, Cochran D, Cohen R, Iacono V, et al (eds). Consensus report. Implant therapy I. Proceedings of the 1996 World Workshop in Periodontics. Ann Periodontol 1996;1:792–795.