Successful Treatment of Early Implant Failure: A Case Series

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ABSTRACT

Background: The aim of this longitudinal study was to evaluate the effect of combined treatment on early progressive bone loss around dental implants.

Methods: The study sample consisted of 18 implants presenting at 4–6 weeks postplacement with early progressive bone loss. Clinical examination indicated the presence of a fistula in the soft tissue covering the implants in most cases. Defects around the implants were curetted, exposed implant surfaces were mechanically debrided and treated with tetracycline solution, and the defects were filled with bone graft and doxycycline powder. Bioabsorbable membranes were used. Final crowns were placed after 6 months. The patients were followed for an average of 30 months.

Results: The surgical sites healed without complication. At the time of loading, the defects were completely restored. At 12 months postloading, there was crestal bone loss to the level of the first thread (average, 1.3 mm). Pocket depths ranged from 3 to 5 mm (average, 3.6 mm) with no bleeding. No further changes were noticed throughout the remaining follow-up visits. All implants were successful according to the criteria proposed by Albrektsson and colleagues.

Conclusions: Early detection and treatment of early progressive bone loss around dental implants are the key to saving early failing implants. The author recommends reevaluation visits 4–6 weeks postimplant placement to detect any signs of early failure so that immediate treatment can be undertaken if needed.

KEY WORDS: antimicrobial therapy, dental implant, early failure, guided bone regeneration, implant failure, progressive bone loss

INTRODUCTION

Today the dental implant is a routine method for rehabilitating partial or total edentulism.[1] The predictable integration and success of dental implants date back to the late 1960s and early 1970s. Fundamental experimental studies conducted by Brånemark and colleagues.[2] and Schroeder and colleagues[3–5] have demonstrated that titanium implants healed dependably by direct bone-to-implant contact, termed *osseointegration*. Implant therapy based on osseointegration has expanded remarkably in its application to dentistry. This development is because of several factors, including higher patient acceptance, increasing number of clinicians receiving education in implant therapy, and higher success rates in the more challenging cases.[6]

The integrity of the hard and soft tissues around dental implants is the key to dental implant longevity.[7–10] Studies have shown that submerged titanium implants had 0.9–1.6 mm marginal bone loss by the end of first year in function, while only 0.05–0.13 mm bone loss occurred annually after the first year.[7,9–13] Nonsubmerged implants also have demonstrated early crestal bone loss, ranging from 0.6 to 1.1 mm at the end of the first year of function.[8,10,14,15]

Despite the high success rates and stability of dental implants, failures do occur.[16] Implant failure can be divided into early (prior to prosthetic treatment) or late (after prosthetic rehabilitation).[17] Most implant failures

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TABLE 1 Percentage of Implants with Progressive Bone Loss to the Total Number of Implants in Different Locations of the Mouth

Implant Location	Maxillary Posterior	Maxillary Anterior	Mandibular Posterior	Mandibular Anterior	Total
Total number of implants	71	28	58	36	193
Implants with progressive bone loss	6	5	7	0	18
Percentage*	8.5%	17.9%	12.1%	0%	9.3%

*Percentage of implants with progressive bone loss to the total number of implants in each location.

have been reported in the maxilla, with almost three times as many implant losses as in the mandible.[18] Early failures have been reported to vary between 1.5 and 21%.[17–21]

The progressive loss of peri-implant bone and soft tissue inflammatory changes are defined as *peri-implantitis*.[22] Early progressive bone loss beyond the first thread of titanium screw implants results in a saucer-like defect. This defect can be seen on the radiograph during the early stages of healing. If left untreated, bone loss will continue and implant failure will result.

The aim of this longitudinal study was to evaluate the effect of mechanical, antimicrobial, and regenerative treatment on early progressive bone loss around dental implants.

MATERIALS AND METHODS

Study Population

One hundred ninety-three implants (Brånemark System and NobleReplace Tapered System, Nobel Biocare AB, Göteborg, Sweden) were placed in 80 patients. Eighty-eight of these implants had mild horizontal ridge defects at the time of their placement which was managed with bone graft (bovine bone and calcium sulfate) buccally. From the 193 implants, 18 implants (10 with bone graft at the time of their placement and 8 without) in 11 patients presented at 4–6 weeks' postsurgical placement with early, progressive bone loss, and these were included in the study. Patients involved in the study were periodontally and systemically healthy and were nonsmokers. O'Leary plaque index was less than 20% in all patients. All surgical procedures and postsurgical follow-ups were done by the author. The lengths of the implants evaluated in this study varied from 10 to 13 mm. Six implants were placed in the posterior maxilla, five in the anterior maxilla, and seven in the posterior mandible (Table 1). The implants were placed at the crestal bone level and were submerged (two-stage approach; Figure 1).

Clinical and Radiographic Evaluation

Baseline for examination was at the 4–6 weeks' postsurgical evaluation visit. Periapical radiographs showed progressive bone loss around the 18 implants (Figure 2). The amount of bone loss averaged 3.15 mm, and it varied from case to case (Table 2). In 11 patients, clinical examination indicated the presence of fistula in the soft tissue covering the implants, with purulent discharge on manipulation (as in Figure 3). In all patients, the tissue covering the implants was bluish-red in color. Five patients reported mild discomfort at the implant site during this visit, while the others were asymptomatic.

Surgical Procedures

Treatments were carried out under local anesthesia with infiltration buccally and lingually. Full thickness flaps were elevated to expose the implants and surrounding defects (Figure 4), which were curetted and cleaned (Figure 5). The exposed implant surfaces were

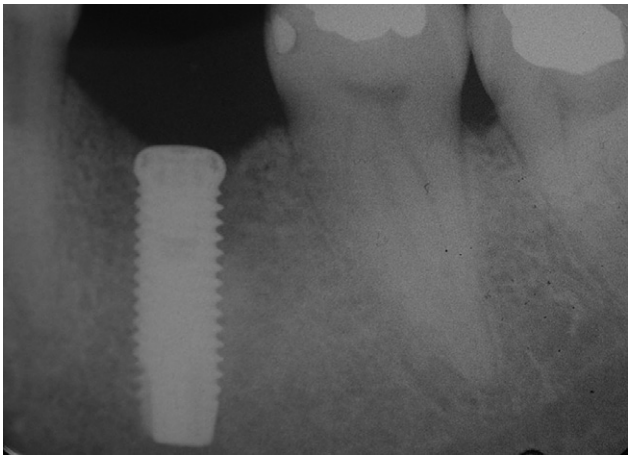

Figure 1 Radiograph immediately after implant placement.

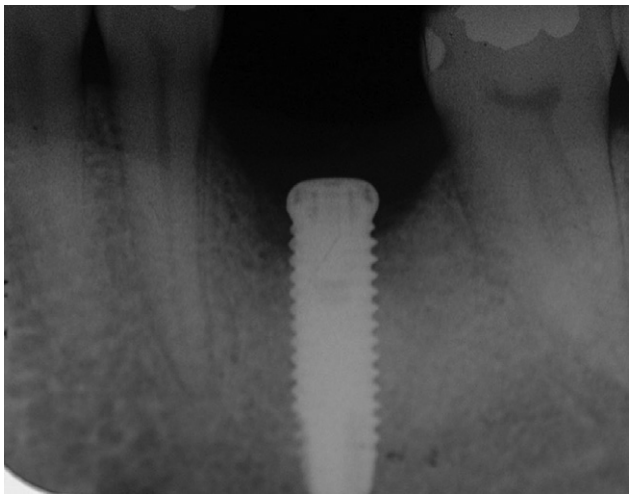

Figure 2 Progressive bone loss 6 weeks postimplant placement.

mechanically debrided and treated with tetracycline solution for 3 minutes.[23,24] The defects were then filled with a mixture of bovine bone (particle size, 0.25–1.0 mm) and calcium sulfate (ratio 4:1) and about 50 mg of doxycycline powder (Figure 6). Bioabsorbable barrier membrane (collagen in 7 cases and calcium sulfate in 11 cases)[25] was used to cover the defect (Figure 7). In nine cases, the flaps were sutured to keep the implant submerged because of the defect's large size (Figure 8). In the other cases, healing abutments were placed and the flaps sutured to keep the abutments exposed. All patients were given 200 mg doxycycline the first day, then 100 mg daily for 9 days. The patients were also given nonsteroidal anti-inflammatory drugs (ibuprofen 600 mg three times daily) and chlorhexidine mouthwash for 1 week postsurgery.

Evaluation of Healing

Two weeks after surgery, the sutures were removed. Second-stage surgery was performed 6 months after regenerative surgery for the nine cases in which the implants were submerged.

Final crowns were placed 6 months postregenerative surgery. The patients were reevaluated every 3 months the first year after loading, then every 6 months afterwards for an average of 30 months (24–54 months; Table 2). Oral hygiene evaluation was performed in each reevaluation visit and oral hygiene instructions were given if needed.

RESULTS

The mean age of the study group was 49.5 years. Seven patients were males and four were females. Of the total number of implants placed, 9.3% had progressive bone loss. The percentage of these to the number of implants in different locations of the mouth is shown in Table 1. The percentage of implants with progressive bone loss to the total number of implants with bone graft at the time of implant placement was 11.4% which was significantly higher than the percentage in cases without bone graft (Table 3). There were no significant differences in the amount of progressive bone loss among the cases with and without bone grafts. The average progressive bone loss at 4–6 weeks' postimplant placement was 3.15 mm.

After regenerative surgery, the surgical sites healed without complication or infection. The patient reported minor discomfort during the second day postsurgery, which was managed by analgesics; no pain or discomfort was reported afterwards.

There was evidence of good clinical ridge contour during the first 6 months of healing with radiographic evidence of defect fill (Figure 9).

At the time of implant loading (6 months postregenerative surgery), the defects were completely restored, and the implants were entirely surrounded by bone. At 12 months postloading, there was crestal bone loss to the level of the first thread (average, 1.3 mm). Pockets depth ranged from 3 to 5 mm (average, 3.6 mm) with no bleeding on probing. No further bone loss or soft tissue changes were noticed throughout the remaining follow-up visits (Figure 10). All implants were successful according to criteria proposed by Albrektsson and colleagues in 1986.[26]

DISCUSSION

The predictability and high success rates of endosseous dental implants have secured their place as a standard treatment modality. Nevertheless, a small number of implants will fail regardless of operator experience or clinically recognizable cause.[27] Failures of dental implants are detrimental to both patients and dental providers. These failures are often preceded by complications at various levels of the treatment phases. Early detection of the complications amenable to rescue therapies may reverse the fate of the implant.[28]

Many possible etiologies of implant failure have been proposed, including surgical trauma, periimplantitis, occlusal overload, anatomic conditions, short implant, and smoking.[10,17,18,21,29–36] Surgical trauma has been suggested as one of most common etiologies of

TABLE 2 Patient and Implant Data

Patient	Age	Sex	Implant	System	Position	Bone Graft	Bone Loss (mm)		Post-Loading Evaluation Period (months)
							Mesial	Distal	
1	37	F	1	Brånemark	Mandibular left first molar	No	4.5	3	36
2	50	M	2	NobleReplace	Maxillary left lateral incisor	Yes	3.5	4	24
			3	NobleReplace	Maxillary left canine	Yes	3.5	3	
3	57	M	4	NobleReplace	Mandibular right first premolar	No	3.5	2.5	24
			5	NobleReplace	Mandibular right first molar	No	3	4	
4	61	M	6	NobleReplace	Maxillary right first premolar	Yes	3	3	54
			7	NobleReplace	Maxillary left first premolar	Yes	2.5	3	
5	34	F	8	NobleReplace	Mandibular left first molar	No	4	3.5	36
			9	NobleReplace	Maxillary left first molar	No	3.5	2.5	
6	57	M	10	Brånemark	Mandibular right first molar	No	4.5	2.5	24
7	58	M	16	NobleReplace	Maxillary left lateral incisor	Yes	2	3	24
8	42	M	17	NobleReplace	Maxillary right second molar	No	4	2.5	24
9	58	F	11	NobleReplace	Mandibular left second premolar	Yes	2.5	3.5	24
			12	NobleReplace	Mandibular left first molar	Yes	3.5	2	
10	46	F	13	NobleReplace	Maxillary left central incisor	Yes	3	3	30
			14	NobleReplace	Maxillary left canine	Yes	2.5	3	
			15	NobleReplace	Maxillary left second premolar	Yes	3.5	2.5	
11	44	M	18	NobleReplace	Maxillary right first molar	No	4	2.5	30

Figure 3 Fistula in the soft tissue covering the implant with purulent discharge.

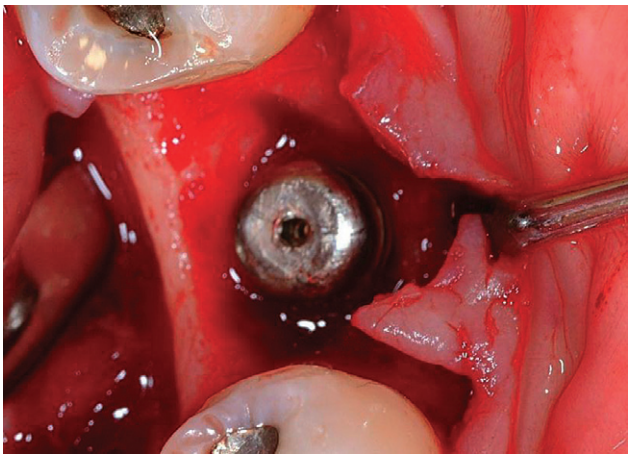

Figure 5 Peri-implant defect after mechanical debridement.

early implant failure.[2,17,37] In the later stages, occlusal overload and peri-implantitis are the two main causative factors.[7,13,23,38–42]

Other possible etiology of early implant failure in cases where implant was simultaneously placed with bone graft and/or guided tissue regeneration is postsurgical foreign body material reaction.[43–45] This may be the explanation of higher percentage of implants with early progressive bone loss in cases where bone graft was used at the time of implant placement (Table 3).

Early implant failure usually occurs very rapidly with progressive bone resorption and loss of the implant before loading. Progressive bone loss around the implant is one of the earliest signs of a failing implant. If this bone loss is not detected and treated at an early stage, implant failure will result.

Limited studies have been published about the treatment of failing implants, with only one case report[46] about the treatment of early implant failure. This case report demonstrated successful management of an early failing implant through antimicrobial therapy and guided tissue regeneration. No studies on the treatment of early implant failure were found.

The current longitudinal study involved 18 implants diagnosed with early progressive peri-implant bone loss. The percentage of implants with progressive bone loss of the total number placed in the mouth was highest in the maxillary anterior area, followed by the mandibular posterior area, and then the maxillary posterior area. None was diagnosed in the mandibular anterior area (Table 1).

All cases were successfully treated by means of mechanical debridement, antimicrobial therapy, and

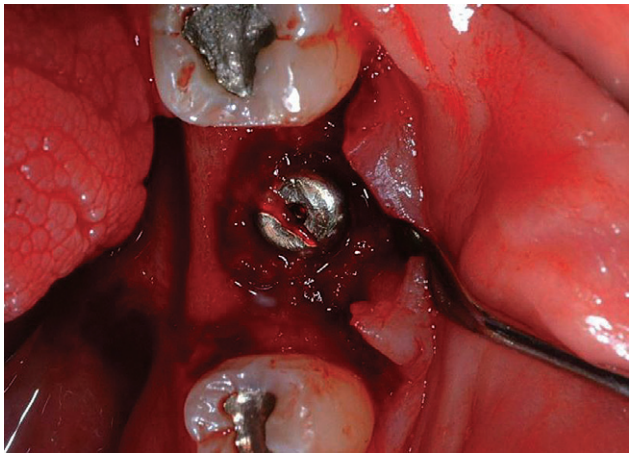

Figure 4 Peri-implant bone loss and granulation tissue immediately after flap reflection.

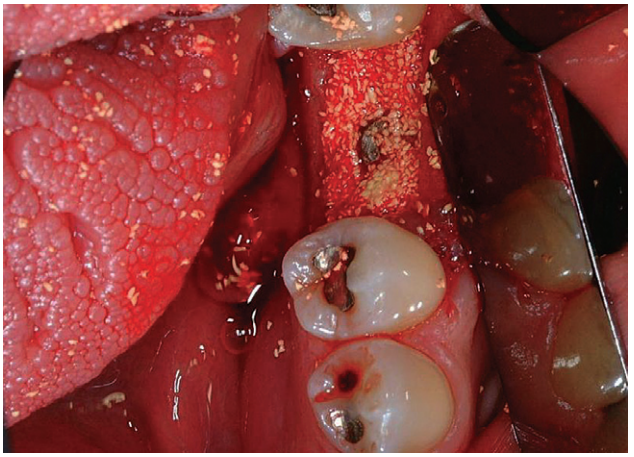

Figure 6 Defect was filled with a mixture of bovine bone and calcium sulfate plus tetracycline powder.

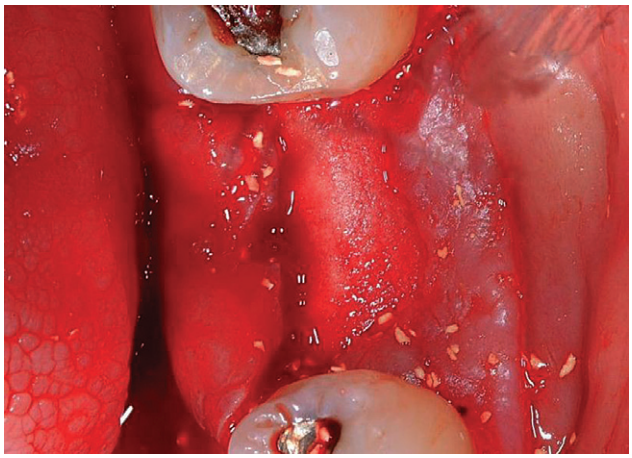

Figure 7 Bioabsorbable collagen membrane used to cover the defect.

TABLE 3 Percentage of Implants with Progressive Bone Loss to the Total Number of Implants Placed with and without Bone Graft at the Time of Implant Placement

	Cases with Bone Graft*	Cases without Bone Graft*
Total number of implants placed	88	105
Number of implants with progressive bone loss	10	8
Percentage†	11.4	7.6

*At the time of implant placement.
†Percentage of implants with progressive bone loss to the total number of implants with and without bone graft.

guided bone regeneration. Early detection of bone destruction (4–6 weeks postimplant placement) was the key to successful treatment. If these implants had been left untreated, early implant failure would have resulted.

At 12 months postloading, all implants had crestal bone loss to the first thread (average, 1.3 mm) which was similar to what was reported by Adell and colleagues.[7] Pocket depths were within normal range (average, 3.6 mm).[47,48] During the evaluation period, implants were successful according to the criteria proposed by Albrektsson and colleagues (1986).[26]

The author recommends a reevaluation visit 4–6 weeks postimplant placement, which will allow the detection of any signs of early implant failure. At this visit, periapical radiographs should be taken. If there is any sign of progressive bone loss, immediate treatment with mechanical debridement, antimicrobial therapy,

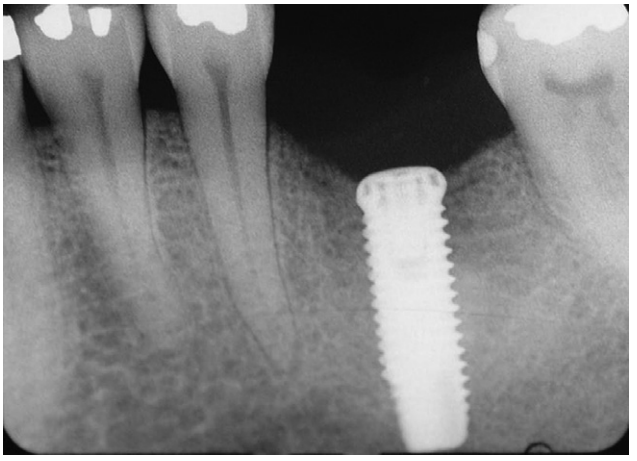

Figure 9 Six months postregeneration. Notice the complete defect fill.

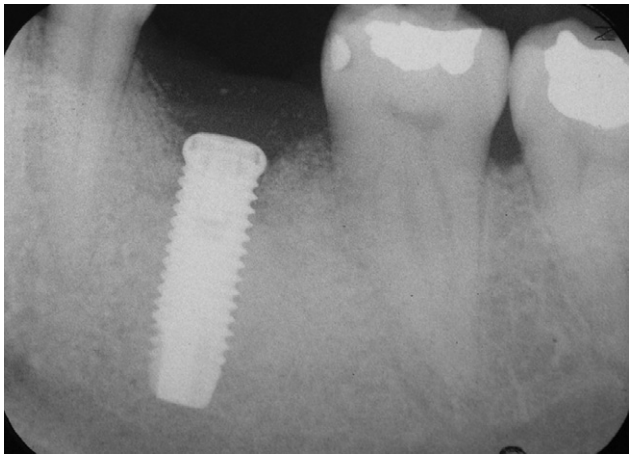

Figure 8 Immediately after guided bone regeneration.

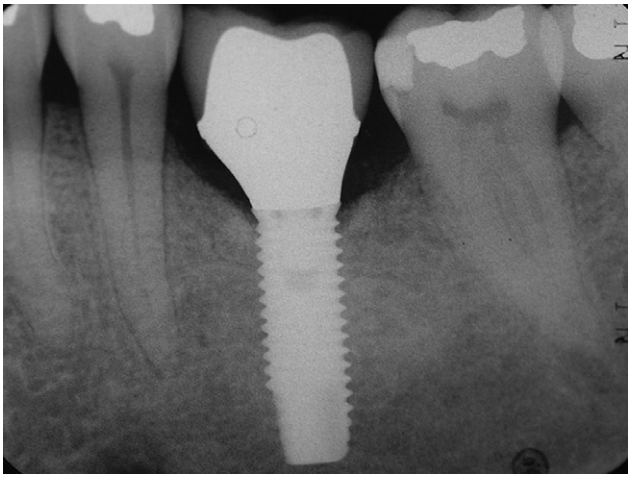

Figure 10 Thirty-six months postloading; no further bone loss was noticed beyond the first thread.

and regenerative therapy (if needed) are recommended to stop the pathologic progression and reverse the fate of the implant.

The major shortcoming of this study was having all surgical procedures and evaluation completed by the authors. This made blind evaluation impossible. Further research with longer evaluation period is needed to evaluate the effectiveness of early treatment of early progressive bone loss on the long-term survival of the dental implants.

CONCLUSIONS

Early detection and treatment of early progressive bone loss around dental implants by mechanical debridement, antimicrobial therapy, and regenerative therapy are the keys for saving early failing implants. The author recommends a reevaluation visit 4–6 weeks postimplant placement to detect any signs of early failure so immediate treatment can be undertaken if needed.

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REFERENCES

1. Hultin M, Gustafsson A, Hallstrom H, Johansson LA, Ekfeldt A, Klinge B. Microbiological findings and host response in patients with peri-implantitis. Clin Oral Implants Res 2002; 13:349–358.
2. Branemark PI, Adell R, Breine U, Hansson BO, Lindstrom J, Ohlsson A. Intra-osseous anchorage of dental prostheses. I. Experimental studies. Scand J Plast Reconstr Surg 1969; 3:81–100.
3. Schroeder A, Pohler O, Sutter F. Tissue reaction to an implant of a titanium hollow cylinder with a titanium surface spray layer. SSO Schweiz Monatsschr Zahnheilkd 1976; 86:713–727.
4. Schroeder A, Stich H, Straumann F, Sutter F. The accumulation of osteocementum around a dental implant under physical loading. SSO Schweiz Monatsschr Zahnheilkd 1978; 88:1051–1058.
5. Schroeder A, van der Zypen E, Stich H, Sutter F. The reactions of bone, connective tissue, and epithelium to endosteal implants with titanium-sprayed surfaces. J Maxillofac Surg 1981; 9:15–25.
6. Buser D, Ingimarsson S, Dula K, Lussi A, Hirt HP, Belser UC. Long-term stability of osseointegrated implants in augmented bone: a 5-year prospective study in partially edentulous patients. Int J Periodontics Restorative Dent 2002; 22:109–117.
7. Adell R, Lekholm U, Rockler B, Branemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1981; 10:387–416.
8. Buser D, Weber HP, Lang NP. Tissue integration of non-submerged implants. 1-year results of a prospective study with 100 ITI hollow-cylinder and hollow-screw implants. Clin Oral Implants Res 1990; 1:33–40.
9. Jemt T, Lekholm U, Grondahl K. 3-year followup study of early single implant restorations ad modum Branemark. Int J Periodontics Restorative Dent 1990; 10:340–349.
10. Oh TJ, Yoon J, Misch CE, Wang HL. The causes of early implant bone loss: myth or science? J Periodontol 2002; 73:322–333.
11. Adell R, Lekholm U, Rockler B, et al. Marginal tissue reactions at osseointegrated titanium fixtures (I). A 3-year longitudinal prospective study. Int J Oral Maxillofac Surg 1986; 15:39–52.
12. Lekholm U, Adell R, Lindhe J, et al. Marginal tissue reactions at osseointegrated titanium fixtures. (II) A cross-sectional retrospective study. Int J Oral Maxillofac Surg 1986; 15:53–61.
13. Cox JF, Zarb GA. The longitudinal clinical efficacy of osseointegrated dental implants: a 3-year report. Int J Oral Maxillofac Implants 1987; 2:91–100.
14. Weber HP, Buser D, Fiorellini JP, Williams RC. Radiographic evaluation of crestal bone levels adjacent to nonsubmerged titanium implants. Clin Oral Implants Res 1992; 3:181–188.
15. Bragger U, Hafeli U, Huber B, Hammerle CH, Lang NP. Evaluation of postsurgical crestal bone levels adjacent to non-submerged dental implants. Clin Oral Implants Res 1998; 9:218–224.
16. Esposito M, Thomsen P, Ericson LE, Lekholm U. Histopathologic observations on early oral implant failures. Int J Oral Maxillofac Implants 1999; 14:798–810.
17. Esposito M, Hirsch JM, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants. (I). Success criteria and epidemiology. Eur J Oral Sci 1998; 106:527–551.
18. Friberg B, Jemt T, Lekholm U. Early failures in 4,641 consecutively placed Branemark dental implants: a study from stage 1 surgery to the connection of completed prostheses. Int J Oral Maxillofac Implants 1991; 6:142–146.
19. Palmqvist S, Sondell K, Swartz B. Implant-supported maxillary overdentures: outcome in planned and emergency cases. Int J Oral Maxillofac Implants 1994; 9:184–190.
20. Tinsley D, Watson CJ, Ogden AR. A survey of U.K. centres on implant failures. J Oral Rehabil 1999; 26:14–18.
21. Kronstrom M, Svenson B, Hellman M, Persson GR. Early implant failures in patients treated with Branemark System titanium dental implants: a retrospective study. Int J Oral Maxillofac Implants 2001; 16:201–207.

22. Lindhe J, Meyle J. Peri-implant diseases: Consensus Report of the Sixth European Workshop on Periodontology. J Clin Periodontol 2008; 35:282–285.
23. Meffert RM. Treatment of failing dental implants. Curr Opin Dent 1992; 2:109–114.
24. Meffert RM. How to treat ailing and failing implants. Implant Dent 1992; 1:25–33.
25. AlGhamdi AS, Ciancio SG. Guided tissue regeneration membranes for periodontal regeneration – a literature review. J Int Acad Periodontol 2009; 11:226–231.
26. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. Int J Oral Maxillofac Implants 1986; 1:11–25.
27. Deas DE, Mikotowicz JJ, Mackey SA, Moritz AJ. Implant failure with spontaneous rapid exfoliation: case reports. Implant Dent 2002; 11:235–242.
28. Park SH, Wang HL. Implant reversible complications: classification and treatments. Implant Dent 2005; 14:211–220.
29. Engquist B, Bergendal T, Kallus T, Linden U. A retrospective multicenter evaluation of osseointegrated implants supporting overdentures. Int J Oral Maxillofac Implants 1988; 3:129–134.
30. Tonetti MS, Schmid J. Pathogenesis of implant failures. Periodontol 2000 1994; 4:127–138.
31. Preiskel HW, Tsolka P. Treatment outcomes in implant therapy: the influence of surgical and prosthodontic experience. Int J Prosthodont 1995; 8:273–279.
32. Duyck J, Naert I. Failure of oral implants: aetiology, symptoms and influencing factors. Clin Oral Investig 1998; 2:102–114.
33. Piattelli A, Piattelli M, Mangano C, Scarano A. A histologic evaluation of eight cases of failed dental implants: is bone overheating the most probable cause? Biomaterials 1998; 19:683–690.
34. Sennerby L, Roos J. Surgical determinants of clinical success of osseointegrated oral implants: a review of the literature. Int J Prosthodont 1998; 11:408–420.
35. el Askary AS, Meffert RM, Griffin T. Why do dental implants fail? Part I. Implant Dent 1999; 8:173–185.
36. Sharawy M, Misch CE, Weller N, Tehemar S. Heat generation during implant drilling: the significance of motor speed. J Oral Maxillofac Surg 2002; 60:1160–1169.
37. Albrektsson T, Eriksson A. Thermally induced bone necrosis in rabbits: relation to implant failure in humans. Clin Orthop Relat Res 1985; 311–312.
38. Lindquist LW, Rockler B, Carlsson GE. Bone resorption around fixtures in edentulous patients treated with mandibular fixed tissue-integrated prostheses. J Prosthet Dent 1988; 59:59–63.
39. Becker W, Becker BE, Newman MG, Nyman S. Clinical and microbiologic findings that may contribute to dental implant failure. Int J Oral Maxillofac Implants 1990; 5:31–38.
40. Block MS, Kent JN. Factors associated with soft- and hard-tissue compromise of endosseous implants. J Oral Maxillofac Surg 1990; 48:1153–1160.
41. Sanz M, Alandez J, Lazaro P, Calvo JL, Quirynen M, van Steenberghe D. Histo-pathologic characteristics of peri-implant soft tissues in Branemark implants with 2 distinct clinical and radiological patterns. Clin Oral Implants Res 1991; 2:128–134.
42. Isidor F. Histological evaluation of peri-implant bone at implants subjected to occlusal overload or plaque accumulation. Clin Oral Implants Res 1997; 8:1–9.
43. Pinholt EM, Bang G, Haanaes HR. Alveolar ridge augmentation in rats by Bio-Oss. Scand J Dent Res 1991; 99:154–161.
44. Pinholt EM, Bang G, Haanaes HR. Alveolar ridge augmentation in rats by combined hydroxylapatite and osteoinductive material. Scand J Dent Res 1991; 99:64–74.
45. Pinholt EM, Haanaes HR, Roervik M, Donath K, Bang G. Alveolar ridge augmentation by osteoinductive materials in goats. Scand J Dent Res 1992; 100:361–365.
46. Lehmann B, Bragger U, Hammerle CH, Fourmousis I, Lang NP. Treatment of an early implant failure according to the principles of guided tissue regeneration (GTR). Clin Oral Implants Res 1992; 3:42–48.
47. Lang NP, Wetzel AC, Stich H, Caffesse RG. Histologic probe penetration in healthy and inflamed peri-implant tissues. Clin Oral Implants Res 1994; 5:191–201.
48. Christensen MM, Joss A, Lang NP. Reproducibility of automated periodontal probing around teeth and osseointegrated oral implants. Clin Oral Implants Res 1997; 8:455–464.