# Treatment of Late Complications Following Implant Placement Associated with Periapical Periodontitis

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**Abstract**

Reports of the occurrence of late complications following implant placement associated with a natural tooth are limited. The infective etiology may be bacteria from periapical lesions around adjacent teeth. This case report demonstrates successful management of a late complication using regenerative surgery with bone graft material and tetracycline at the same time as root canal therapy of the adjacent tooth. The detoxification procedure was performed with tetracycline, and the defect area was grafted with a 4:1 volume ratio combination of deproteinized bovine bone mixed with tetracycline. Soft tissue healing was uneventful, and the treatment yielded improved clinical results with bony gain.

*Key words: Late complication, natural tooth, root canal, tetracycline, bovine bone*

## Introduction

Ever since the application of osseointegrated dental implants has found wide acceptance for prosthetic treatment, complications and failures have been of special concern (Brägger *et al*., 2001). There are limited reports of the occurrence of complications associated with a natural tooth (Tözüm *et al*., 2006). The authors suggested that the probable infective etiology might be the bacteria from periapical lesions around adjacent teeth (Reiser and Nevins, 1995) or residual infection at a site with a history of periapical pathosis of endodontic origin (Ayangco and Sheridan, 2001; Ataullah *et al*., 2006).

Mechanical debridement, antiseptics, antibiotics, surgical procedures, and explantation are suggested as treatment depending on the severity of the clinical and radiographic manifestations of the lesion (Schou *et al*., 2004). Regenerative techniques, including barrier membranes alone and/or in combination with different bone substitutes, together with systemic antibiotic therapy, were evaluated in dogs (Nociti Jr. *et al*., 2001), and non-human primates (Schou *et al*., 2003b). Several protocols have been suggested, including air-powder abrasives (Machado *et al*, 2000), citric acid (Jovanovic *et al*., 1992), and antimicrobial agents (Lang *et al*., 2001) for the detoxification procedures.

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Tetracylines are primarily bacteriostatic antimicrobials, which exert their antibacterial activity by inhibiting microbial protein synthesis (Copra and Howe, 1978). Tetracycline is used widely in regeneration procedures because of its positive effect with bone graft material (Hars and Massler, 1972; Al-Ali *et al*., 1989) and its traditional antibacterial effect (Baker *et al*., 1983). However, there have been limited reports on bone graft procedures combined with tetracycline application in lesions associated with implants (Ayanco *et al*., 2001; Park *et al*., 2004).

This case report describes the management of a late complication in the coronal area of an implant associated with an adjacent natural tooth having endodontic pathology. Regenerative surgery with bone graft material and tetracycline was done at the same time as root canal therapy of the adjacent tooth.

## Case report

A 44-year-old man presented to the Dental Clinic at the Armed Forces Capital Hospital in Seoul, Korea, seeking treatment for his lower right posterior jaw. The patient had a non-contributory medical history. Clinical examination revealed that his lower second premolar had severe decay (*Figure 1*) and 5 mm of pocket depth. Local plaque accumulation was seen and bleeding on probing was noticed.

Treatment with a dental implant was planned after consultation with the patient about his condition, treatment period, and complications. A full-thickness buccal flap was elevated and the retained root was carefully extracted. One 3.8 x 14 mm implant (Implantium,

***Figure 1. Initial clinical photograph showing remaining root in the lower second premolar area.***

***Figure 3. Graft material was placed in the defect area.***

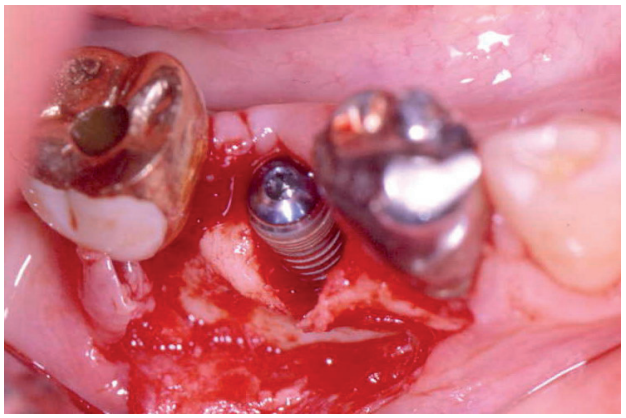

***Figure 2. Buccal view of the installation of implants showing the gap on buccal area.***

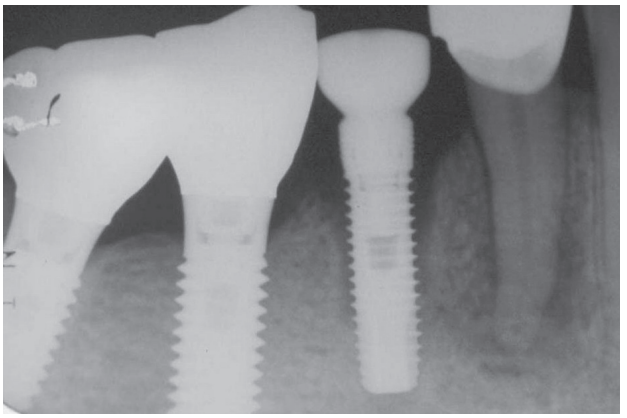

***Figure 4. Radiograph demonstrating a defect area involving six macro threads around the implant and radiolucency at the apex of the first premolar.***

Dentium®, Seoul, Korea) was placed with an insertion torque of 40 N (*Figure 2*). The remaining defect on the buccal area was 4.5 mm (mesio-distal) x 5 mm (apico-coronal) and was grafted with deproteinized bovine bone (Bio-Oss®, Geistlich Pharm AG, Wolhausen, Switzerland) (*Figure 3*). A healing abutment was connected and sutures were applied for wound closure. The patient was placed on amoxicillin 500 mg, three times a day for 5 days, mefenamic acid 500 mg initially, then mefenamic acid 250 mg four times a day for 5 days, and chlorhexidine digluconate 0.12% three times a day for 4 weeks. The patient was asked not to chew on that side or brush the surgical area for the first 4 weeks post-operatively.

The patient came to the clinic complaining of pus discharge and swelling two months after implant surgery. Clinical examination revealed 4 mm to 7 mm pocket defects with exudates coming through the gingiva. Local plaque accumulation was seen at the marginal surface with a modified implant index of 1 (Mombelli *et al.*, 1987). A periapical radiograph, taken with an X-ray machine (Zeus®, Hallim, Seoul, Korea), demonstrated an intrabony defect involving up to five macro threads of the implant and radiolucency at the apex of the first premolar (*Figure 4*). The lesion was round, 5 mm in diameter, and mainly localized to the apical area of the root. No resorption of the root was seen. The lower first premolar was diagnosed as the possible etiologic factor

for the formation of the lesion involving the dental implant located in the second premolar area. Root canal therapy of the first premolar was done at the same time as the surgical treatment. The tooth was isolated with a rubber dam. A conventional access cavity was prepared in the occlusal surface of the first premolar with a 330-carbide bur and the cavities were widened with an Endo-Z bur (Dentsply Maillefer, Tulsa, OK) to enhance the visibility of the root canal. Irrigation of the canal was done several times with 5% sodium hypochlorite and the last irrigation solution was left in the canal for several minutes. Determination of the working length was done using an electronic apex locator (Root ZX®, J Morita Corporation, Kyoto, Japan) and radiograph, and canal enlargement was then performed. The root canal was filled with gutta-percha points and sealer (AH26, Dentsplay, Konstanz, Germany) using a lateral condensation technique, and an amalgam core was added.

A full thickness flap was reflected by a sulcular incision followed by vertical releasing incisions. The granulation tissue was removed with plastic curettes (Hu-Friedy, Chicago, IL, USA), and it was found that the wound dehiscence extended apically, making a total of five macro threads exposed (*Figure 5*). All remaining tissue tags were carefully removed, and once the implant surface was visibly free of any debris and tissue tags, the surface was washed copiously with saline. The surface was then burnished with tetracycline solution (50 mg/ml) on a cotton pledget for two minutes. The 6.0 mm (mesio-distal) x 7.5 mm (apico-coronal) defect was then packed with deproteinized bovine bone (Bio-Oss®, Geistlich Pharm AG, Wolhausen, Swizerland) and a 4:1 volume ratio of tetracycline (*Figure 6*). Sutures were placed, and the patient was prescribed amoxicillin 500 mg three times a day for 7 days, mefenamic acid 500 mg initially, then mefenamic acid 250 mg four times a day for 7 days, and chlorhexidine digluconate 0.12% three times a day for 4 weeks.

A radiograph taken one month after the treatment showed a decrease in radiolucency in the first premolar and an increase in radiopacity around the implant (*Figure 7*). A radiograph taken at the time impressions were taken, which was three months after treatment, revealed complete healing of the first premolar. The final implant-supported crown for the second premolar was inserted four months after treatment, which was six months after installation of the fixture (*Figure 8*).

Soft tissue healing was uneventful and the infrabony level at the final examination was 5 mm, demonstrating that the treatment produced improved clinical results (*Figure 9*). A panoramic radiograph taken nine months after the treatment demonstrated a stable result around the implant (*Figure 10*), and the patient was scheduled for periodic follow-up visits.

## Discussion

This case report describes the management of a late complication following implant placement that was associated with an adjacent natural tooth with endodontic pathology.

Inflammation around an implant may be the result of the presence of a pre-existing infection or residual root fragments and foreign bodies in the bone, contamination of the implant, implant placement in an infected maxillary sinus, bone overheating or implant overloading (Piattelli *et al.*, 1998). A periapical lesion may be another factor, and the root-end inflammatory process may communicate with the surface of the implant fixture (Sussman and Moss, 1993; Tözüm *et al.*, 2006). The source of bacteria may be from residual infection from a bone site with a history of failed endodontic procedure (Ayangco and Sheridan, 2001; Ataullah *et al.*, 2006). The furcation involvement at the adjacent natural tooth may contaminate the adjacent dental implant (Oh *et al.*, 2003).

In situations of peri-implantitis, the microbial composition of plaque closely approximates that seen in periodontitis (Pontoriero *et al.*, 1994), but the microbiota of successful implants is similar to that of periodontal health (Lee *et al.*, 1999). The observed pus secretion in this report is most likely to be associated mainly with the periapical lesion of the adjacent tooth.

Inflammation around implants has been reported to develop within a few weeks (Sussman and Moss, 1993; Sussman, 1997), a few months (Ataullah *et al.*, 2006), a few years (Tözüm *et al.*, 2006) or up to 11 years (O'Sullivan *et al.*, 2006). Surgical removal of the dental implants was performed to avoid possible osteomyelitis (Sussman, 1997). In contrast, removal is avoided if the implant has stable osseointegration and complete debridement of the lesion was performed (Tözüm *et al.*, 2006).

In this report surgical treatment was performed because the periodontal pocket depth was greater than 5 mm and extensive bone loss was present (Mombelli and Lang, 1998). A plastic curette was used for mechanical cleaning to remove granulation tissue in this case because plastic curettes are reported to cause less implant surface alteration (Ramaglia *et al.*, 1995). The affected area is detoxified by chemical means to further remove endotoxins and other surface contaminants. Several chemical techniques using citric acid (Jovanovic *et al.*, 1992), chlorhexidine (Wetzel *et al.*, 1999), and/or hydrogen peroxide (Khoury and Buchmann, 1992), have been proposed to disinfect implant surfaces. The detoxification of implant surface was done using irrigation with saline (Persson *et al.*, 2001) and burnishing of tetracycline (Ayangco and Sheridan, 2001) in this case. The concentration of tetracycline for burnishing was 50 mg/ml, as used in the treatment of intrabony periodontal defects (Masters *et al.*, 1996), and the solution was

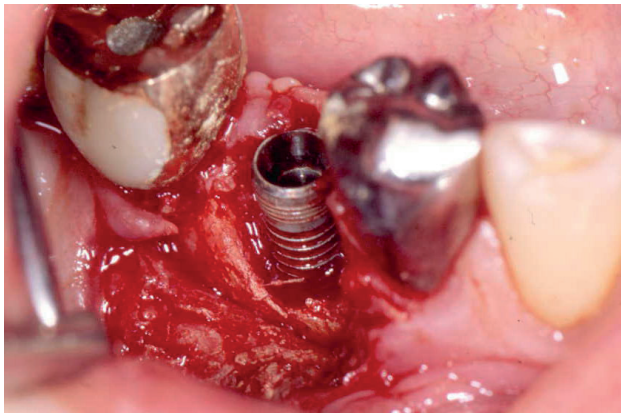

*Figure 5. The granulation tissue is removed, revealing a 6.0 mm (mesio-distal) x 7.5 mm (apico-coronal) defect on the most mesial implant.*

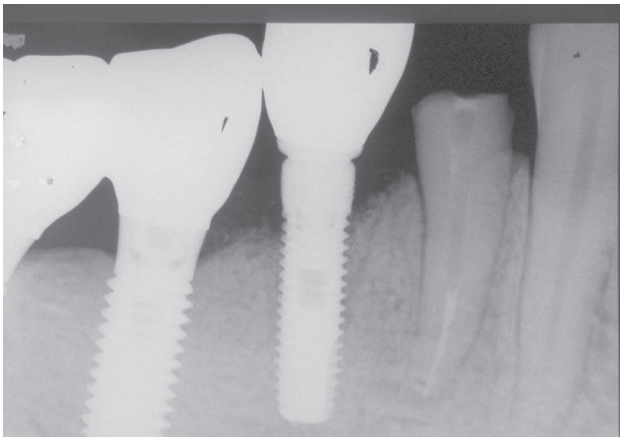

*Figure 8. Radiograph taken at the time of delivery of prosthesis, which was 4 months after treatment. The crown of the lower right first premolar was removed because the tooth was under preparation for restoration.*

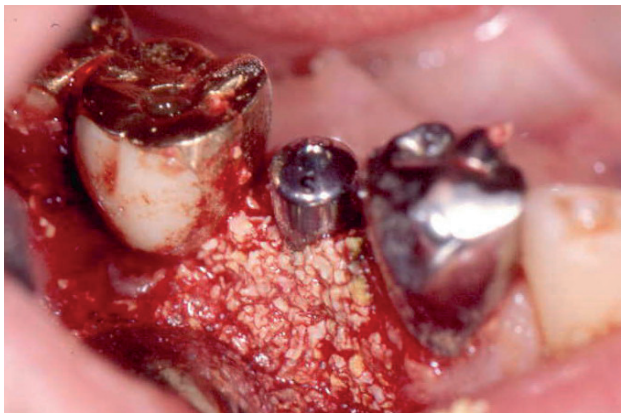

*Figure 6. The defect area is filled with deproteinized bovine bone mixed with tetracycline after irrigation with saline and detoxification with tetracycline.*

*Figure 9. Clinical view five months after delivery of prosthesis, which was nine months after treatment. The soft tissue shows uneventful healing.*

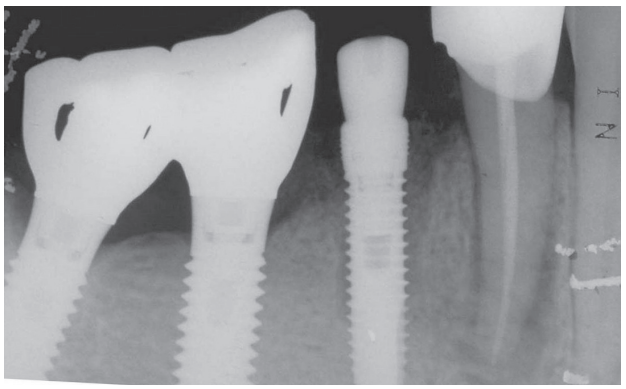

*Figure 7. Radiograph taken one month after treatment.*

applied to the implant surface using cotton pledgets for 2 minutes, as used in the treatment of furcation defects (Harris, 2002). Surface conditioning with tetracycline does not influence its micro-morphology (Herr *et al.*, 2008).

The remaining defect area was filled with bovine bone and tetracycline at a 4:1 volume ratio, as was used in the treatment of furcation defects and localized juvenile periodontitis (Evans *et al.*, 1989). Systemic application of amoxicillin was given because the antibacterial activity of penicillin G, amoxicillin, amoxicillin-clavulanate, and the combination amoxicillin-metronidazole was significantly higher than other antibiotics tested (Sbordone *et al.*, 1995).

A combination of grafting materials and a membrane is suggested in the surgical treatment of osseous defects in peri-implantitis (Schou *et al.*, 2003a). However, a membrane was not used in this case because the grafted bone

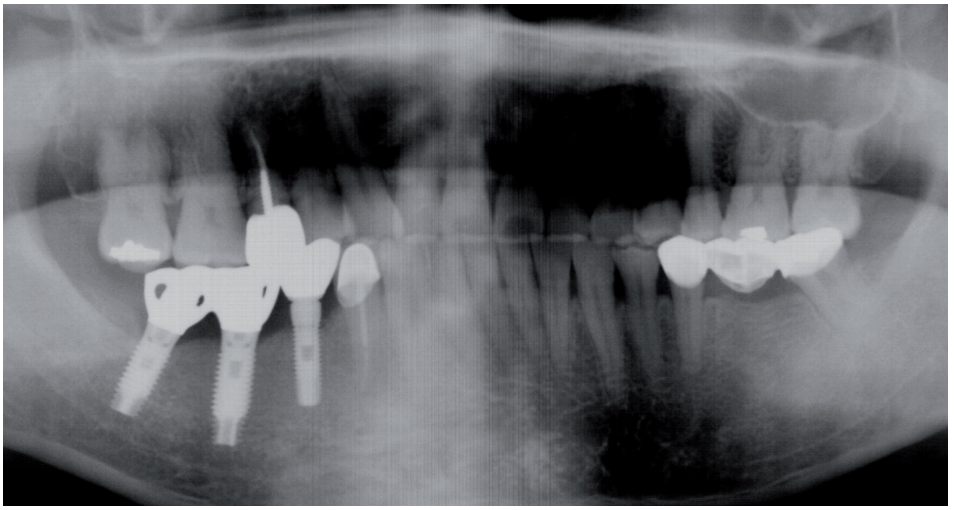

***Figure 10. Radiograph taken nine months after treatment. The defect area shows stable results up to the most recent follow-up period.***

seemed to stabilize itself in the defect, and a membrane would be prone to exposure, especially around the implant area, where frequent complications are reported (Grunder *et al.*, 1993; Schou *et al.*, 2003a).

It should also be emphasized that comprehensive history taking and thorough examination (including sensitivity testing, vitality testing and radiographs) is of great importance before implant placement in order to prevent such complications.

## Conclusions

This case demonstrates successful management of a late complication following implant placement using regenerative surgery with bone graft material and tetracycline at the same time as root canal therapy of the adjacent tooth. The tetracycline was used to burnish the implant surface and was applied in conjunction with an osseous graft in the defect area. The treatment with tetracycline seems to yield improved clinical results up through the follow-up period.

## References


Al-Ali, W., Bissada, N.F., and Greenwell, H. The effect of local doxycycline with and without tricalcium phosphate on regenerative healing potential of periodontal osseous defects in dogs. *Journal of Periodontology* 1989; **60:**582-590.

Ataullah, K., Chee, L.F., Peng, L.L., *et al.* Management of retrograde peri-implantitis: a clinical case report. *The Journal of Oral Implantology* 2006; **32:**308-312.

Ayangco, L. and Sheridan, P.J. Development and treatment of retrograde peri-implantitis involving a site with a history of failed endodontic and apicoectomy procedures: a series of reports. *The International Journal of Oral & Maxillofacial Implants* 2001; **16:**412-417.

Baker, P.J., Evans, R.T., Coburn, R.A., *et al.* Tetracycline and its derivatives strongly bind to and are released from the tooth surface in active form. *Journal of Periodontology* 1983; **54:**580-585.

Brägger, U., Aeschlimann, S., Bürgin, W., *et al.* Biological and technical complications and failures with fixed partial dentures (FPD) on implants and teeth after four to five years of function. *Clinical Oral Implants Research* 2001; **12:**26-34.

Evans, E.H., Yukna, R.A., Sepe, W.W., *et al.* Effect of various graft materials with tetracycline in localized juvenile periodontitis. *Journal of Periodontology* 1989; **60:**491-497.

Grunder, U, Hürzeler, M.B., Schüpbach, P., *et al.* Treatment of ligature-induced peri-implantitis using guided tissue regeneration: A clinical and histologic study in the beagle dog. *The International Journal of Oral & Maxillofacial Implants* 1993; **8:**282-293.

Harris, R.J. Treatment of furcation defects with an allograft-alloplast-tetracycline composite bone graft combined with GTR: human histologic evaluation of a case report. *The International Journal of Periodontics & Restorative Dentistry* 2002; **22:**381-387.

Hars, E. and Massler, M. Effects of fluorides, corticosteroids and tetracyclines on extraction wound healing in rats. *Acta Odontologica Scandinavica* 1972; **30:**511-522.

Herr, Y., Woo, J.A., Kwon, Y.H., *et al.* Implant surface conditioning with tetracycline-HCl: A SEM study. *Key Engineering Materials* 2008; **361-363:**849-852.

Jovanovic, S.A., Kenney, B., Carranza, F.A., *et al.* The regenerative potential of plaque-induced peri-implant bone defects treated by a submerged membrane technique: An experimental study. *The International Journal of Oral & Maxillofacial Implants* 1992; **7:**233-245.

Khoury, F. and Buchmann, R. Surgical therapy of peri-implant disease: A 3-year follow-up study of cases treated with 3 different techniques of bone regeneration. *Journal of Periodontology* 2001; **72:**1498-1508.

Lang, N.P., Mombelli, A., Tonetti, M.S., *et al.* Treatment of peri-implantitis by local delivery of tetracycline. Clinical, microbiological and radiological results. *Clinical Oral Implants Research* 2001; **12:**287-294.

Lee, K.H., Maiden, M.F., Tanner, A.C., *et al.* Microbiota of successful osseointegrated dental implants. *Journal of Periodontology* 1999; **70:**131-138.

Machado, M.A., Stefani, C.M., Sallum, E.A., *et al.* Treatment of ligature-induced peri-implantitis defects by regenerative procedures. Part II: A histometric study in dogs. *Journal of Oral Science* 2000; **42:**163-168.

Masters, L.B., Mellonig, J.T., Brunsvold, M.A., *et al.* A clinical evaluation of demineralized freeze-dried bone allograft in combination with tetracycline in the treatment of periodontal osseous defects. *Journal of Periodontology* 1996; **67**:770-781.

Mombelli, A. and Lang, N.P. The diagnosis and treatment of peri-implantitis. *Periodontology 2000* 1998; **17:**63-76.

Mombelli, A., Van Oosten M.A., Schurch E. Jr., *et al.* The microbiota associated with successful or failing osseointegrated titanium implants. *Oral Microbiology and Immunology* 1987; **2:**145-151.

Nociti, F.H. Jr., Machado, M.A., Stefani, C.M., *et al.* Absorbable versus nonabsorbable membranes and bone grafts in the treatment of ligature-induced peri-implantitis defects in dogs. Part I. A clinical investigation. *Clinical Oral Implants Research* 2001; **16:**659-667.

Oh, T.J., Yoon, J. and Wang, H.L. Management of the implant periapical lesion: a case report. *Implant Dentistry* 2003; **12:**41-46.

O'Sullivan, D., King, P. and Jagger, D. Osteomyelitis and pathological mandibular fracture related to a late implant failure: a clinical report. *The Journal of Prosthetic Dentistry* 2006; **95:**106-110.

Park, S.H., Sorensen, W.P. and Wang, H.L. Management and prevention of retrograde peri-implant infection from retained root tips: two case reports. *The International Journal of Periodontics & Restorative Dentistry* 2004; **24:**422-433.

Persson, L.G., Berglundh, T., Sennerby, L., *et al.* Re-osseointegration after treatment of peri-implantitis at different implant surfaces. An experimental study in the dog. *Clinical Oral Implants Research* 2001; **12:**595-603.

Piattelli, A., Scarano, A., Balleri, P., *et al.* Clinical and histologic evaluation of an active "implant periapical lesion": a case report. *The International Journal of Oral & Maxillofacial Implants* 1998; **13:**713–716.

Pontoriero, R., Tonelli, M.P., Carnavale, G., *et al.* Experimentally induced peri-implant mucositis. A clinical study in humans. *Clinical Oral Implants Research* 1994; **5:**254-259.

Ramaglia, L., di Lauro, A.E., Morgese, F., *et al.* Profilometric and standard error of the mean analysis of rough implant surfaces treated with different instrumentations. *Implant Dentistry* 2006; **15:**77-82.

Reiser, G.M. and Nevins, M. The implant periapical lesion: etiology, prevention, and treatment. *Compendium of Continuing Education in Dentistry* 1995; **16:**768-772.

Sbordone, L., Barone, A., Ramaglia, L., *et al.* Antimicrobial susceptibility of periodontopathic bacteria associated with failing implants. *Journal of Periodontology* 1995; **66:**69-74.

Schou, S., Holmstrup, P., Jørgensen, T., *et al.* Autogenous bone graft and ePTFE membrane in the treatment of peri-implantitis. I. Clinical and radiographic observations in cynomolgus monkeys. *Clinical Oral Implants Research* 2003a; **14:**391-403.

Schou, S., Holmstrup, P., Jørgensen, T., *et al.* Anorganic porous bovine derived bone mineral (Bio-Oss) and ePTFE membrane in the treatment of peri-implantitis in cynomolgus monkeys. *Clinical Oral Implants Research* 2003b; **14:**535-547.

Schou, S., Berglundh, T. and Lang, N.P. Surgical treatment of peri-implantitis. *The International Journal of Oral & Maxillofacial Implants* 2004; **19:**S140-S149.

Sussman, H.I. and Moss, S.S. Localized osteomyelitis secondary to endodontic-implant pathosis. A case report. *Journal of Periodontology* 1993; **64:**306-310.

Sussman, H.I. Endodontic pathology leading to implant failure: a case report. *The Journal of Oral Implantology* 1997; **23:**112-115.

Tözüm, T., Sençimen, M., Ortakoğlu, K., *et al.* Diagnosis and treatment of a large periapical implant lesion associated with adjacent natural tooth: a case report. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics* 2006; **101:**132-138.

Wetzel, A.C., Vlassis, J., Caffesse, R.G., *et al.* Attempts to obtain reosseointegration following experimental peri-implantitis in dogs. *Clinical Oral Implants Research* 1999; **10:**111-119.