



George Nikou, Dimitris Nikolidakis, Peter Thoolen, Anton Sculean

## Management of peri-implant recession associated with bone fenestration and dehiscence in the anterior region



**George Nikou**  
Department of  
Periodontology,  
Radboud University  
Medical Center,  
The Netherlands

**Dimitris Nikolidakis**  
Department of  
Periodontology,  
Radboud University  
Medical Center,  
The Netherlands

**Peter Thoolen**  
Department of  
Periodontology,  
Radboud University  
Medical Center,  
The Netherlands

**Anton Sculean**  
Department of  
Periodontology,  
Radboud University  
Medical Center,  
P.O. Box 9101,  
Internal Postal Code 117,  
6500 Nijmegen,  
Philips van Leydenlaan 25,  
The Netherlands  
Tel: + 31 24 366 83 79  
Fax: + 31 24 361 46 57  
Email:  
anton.sculean@gmx.de

**KEY WORDS** *aesthetics, bone dehiscence, collagen membrane, connective tissue graft, natural bone mineral, peri-implant recession*

Guided bone regeneration is a valuable treatment in order to accomplish an adequate height and thickness of alveolar bone before or during implant placement. Inadequate augmentation in combination with poor implant placement may lead to bone fenestration and/or dehiscence, which may manifest clinically as peri-implant recession. The aim of the present case report is to present the management of a recession of the peri-implant soft tissue associated with bone dehiscence and fenestration. The step-by-step procedure and the clinical outcome 18 months following treatment are presented. The treatment approach comprised reconstructive surgery by means of a natural bone mineral, bioresorbable collagen membrane and connective tissue graft followed by complete soft tissue coverage of the implant. After a period of 6 months, the second-stage surgery was performed to expose the coronal part of the implant and to place the healing abutment. The thickness of the vestibular gingiva was further increased using the modified roll technique. At 18 months following treatment, the clinical and radiographic re-evaluation revealed a stable clinical situation and a satisfactory aesthetic appearance of the peri-implant soft tissue.

### ■ Introduction

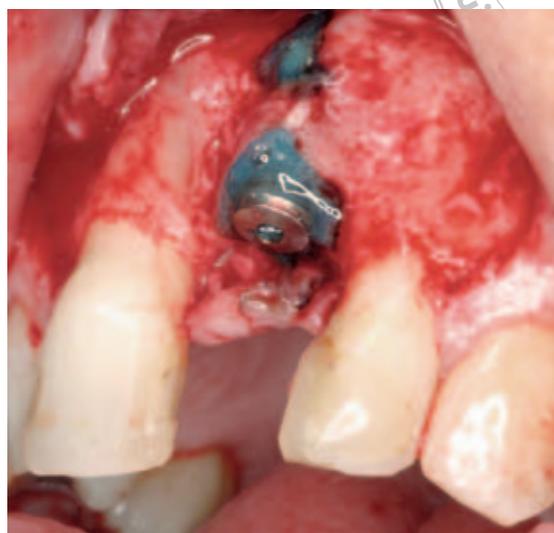
Dental implants represent a well-documented treatment option for partially edentulous patients<sup>1</sup>. However, a sufficient amount of bone is a prerequisite for installation of oral implants<sup>2</sup>. The placement of an implant at a site with a thin crestal ridge could result in a buccal dehiscence<sup>3</sup>. Guided bone regeneration (GBR) with or without osseous grafting can be used to pro-

vide an optimal implant site<sup>3</sup>. Various techniques used in either one stage<sup>4</sup> or two stages<sup>5</sup> have been employed to regenerate the lost hard tissues. These treatment approaches are of particular clinical significance in anterior areas of the dentition, where an insufficient amount of bone may hinder placement of dental implants in aesthetically optimal positions.

Lateral ridge augmentation is often performed by means of autografts and GBR with either non-bio-



**Fig 1** Clinical view at the baseline situation after implant placement indicating a peri-implant recession and implant exposure that jeopardises the aesthetic appearance.



**Fig 2** Following flap elevation, a bone fenestration in the middle third of the implant and a dehiscence were visible.

resorbable or bioresorbable membrane barriers<sup>6</sup>. The rationale for using grafts in combination with GBR is to provide support to the membrane in situations with inadequate defect morphology, thus offering a scaffold for the in-growth of capillaries and perivascular tissue<sup>6</sup>. Autografts are considered the gold standard for graft materials due to their osteoinductive properties<sup>7</sup>. They can be harvested from either extraoral or intraoral donor sites<sup>7</sup>. The extraoral bone grafts can be of high quantity but require additional surgery and are associated with a high morbidity<sup>7</sup>. On the other hand, intraoral bone grafts may not require additional surgery, but can only be harvested in limited quantities<sup>7</sup>. It has been shown that a natural bone mineral (NBM) possesses significant osteoconductive capacity and can be successfully used in conjunction with GBR for treating dehiscence-type defects<sup>8</sup>. Another study has evaluated the healing of bone defects around osseointegrated dental implants by means of a combined treatment consisting of defect fill with either NBM or autografts and coverage with bioresorbable membranes<sup>9</sup>. At 16 months following treatment, the results have shown that bone implant contact, horizontal bone growth, vertical bone growth and area density of graft material was higher for the NBM compared with the autograft, although the difference was not statistically significant<sup>9</sup>. An insufficient volume or loss of hard tissue support around an osseointegrated dental implant may subsequently result in a recession of the soft tissues surrounding the implant, thus leading to exposure of the

implant surface. The management of these types of complications is from both a patient's and a clinician's point of view of crucial importance. However, currently there are very limited data on the clinical management of combined hard and soft tissue defects associated with a compromised aesthetic situation around osseointegrated dental implants.

The aim of the present case report was thus to present the management of a recession of the peri-implant soft tissue associated with bone dehiscence and fenestration. The step-by-step procedure and the clinical outcome 18 months following treatment are shown.

### ■ Case description

A 38-year-old, Caucasian, non-smoking female was referred to the Department of Periodontology, Radboud University Nijmegen Medical Centre, in 2004 from her dentist for peri-implant plastic reconstructive surgical treatment because of an alveolar bone resorption and gingival recession at the vestibular side. The patient was in good general health without any systemic diseases (ASA score I).

The dental history revealed that 31 years ago the patient had an accident resulting in dislocation of tooth 21. Seven years later, an orthodontic treatment was performed aiming to realign tooth 21. In 2002, an apical root resorption was radiographically diagnosed and the tooth removed. The patient was then



**Fig 3** Decorticalisation of peri-implant bone for providing blood to the area for regeneration.



**Fig 4** Application of natural bone mineral granules (1–2 mm) around the bone defect.

referred to a maxillofacial surgeon for implant therapy. Treatment consisted of bone augmentation at the area of 21 with a block graft from the ascending ramus of the mandible. At 4 months after grafting, an oral implant (Astra® Tech Implant system, Mölndal, Sweden) of 13 mm length and 4 mm diameter was placed, and the implant site was further augmented with autogenous bone removed from the spina nasalis and subsequently covered with a bioresorbable collagen barrier (BioGide®, Geistlich Pharma AG, Wolhusen, Switzerland). At 16 months following implant placement, the patient was referred to the university for further treatment related to an unsatisfactory aesthetic appearance of the soft tissue surrounding the implant.

During oral inspection and evaluation of the periodontal status, the oral hygiene and the bleeding score were found to be adequate (i.e. FMPS = 18%, FMBS = 11%). Full mouth probing pocket depths ranged from 1 to 3 mm with localised recessions up to 2 mm. In the area of the implant, a soft tissue recession and marginal bone resorption were observed (Fig 1). The intraoral radiograph revealed a slight radiolucency around the implant.

The patient was diagnosed with peri-implant recession associated with marginal bone resorption and unfavourable aesthetic appearance around the implant in the area 21. The aetiology was probably related to the unsuccessful bone augmentation and aesthetically improper implant placement (i.e. too far buccally).

## ■ Treatment protocol and post-operative care

The treatment protocol comprised a combined surgical protocol consisting of bone augmentation, GBR and peri-implant soft tissue grafting. Prior to surgery, the suprastructure of the implant was removed. Following a mid-crestal horizontal incision, full-thickness buccal and palatal flaps were elevated, revealing the presence of a dehiscence and a fenestration bony defect located at the vestibular site of the implant (Fig 2). According to the classification by Tinti and Parma-Benfenati<sup>10</sup>, the defects were classified as class I dehiscence and class II fenestration. Following topical application of tetracycline to facilitate implant surface decontamination, the surrounding bone plate was decorticalised in order to induce bleeding (Fig 3). Subsequently, the bone defect was filled with NBM (Bio-Oss® granules 1–2 mm diameter; Geistlich Pharma AG, Wolhusen, Switzerland) (Fig 4). The graft particles were covered with a bioresorbable collagen membrane of porcine origin (BioGide®, Geistlich Pharma AG, Wolhusen, Switzerland) (Fig 5). The collagen membrane was additionally covered with a connective tissue graft harvested from the palate (Fig 6). The flaps were coronally displaced to allow complete tension-free coverage of the implant and sutured with horizontal mattress and interrupted single sutures using microporous bioresorbable monofilament made of expanded polytetrafluoroethylene (ePTFE) suture material (Gore-Tex®



**Fig 5** Application of the collagen membrane in order to hold the granules in place and exclude soft tissue in-growth.



**Fig 6** Connective tissue graft applied above the membrane in order to increase the volume of the soft tissue and improve the aesthetic appearance.

sutures, WL Gore & Associates Inc, Flagstaff, AZ, USA) (Fig 7). A temporary etch bridge was constructed for replacement of the implant suprastructure.

The post-operative care consisted of a post-operative antibiotic regimen (3 x 500 mg daily amoxicillin for 7 days). The post-surgical pain and oedema were controlled with tablets of 600 mg ibuprofen and the patient was instructed to rinse twice daily with 0.12% chlorhexidine for 4 weeks. Gentle wiping of the operated dentogingival area with a soft surgical toothbrush was allowed in the first 4 post-operative weeks. Sutures were removed after 2 weeks.

The post-operative healing was uneventful. No extensive pain, haematoma, suppuration, or flap dehiscence was detected. The patient was enrolled in a supportive care programme consisting of oral hygiene reinforcements and professional prophylaxis tooth cleaning on a 3-month basis.

For a period of 6 months the implant remained submerged and the healing process of the augmented area was not disrupted. At the 6-month post-healing period, the clinical and radiographic examination confirmed a healthy stable peri-implant situation, excluding any peri-implant radiolucency (Figs 8 and 9). At this time, the second-stage surgery was performed to expose the coronal part of the implant and to place the healing abutment. Furthermore, the soft tissue volume buccal of the implant appeared inadequate compared with the gingival

morphology of the neighbouring teeth. Thus, in order to further increase the thickness of the vestibular gingiva, the modified roll technique<sup>11</sup> was performed (Fig 10). Tablets of 600 mg ibuprofen were prescribed preventively, in case of minor pain, and the patient was instructed to rinse twice daily for 1 week with 0.12% chlorhexidine. After 1 week the sutures were removed and 6 weeks later a temporary crown was placed. At this period, a non-eventful healing was observed excluding any extensive pain, haematoma, suppuration or flap dehiscence. After 5 months, a zirconium abutment and a full-ceramic crown (Procera® AllCeram system, Nobel Biocare AB, Göteborg, Sweden) were placed on the implant.

## ■ Results

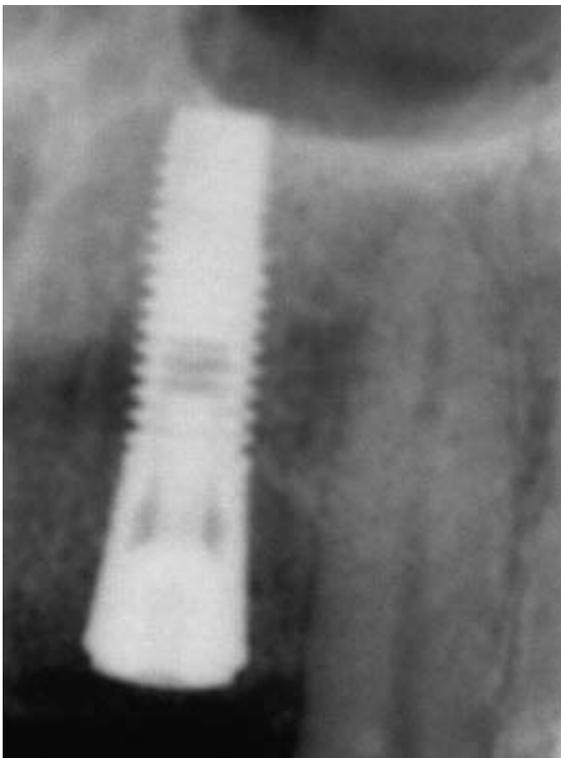
At 18 months following placement of the permanent crown, the general periodontal status indicated stable periodontal conditions with shallow probing pocket depths and reduced bleeding and plaque scores (FMBS = 8% and FMPS = 15%, respectively). No recession of the peri-implant soft tissues was visible. The thickness of the soft tissue and the emergence profile appeared adequate, showing a satisfactory aesthetic outcome (Figs 11 and 12). The radiograph revealed a stable condition of the hard tissue surrounding the implant (Fig 9). The patient was satisfied with the final aesthetic result.



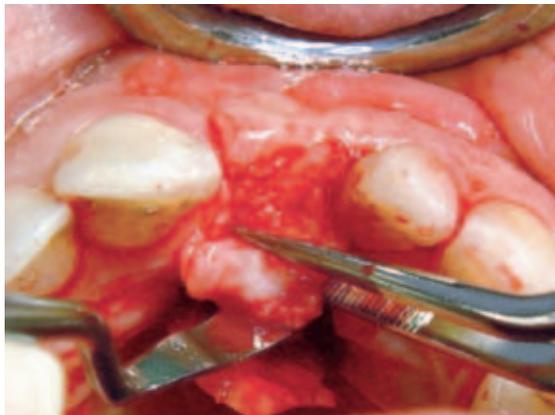
**Fig 7** Coronal reposition and suture of the flap after flap extension with the use of periosteal incisions.



**Fig 8** Clinical examination after 6 months revealed that adequate soft tissue was present.



**Fig 9** Radiographic evaluation revealed no evidence of radiolucency.



**Fig 10** During the second stage for the healing abutment placement the modified roll technique<sup>11</sup> was performed to additionally improve the soft tissue condition.



**Fig 11** Clinical view 18 months after surgical treatment. The final restoration has already been cemented.



**Fig 12** The profile appearance of the region after hard and soft tissue augmentation indicated a considerable improvement.



## ■ Discussion

The present case report demonstrates successful management of a treatment failure following implant placement, which resulted in a recession of the peri-implant soft tissue associated with bone dehiscence and fenestration. The treatment approach consisted of reconstructive surgery by means of a deproteinised bovine bone mineral and GBR by means of a collagen membrane and a connective tissue graft. During the first surgery, a combination of bone fenestration and dehiscence at the buccal alveolar plate was visible. The bony defects were classified as class I fenestration (i.e. the implant surface penetrates the wall of the bone by an insignificant amount but is still located within the bony envelope) and a class I dehiscence (i.e. the implant surface resides within the envelope of bone)<sup>10</sup>. It has been suggested that the establishment of an implant surface conducive to bone formation is a prerequisite for successful regenerative treatment around implants. In order to achieve this goal, decontamination and removal of soft tissue cells from the implant surface, without, however, modifying its surface was proposed<sup>12</sup>. Although in the present case, no signs of peri-implant inflammation were present, decontamination of the implant surface was performed using tetracycline<sup>12</sup>.

According to the biological principle of GBR, access to the area intended for regeneration should be given to desired cells residing into the bone marrow<sup>13</sup>. It was thus proposed that the perforation or removal of the cortical bone plate adjacent to the wound area might allow easier access of these cells into the wound area<sup>13</sup>. Subsequently, this procedure may lead to higher bone formation rate and faster maturation of bone, compared with non-perforated sites<sup>13</sup>. Also, in the present case, during reconstructive surgery the surrounding bone was decorticalised in order to induce additional bleeding and enhance the regeneration process.

GBR has been shown to result in predictable bone fill of peri-implant bone defects<sup>14</sup>. The rationale for using graft material in combination with GBR is to support the membrane in situations with inadequate defect morphology and to offer a scaffold for the ingrowth of capillaries and osteo-progenitor cells. Furthermore, autogenous grafts are believed to contain various growth factors known to play an important

role in bone formation (i.e. bone morphogenetic proteins)<sup>13</sup>. An ideal bone graft should be, apart from sterile, non-toxic and non-reactive immunologically, also osteoconductive and/or osteoinductive, resorbable, available in sufficient quantities, not expensive and favourable in handling<sup>13</sup>. The NBM graft material used in this study has been demonstrated to possess significant osteoconductive capacity and can be successfully used in conjunction with GBR in dehiscence defects<sup>8</sup>.

It was proposed that the membranes used for GTR/GBR procedures should be biocompatible and clinically manageable, to provide cell occlusion and space maintenance and be integrated into the host tissue<sup>15</sup>. The bioresorbable membranes should exhibit minimal tissue reactions during resorption without any negative influence upon the regeneration process<sup>15</sup>. The advantage of bioresorbable compared with non-bioresorbable membranes is related to the lack of a second surgery needed for membrane removal, which may influence the newly formed tissues. This, in turn, may result in lower patient morbidity and enhanced cost-effectiveness of the treatment. The use of the bioresorbable collagen membrane in combination with NBM is a well-documented treatment approach for GBR<sup>16</sup>. In a 5-year prospective study, Zitzmann et al<sup>17</sup> have shown that the combination of NBM and either bioresorbable collagen or e-PTFE non-bioresorbable membranes may result in comparable clinical outcomes<sup>17</sup>.

In the present case report, a connective tissue graft was additionally placed during reconstructive surgery while during the second-stage surgery the modified roll technique was employed<sup>11</sup>. These techniques were used to obtain an adequately thick soft tissue around the implant, which is desirable to avoid complications such as mechanical tissue trauma, inflammation and poor aesthetics. Observations from case reports have suggested that in soft tissue recessions around implants, the use of a connective tissue graft may correct certain mucogingival problems by thickening the existing mucosa and creating a collagenous collar around implants, which in turn may enhance the aesthetic appearance of peri-implant soft tissues<sup>18</sup>. On the other hand, it should be noted that the additional use of the modified roll technique<sup>11</sup> during second-stage surgery might have been avoided, without significantly influencing the



final clinical outcome. However, this issue along with the predictability of the presented protocol need to be confirmed in larger clinical studies.

In conclusion, this case report has shown that the presented treatment approach may result in improved conditions of the peri-implant soft and hard tissues and satisfactory aesthetic appearance for the patient.

## ■ Acknowledgement

We would like to thank Dr J Kox for referring this patient to our department and for his constructive cooperation during the entire treatment.

## ■ References

- Schmitt A, Zarb GA. The longitudinal clinical effectiveness of osseointegrated dental implants for single-tooth replacement. *Int J Prosthodont* 1993;6:197–202.
- Lekholm U, Zarb GA. Patient selection and preparation. In Brånemark PI, Zarb GA, Albrektsson T (ed). *Tissue Integrated Prostheses: Osseointegration in Clinical Dentistry*. Chicago: Quintessence 1985;129–145.
- Buser D, Dula K, Belser U, Hirt HP, Berthold H. Localized ridge augmentation using guided bone regeneration. I. Surgical procedure in the maxilla. *Int J Periodontics Restorative Dent* 1993;13:28–45.
- De Boever AL, De Boever JA. A one-stage approach for non-submerged implants using a xenograft in narrow ridges: report of seven cases. *Int J Periodontics Restorative Dent* 2003;23:169–175.
- Lang NP, Hämmerle CHF, Brägger U, Lehmann B, Nyman SR. Guided tissue regeneration in jawbone defects prior to implant placement. *Clin Oral Implants Res* 1994;5:92–97.
- Buser D, Dula K, Hess D, Hirt HP, Belser U. Localized ridge augmentation with autografts and barrier membranes. *Periodontol* 2000 1999;19:151–163.
- Goldberg VM, Stevenson S. Natural history of autografts and allografts. *Clin Orthop* 1987;225:7–16.
- Hämmerle CHF, Chiantella GC, Karring T, Lang NP. The effect of a deproteinized bovine bone mineral on bone regeneration around titanium dental implants. *Clin Oral Implants Res* 1998;9:151–162.
- Hockers T, Abensur D, Valentini P, Legrand R, Hämmerle CHF. The combined use of bioresorbable membranes and xenografts or autografts in the treatment of bone defects around implants. *Clin Oral Implants Res* 1999;10:487–498.
- Tinti C, Parma-Benfenati S. Clinical classification of bone defects concerning the placement of dental implants. *Int J Periodontics Restorative Dent* 2003;23:147–155.
- Scharf DR, Tarnow DP. Modified Roll technique for localized alveolar ridge augmentation. *Int J Periodontics Restorative Dent* 1992;12:415–425.
- Mellonig JT, Griffiths G, Mathys E, Spitznagel J. Treatment of the failing implant: case reports. *Int J Periodontics Restorative Dent* 1995;15:384–395.
- Hämmerle CHF. Membranes and bone substitutes in GBR. In: Lang NP (ed). *Proceedings of the 3rd European Workshop on Periodontology: Implant Dentistry*. Berlin: Quintessence 1999;468–499.
- Hämmerle CHF, Karring T. Guided bone regeneration at oral implant sites. *Periodontol* 2000 1998;17:151–175.
- Gottlow J. Guided tissue regeneration using bioresorbable and non-resorbable devices: initial healing and long-term results. *J Periodontol* 1993;64:1157–1165.
- Zitzmann NU, Naef R, Schärer P. Resorbable versus non-resorbable membranes in combination with Bio-Oss for guided bone regeneration. *Int J Oral Maxillofac Implants* 1997; 12:100–109.
- Zitzmann NU, Schärer P, Marinello CP. Long-term results of implant treated with guided bone regeneration: a 5-year prospective study. *Int J Oral Maxillofac Implants* 2001; 16:355–366.
- Azzi R, Etienne D, Takei H, Fenesch P. Surgical thickening of the existing gingiva and reconstruction of the interdental papilla around implant supported restorations. *Int J Periodontics Restorative Dent* 2002;22:71–77.