# **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.<sup>1</sup> 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.<sup>2</sup> and Schroeder and colleagues<sup>3–5</sup> have demonstrated that titanium implants healed dependably by direct bone-

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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.<sup>6</sup>

The integrity of the hard and soft tissues around dental implants is the key to dental implant longevity.<sup>7–10</sup> 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.<sup>7,9–13</sup> 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.<sup>8,10,14,15</sup>

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

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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.<sup>18</sup> 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 periimplantitis.<sup>22</sup> 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. Eightyeight 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.<sup>23,24</sup> 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)<sup>25</sup> 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.<sup>26</sup>

#### 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.<sup>27</sup> 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.<sup>28</sup>

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

							Bone Los	ss (mm)	Post-Loading Evaluation
Patient	Age	Sex	Implant	System	Position	Bone Graft	Mesial	Distal	Period (months)
1	37	ц	1	Brånemark	Mandibular left first molar	No	4.5	3	36
2	50	Μ	2	NobleReplace	Maxillary left lateral incisor	Yes	3.5	4	24
			3	NobleReplace	Maxillary left canine	Yes	3.5	3	
3	57	Μ	4	NobleReplace	Mandibular right first premolar	No	3.5	2.5	24
			5	NobleReplace	Mandibular right first molar	No	3	4	
4	61	Μ	9	NobleReplace	Maxillary right first premolar	Yes	6	6	54
			7	NobleReplace	Maxillary left first premolar	Yes	2.5	33	
5	34	ц	8	NobleReplace	Mandibular left first molar	No	4	3.5	36
			6	NobleReplace	Maxillary left first molar	No	3.5	2.5	
9	57	Μ	10	Brånemark	Mandibular right first molar	No	4.5	2.5	24
7	58	Μ	16	NobleReplace	Maxillary left lateral incisor	Yes	2	33	24
8	42	М	17	NobleReplace	Maxillary right second molar	No	4	2.5	24
6	58	ц	11	NobleReplace	Mandibular left second premolar	Yes	2.5	3.5	24
			12	NobleReplace	Mandibular left first molar	Yes	3.5	2	
10	46	ц	13	NobleReplace	Maxillary left central incisor	Yes	ŝ	${\mathfrak S}$	30
			14	NobleReplace	Maxillary left canine	Yes	2.5	Э	
			15	NobleReplace	Maxillary left second premolar	Yes	3.5	2.5	
11	44	М	18	NobleReplace	Maxillary right first molar	No	4	2.5	30



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

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

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.<sup>43–45</sup> 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.



Figure 5 Peri-implant defect after mechanical debridement.

Limited studies have been published about the treatment of failing implants, with only one case report<sup>46</sup> 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.

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.<sup>7</sup> Pocket depths were within normal range (average, 3.6 mm).<sup>47,48</sup> During the evaluation period, implants were successful according to the criteria proposed by Albrektsson and colleagues (1986).<sup>26</sup>

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,

#### 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 <sup>†</sup>	11.4	7.6

\*At the time of implant placement.

<sup>†</sup>Percentage of implants with progressive bone loss to the total number of implants with and without bone graft.



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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