Surgical Management of Severe Peri-Implantitis in the Esthetic Zone: A Case Report With a 6-Year Follow-Up

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INTRODUCTION

Peri-implantitis is generally defined as bacterial infections of the peri-implant tissue, which results in peri-implant bone loss and eventual implant loss.[1] Similar to the etiology of periodontitis, dental plaque and biofilm are regarded as the primary causes of peri-implantitis.[2] Some parameters—such as age, poor oral hygiene, absence of keratinized tissue, and overloading—are also considered as possible peri-implantitis etiologic factors.[3–5] Further, diabetes, bone metabolic diseases, and genetic changes have been linked with peri-implantitis.[6]

In previous studies, the frequency of peri-implantitis ranged from 5% to 43%.[2,3,7] However, with the increasing number of implants installed in clinical practice, a rising prevalence of peri-implantitis is anticipated, highlighting the importance of effective and predictable treatments. Studies investigating therapeutic approaches for peri-implantitis are diverse, including several surgical and nonsurgical therapies with various degrees of success. Most therapies emphasize the importance of lesion debridement, infected implant surfaces decontamination, and oral hygiene maintenance. In recent reviews, nonsurgical therapy was not found to be effective in peri-implantitis lesions.[2,4] Adjunctive chlorhexidine application has only limited effects on clinical and microbiological parameters.[8] Laser therapy has minor beneficial effects on peri-implantitis and needs to be further evaluated.[4,8,9] However, surgical approaches demonstrate relative efficacy in the management of peri-implantitis.[2–4,7,9] Open debridement, surface decontamination, and regenerative procedures may resolve peri-implantitis and promote bone fill.[2,3,9] Peri-implant defect fill using a bone substitute (with or without a membrane technique) has been maintained for over 3 years.[10]

The aim of this article is to present the surgical improvement of severe peri-implantitis in the esthetic zone, with a 6-year follow-up. Complete debridement, implantoplasty, and decontamination was followed by guided bone regeneration (GBR) to correct the defects. A subepithelial connective tissue graft was used to increase the peri-implant keratinized tissue. Favorable treatment results, along with oral hygiene maintenance and regular follow-ups, ensured long-term stability in this case.

CASE REPORT

Patient description

A 53-year-old nonsmoking, healthy female was referred to our clinic for symptomatic implants at the maxillary central incisors. Two Friadent-2 implants (Dentsply Friadent, Mannheim, Germany) installed 4 years earlier to replace teeth #8 and #9 had been in function for 42 months before her visit. The patient described gum swelling, bleeding, and persistent discomfort at the #8 and #9 implants over the past two years. Clinical evaluation revealed edematous peri-implant soft tissue, gingival recession, suppuration, and bleeding on probing with deep pockets (6–11 mm) at implants #8 and #9 (Table 1, Figure 1). Thin periodontal biotype and inadequate keratinized tissue were noted at the ailing implants. A low smile line was also observed during the patient's laugh. Radiographic examination showed radiolucency around the #8 and #9 implants (Figure 2).

The patient was informed that the existing peri-implantitis might result in further bony destruction and gingival recession, open interproximal embrasures (ie, "black triangles"), and implant loss. After potential risks and benefits of treatment options were discussed with the patient, surgical debridement was followed by GBR; soft tissue augmentation at the #8 and #9 implants were scheduled. Postoperative longer crown lengths were anticipated and accepted by the patient. A detailed informed consent was obtained before treatment.

Surgical debridement, decontamination, and GBR

The patient was prescribed amoxicillin (500 mg 3 times a day for 1 week) starting 1 day preoperatively. A mucoperiosteal flap was raised to expose the bony defects at implants #8 and #9.

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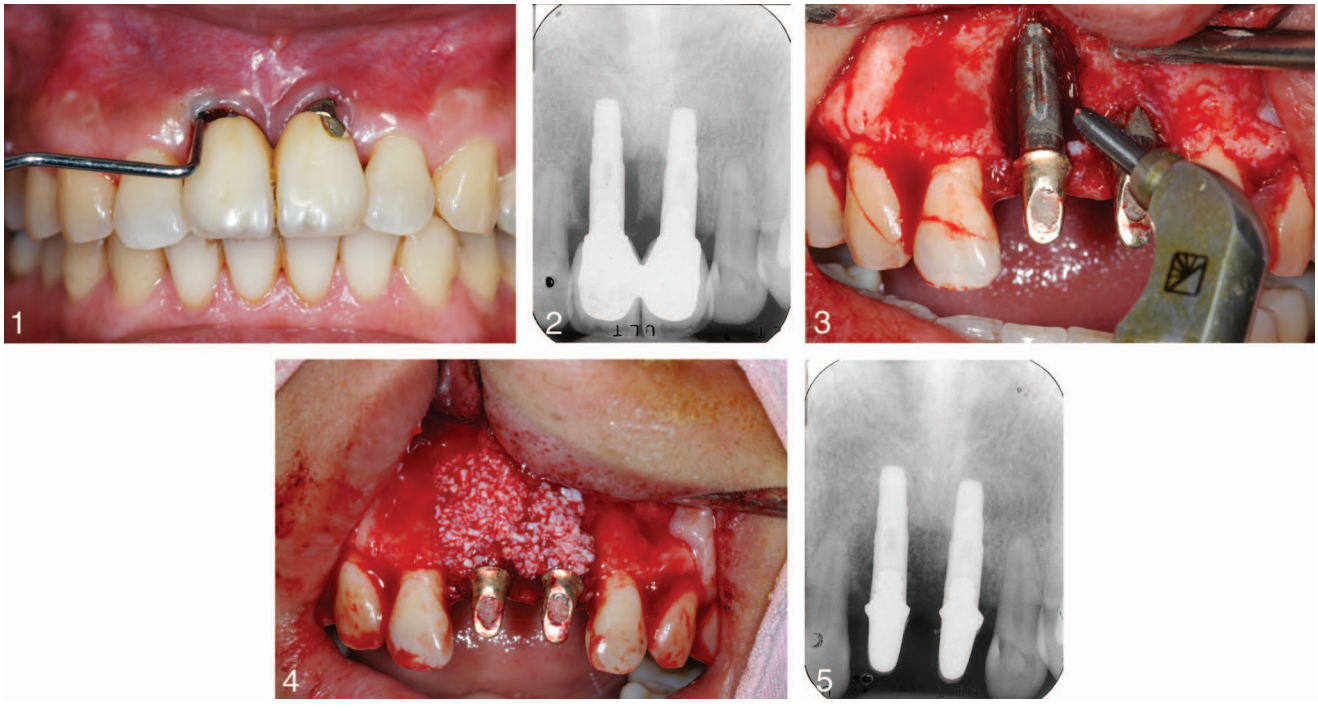
Table 1

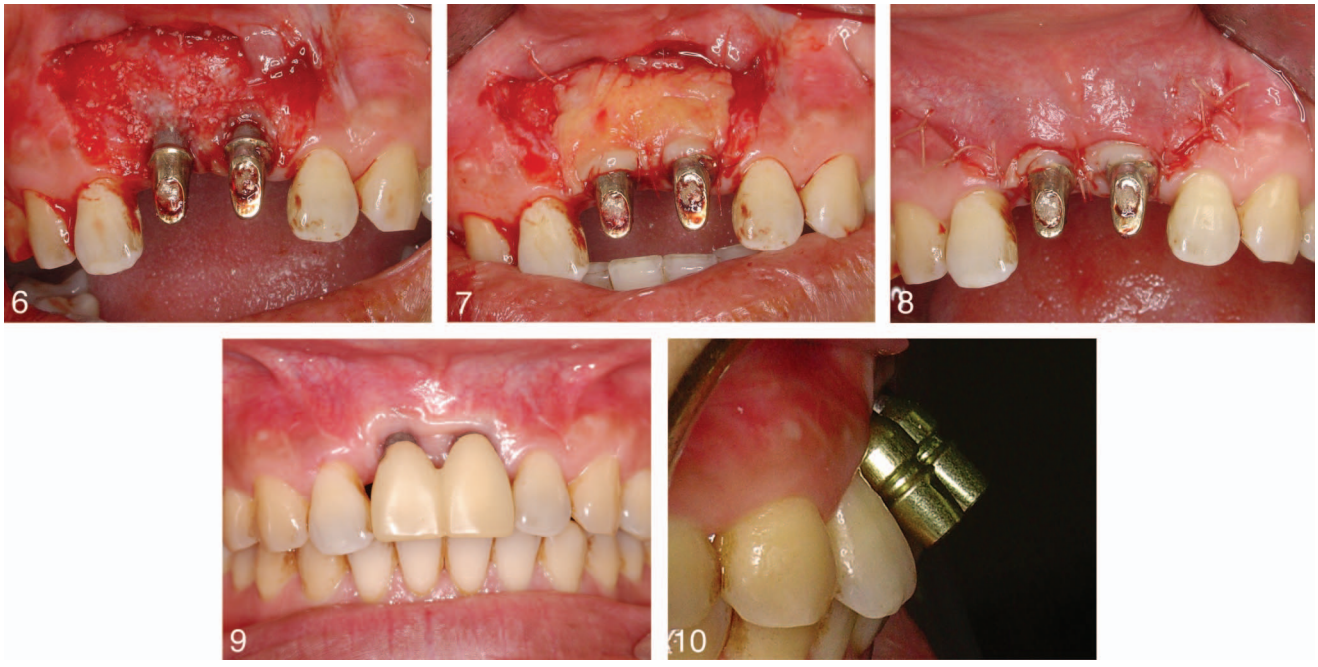
The periodontal probing depths at preoperative, postoperative, and follow-up visits

		Probing Depths (mm)					
		#8 Implant			#9 Implant		
		Distal	Middle	Mesial	Distal	Middle	Mesial
Preoperative	facial	11	12	11	5	6.5	6
	palatal	4	4	3.5	3.5	3	4
Postoperative 6 months	facial	4.5	5.5	4.5	3.5	4	3.5
	palatal	3.5	4	3.5	3	3	3
1-year follow-up	facial	4.5	4	4.5	3	3.5	2
	palatal	3.5	3	3.5	3	3	2.5
3-year follow-up	facial	4	4.5	4.5	3.5	3	2.5
	palatal	3.5	3	3.5	3	3	2.5
6-year follow-up	facial	4	4.5	4.5	3.5	3	2.5
	palatal	3.5	3	3.5	3	3	2.5

The granulation tissue was removed with stainless steel hand instruments. Implantoplasty of the infected implant surfaces was carried out using a diamond bur connected to a high-speed handpiece. Air abrasion (Figure 3) followed by chlorhexidine-soaked gauze were used to decontaminate the implant surfaces. To apply the sandwich bone augmentation (SBA) technique, autogenous bone harvested from the surgical site was placed into the defects as the first layer around the implants. Subsequently, bovine-derived xenograft (Bio-Oss, Geistlich, Wolhusen, Switzerland) was used as the second layer (Figure 4). Finally, a resorbable collagen membrane (BioMend Extend, Zimmer, Carlsbad, Calif) was utilized to differentiate cell growth. Primary closure was achieved with a coronally advanced flap. The patient was instructed to use chlorhexidine-soaked swabs instead of a brush to clean the surgical site during the postoperative 2 weeks. Thereafter, regular tooth brushing was encouraged. In addition, the patient was asked to rinse with 0.12% chlorhexidine (Sensitive Pro.Relief, Colgate-Palmolive, New York, NY) for 6 weeks after surgery. The postoperative radiograph demonstrated the radiopacity of bone grafting material (Figure 5). An acrylic resin bridge served as the interim prosthesis during the healing phase.



Figures 1–5. Figure 1. Pretreatment photograph of the ailing #8 and #9 implants. Deep probing depths, bleeding on probing, and mucosal recession were observed. **Figure 2.** Preoperative radiographic bone loss around the implants. **Figure 3.** Decontamination of the implant surfaces with air-abrasives following granulation tissue removal and implantoplasty. **Figure 4.** The peri-implant defects were augmented with autogenous bone and xenograft and then covered with a resorbable collagen membrane. **Figure 5.** Periapical film taken just after the bone augmentation surgery.



Figures 6–10. Figures 6–8. Eight-month reentry surgery and soft tissue augmentation. **Figure 6.** Bone regeneration around the implants with minor grafting remains. **Figure 7.** A subepithelial connective tissue graft was secured to the #8 and #9 implants. **Figure 8.** Primary closure of the wound. **Figures 9 and 10.** Four months after the reentry surgery. **Figure 9.** The keratinized tissue around implants #8 and #9 was increased and matured. **Figure 10.** The impression copings indicating the unfavorable implant axes with excessive labioversion.

Surgical reentry and soft tissue augmentation

Eight months after the debridement and bone augmentation, a surgical reentry was performed. Clinically, improvement of the osseous defects and remnant bone grafting particles were detected (Figure 6). To enhance the peri-implant keratinized tissue, a subepithelial connective tissue graft harvested from the right palate was secured to the buccal aspect of the implants (Figure 7). Thereafter, the flap was repositioned with primary closure (Figure 8).

Definitive restoration and follow-up

After another healing period of 4 months, the peri-implant soft tissue had matured with no sign of active inflammation detected. The keratinized tissue surrounding the implants was improved, and the pockets were reduced to 3–4.5 mm (Figure 9). Two prefabricated impression copings were connected to the implants, revealing the adverse implant axes (Figure 10). Thereafter, a final impression was made, and 2 metal-ceramic crowns were cemented to the implants. The anticipated longer crowns were masked with pink porcelain to mimic the texture of the adjacent soft tissue (Figure 11). A harmonious smile was achieved (Figure 12), and a radiograph indicated bone regeneration around implants #8 and #9 (Figure 13).

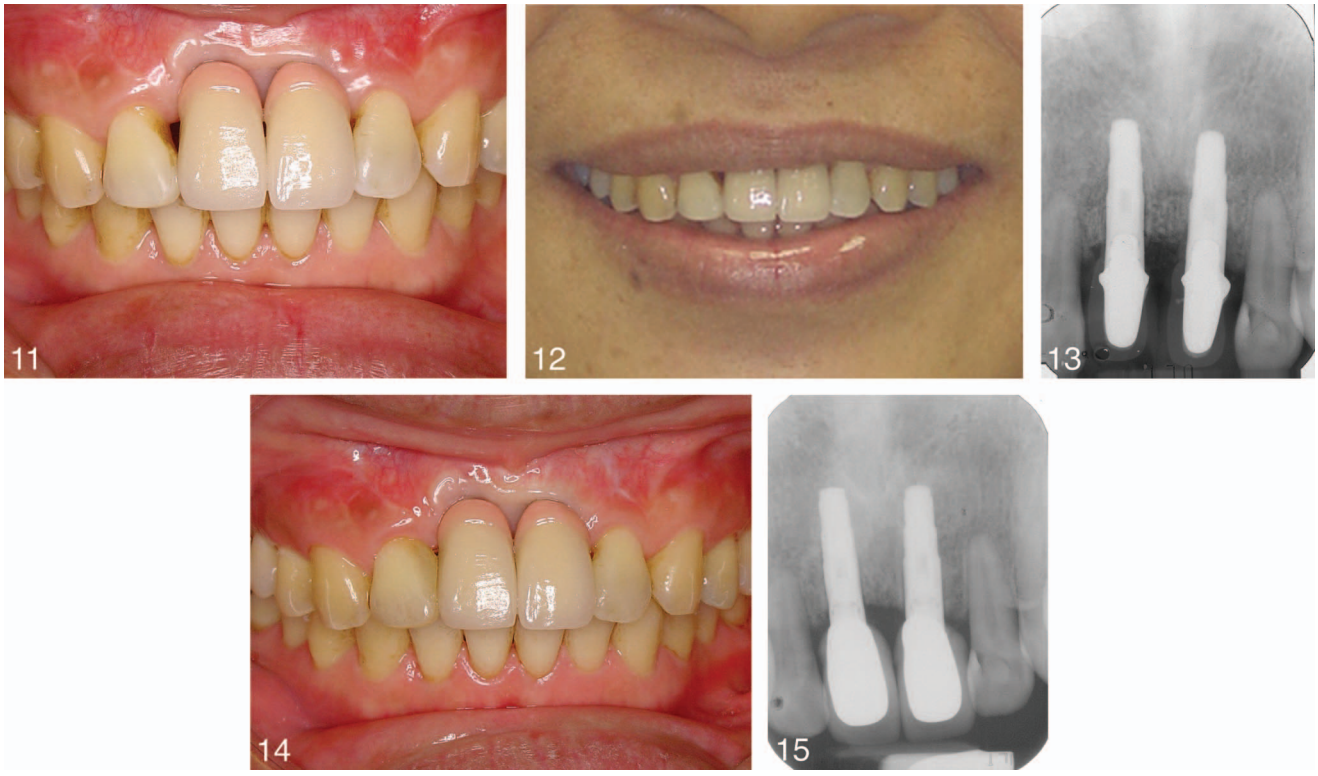
A 6-year follow-up showed that the peri-implant tissues were healthy and stable (Figure 14). Radiographic examination revealed the matured bone fill (Figure 15). The surgical treatment ceased the progression of peri-implantitis and established a maintainable environment for oral hygiene. However, good plaque elimination and regular follow-ups are crucial for long-term stability.

Discussion

Bacterial plaque has been regarded as the cause of peri-implantitis; therefore, treatment must include anti-infective measures. In this case, the patient had long complained of persistent discomfort and discharge at the #8 and #9 implants. Apart from oral hygiene reinforcement and debridement, antibiotic medication was prescribed to reduce the bacterial infection. Amoxicillin is one of the antibiotics with bactericide effects. It is usually recommended by guidelines as the first-choice drug with good absorbability, following oral administration.[11] The patient was allergic to several antibiotics except amoxicillin. To reduce the existing bacterial infection, use of antibiotics was prescribed for at least 1 week.

Ideally, implant placement should be based on a restoration-driven treatment plan with correct three-dimensional positioning of the implant.[12] In this case, the axes of the implants came through the facial surfaces with excessive labioversion. Improper positioning of these implants might result in extremely thin buccal plate and even bony dehiscence. If left untreated, the unfavorable tissues could make the implants esthetically compromised and susceptible to peri-implantitis.

Occlusal examination revealed no heavier or premature contacts on the implant-supported bridge, which excluded the possibility of overloading. In this case, peri-implantitis might be attributed to bacterial invasion, which could be worsened by unfavorable implant positioning, improper management of tissues at the implant sites, lack of oral hygiene, and irregular check-up visits. Furthermore, extensive inflammation without proper intervention was presumed to exacerbate the bony destruction surrounding the implants.



Figures 11–15. Figures 11–13. The definitive metal-ceramic crowns on implants #8 and #9. **Figure 11.** Peri-implant health was achieved. Pink porcelain was used to simulate the texture of the adjacent soft tissue. **Figure 12.** The harmonious smile view. **Figure 13.** Radiograph revealing the increased radiopacity in comparison with the initial film. **Figures 14 and 15.** The 6-year follow-up. **Figure 14.** The peri-implant tissues remain stable without progression of peri-implantitis. **Figure 15.** Radiograph showing further bone maturation.

Removal of an osseointegrated but ailing peri-implantitis–affected implant may increase morbidity, time, and cost for restoring the explanted site. Here, the implants had been in function for 42 months, despite biological and esthetic complications. The patient desired to have the ailing implants treated and preserve implantation. Potential benefits and risks were explained, and detailed informed consent was obtained before the treatment.

Nonsurgical debridement may not be adequate for removing bacterial load from implants surfaces with peri-implant pockets $\geqq$5 mm.[4,13] In this case, open flap debridement and decontamination were performed to completely remove the granulation tissue and condition the affected implant surfaces, respectively. To effectively remove the adherent granular tissue and calculus, stiff instruments were preferred over plastic curettes. Titanium curettes/brushes, ultrasonic scalers, or stainless steel instruments are suitable for open flap debridement. In our opinion, the extent of debridement was more crucial than the metal implements selected in such a severe infection. Schwarz et al. indicated the safety and efficacy of implantoplasty to serve as an approach for treating peri-implantitis.[14] Implantoplasty was performed at the exposed implant surfaces to reduce the potential risk for a reinfection. In a recent randomized controlled clinical study, the combined surgical resective/regenerative therapy of moderate-to-advanced peri-implantitis defects demonstrated more predictable clinical improvements than did a regenerative approach alone.[15] To enhance the decontamination of the infected implant surfaces in this case, mild implantoplasty using a diamond bur was used to lightly grind the calculus infected areas and aid in calculus elimination. The modified implant surface, without additional polish, provided favorable environment for bone regeneration; however, further controlled clinical trials aimed at investigating the impact of a combined surgical resective/regenerative therapy of peri-implantitis defects are needed to support the results.

The application of bone substitutes can be efficacious for the treatment of peri-implantitis lesions.[4,9] Schwarz et al. applied GBR in peri-implantitis defects under nonsubmerged healing and obtained clinically significant improvements.[16] In the subsequent study with 4-year results, the combination of natural bone mineral and collagen membrane in GBR seemed to correlate with greater improvements in probing pocket depth and clinical attachment level.[17] The SBA technique used in this case consisted of autogenous bone as the innermost graft, xenograft as the second layer, and a resorbable membrane as the outermost layer. Based on the creeping substitution property, autogenous bone allows faster resorption of the inner graft to improve bone-to-implant contact.[18] The outer layer of xenograft with slow resorption property facilitates space creation and maintenance.[19] Meanwhile, a membrane can exclude soft tissue, thereby enhancing bone formation.[20] In the case presented, the SBA technique appeared to be beneficial to bone regeneration at the affected implant sites.

The presence of an appropriate amount of peri-implant

TABLE 2

The plaque index at preoperative, postoperative, and follow-up visits

	Plaque Index*							
	#8 Implant				#9 Implant			
	Distofacial	Facial	Mesiofacial	Lingual	Distofacial	Facial	Mesiofacial	Lingual
Preoperative	3	3 (3+3+3+3)/4 = 3	3	3	3	3 (3+3+3+3)/4 = 3	3	3
Postoperative 6 months	2	2 (2+2+2+1)/4 = 1.75	2	1	2	1 (2+1+2+1)/4 = 1.5	2	1
1-year follow-up	1	1 (1+1+1+1)/4 = 1	1	1	1	1 (1+1+2+1)/4 = 1.25	2	1
3-year follow-up	0	1 (0+1+1+0)/4 = 0.5	1	0	1	0 (1+0+0+1)/4 = 0.5	0	1
6-year follow-up	1	1 (1+1+1+1)/4 = 1	1	1	1	1 (1+1+1+0)/4 = 0.75	1	0

*The scale according to Löe and Silness[25] was used to determine the plaque index.

keratinized gingiva is required for esthetics and long-term maintenance. Studies have reported that increased width of keratinized mucosa around implants is associated with lower mean alveolar bone loss and improved indices of soft tissue health.[21–23] Significantly greater bone loss was detected at implants with the width of keratinized mucosa less than 2 mm.[23,24] Here, the absence of adequate peri-implant keratinized tissue hindered oral hygiene and was related to higher plaque accumulation and gingival inflammation (Tables 2 and 3).[25–27] In addition, toothbrushing was painful because of the thin and inadequate keratinized mucosa. To create a favorable environment for peri-implant health and maintenance, soft tissue augmentation was executed in this case to increase the peri-implant keratinized tissue (Table 4). In addition, direct visualization of the outcome of previous bone grafting was easy and clear through the open flap surgery.

From an esthetic point of view, pink porcelain was used to mask the anticipated gingival recession after surgical treatment of peri-implantitis.[28,29] Composite resin was added to adjacent teeth #7 and #10 for reduction of the black triangles. Since peri-implant health is not easy to maintain, the patient was carefully instructed of effective oral hygiene procedures and enrolled in a maintenance program.[2,13,30]

Although some therapies have demonstrated beneficial effects in treating peri-implantitis, evidence is inadequate to support a specific treatment protocol.[2,4,13,31] Many factors—such as oral hygiene, occlusion, implant surfaces, hard and soft tissue conditions, patient cooperation, and expectations—should be considered before creating a treatment plan. Most importantly, the potential risks and benefits of treatment alternatives should be informed and discussed before intervention, which should be evaluated on an individual basis. Moreover, well-designed and preferably longitudinal, randomized controlled clinical trials are needed to clarify the issue.

CONCLUSIONS

The case presents a favorable resolution of peri-implantitis at the maxillary central incisors with stable treatment results. Complete debridement, implantoplasty, and decontamination are crucial in treating peri-implantitis. The existing tissue defects required augmentation to provide configurations for easy hygiene maintenance that, in turn, contributed to long-term implant stability. In addition, patient oral hygiene and a maintenance program should be strictly performed to ensure

TABLE 3

The gingival index at preoperative, postoperative, and follow-up visits

	Gingival Index*							
	#8 Implant				#9 Implant			
	Distofacial	Facial	Mesiofacial	Lingual	Distofacial	Facial	Mesiofacial	Lingual
Preoperative	3	3 (3+3+3+2)/4 = 2.75	3	2	2	3 (2+3+3+2)/4 = 2.5	3	2
Postoperative 6 months	2	2 (2+2+1+1)/4 = 1.5	1	1	2	1 (2+1+1+1)/4 = 1.25	1	1
1-year follow-up	1	0 (1+0+1+1)/4 = 0.75	1	1	1	1 (1+1+1+0)/4 = 0.75	1	0
3-year follow-up	1	1 (1+1+1+1)/4 = 1	1	1	1	0 (1+0+1+0)/4 = 0.5	1	0
6-year follow-up	0	1 (0+1+1+1)/4 = 0.75	1	1	1	0 (1+0+1+0)/4 = 0.5	1	0

*The scale according to Löe and Silness[25] was used to determine the gingival index.

TABLE 4

The width of keratinized tissue at preoperative, postoperative, and follow-up visits

	Width of Keratinized Tissue* (mm)	
	#8 Implant	#9 Implant
Preoperative	1.5	2
Postoperative 6 months	4.5	3.5
1-year follow-up	4	3.5
3-year follow-up	4	3.5
6-year follow-up	4	3.5

*A periodontal probe was used to measure the width of keratinized tissue at the implant abutment buccal site from the mid-facial mucosal margin to the mucogingival junction.

continued stability after successful treatment of peri-implantitis. Further studies are necessary to verify these encouraging results.

Abbreviations

GBR: guided bone regeneration

SBA: sandwich bone augmentation

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