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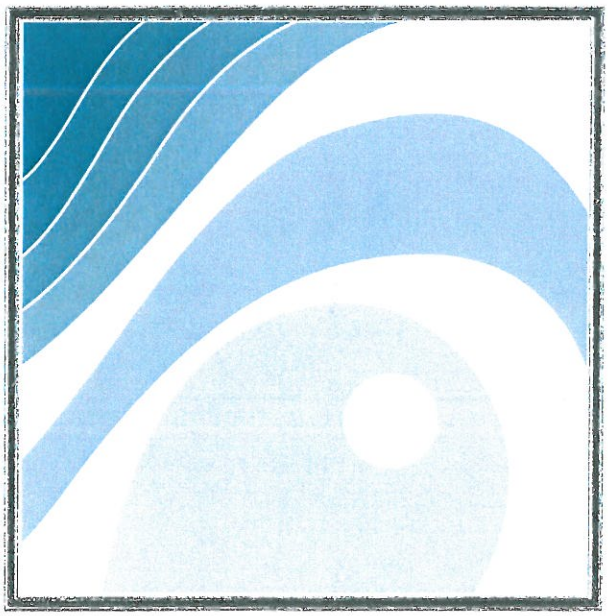

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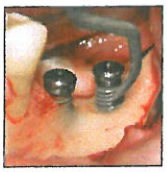
QUINTESSENCE PUBLISHING

Treatment of Peri-implantitis: Surgical Therapeutic Approaches Based on Peri-implantitis Defects



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Peri-implantitis is a frequently occurring inflammatory disease mediated by bacterial infection that results in the loss of supporting bone. Peri-implantitis should be treated immediately, but there is a lack of evidence regarding the most effective therapeutic interventions. Nonsurgical periodontics may be the treatment of choice in cases of peri-implant mucositis or if the patient has medical contraindications or refuses to consent to more appropriate treatment. Peri-implantitis defects will dictate the therapeutic approach and present a guideline for relative clinical management. The suggested therapeutic solutions are derived from clinical experience and are meant to be a useful guide. (Int J Periodontics Restorative Dent 2013;33:627–633. doi: 10.11607/prd.1549)

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Implant therapy has become a widely implemented treatment alternative for replacing missing teeth.[1] Although favorable long-term results of implant therapy have been reported, some implants suffer from peri-implantitis.[2–4] The long-term outcomes of implant therapy appear to be enhanced by supportive periodontal treatment for patients who are periodontally compromised, but those who are not compliant present a significant risk for implant complications.[5] Peri-implantitis is an inflammatory disease mediated by bacterial infection that results in the loss of supporting bone and occurs with some frequency.[4] Risk indicators include poor oral hygiene, a history of periodontitis, diabetes, and smoking. Peri-implantitis should be treated without delay,[6] but there is a paucity of evidence regarding the most effective therapeutic interventions.[7] Nonsurgical periodontics may be the treatment of choice in cases of peri-implant mucositis[8] or if the patient has medical contraindications or refuses to consent to more appropriate treatment. Decontamination of the implant surface is of primary importance because of the bacterial etiology.[9]

Table 1 Surgical procedures

Diagnosis	Therapy
1. Mucogingival defect with bony fenestration or dehiscence.	Mucogingival techniques.
2. Horizontal bone loss: mild to moderate.	Apically positioned flap without osseous resective surgery (ORS). ORS and implantoplasty.
3. Vertical bone loss: contained infrabony defect, a funnel-shaped three-wall.	Bone grafts and/or bone substitution with or without resorbable membrane.
Noncontained one- to two-wall defect.	Guided bone regeneration (nonresorbable membrane and autogenous bone).
4. Combined vertical and horizontal bone loss.	Guided bone regeneration (nonresorbable membrane and autogenous bone).
5. Loss of osseointegration or bone loss ≥ two thirds of implant length.	Explantation, regeneration, and implant restoration.

Defect debridement and implant surface decontamination

Any surgical protocol must begin with defect debridement and implant surface decontamination. Ideally, the implant prosthetic superstructure should be removed to gain surgical access. A cover screw should be inserted to protect the internal surface of the implant. The goal of defect debridement is to completely remove the granulomatous tissue and tissue tags around the implant surface after flap reflection. This will expose bony marrow cavities that can allow the egress and proliferation of progenitor cells that contribute to soft and hard tissue healing.

The goal of implant surface decontamination is to eliminate biofilm as the primary etiology of peri-implantitis with a combination of ultrasonic and manual instruments. Initially, ultrasonic instrumentation with dedicated implant inserts (carbon composite, plastic, or plastic fused to metal) is used. Next, manual instrumentation with a titanium curette (Martin, KLS) is used to complete biofilm removal. Air polishing with sodium bicarbonate powder and glycine (EMS) is used to sandblast the exposed threads followed by a 3-minute application of a solution of tetracycline hydrochloride in sterile water (50 mg/mL) (Ambramicina, Sharper), rinsed out with physiologic solution for 30 seconds, to detoxify the exposed threads.[10]

There are different patterns of bone loss and they greatly influence the therapeutic approach (Table 1).

The following problems are associated with peri-implantitis. Soft tissue recession accompanied by marginal bone resorption associated with exposed implant threads is a common esthetic problem. When implants are inserted into thin alveolar ridges or in postextraction sites, gingival recession may be a consequence of a thin biotype of gingival tissue with subsequent exposure of the most coronal part of the implant surface.[11] Those implants that are invested in bone, with only a few buccal exposed threads, usually require a mucogingival correction with no bone regenerative treatment.[12,13]

The amount of gingival coverage possible can be predicated by the gingival biotype, the degree of gingival recession, and the integrity of the adjacent interproximal bone.[14] Combination grafts with a connective tissue graft placed beneath a coronally advanced flap[15]

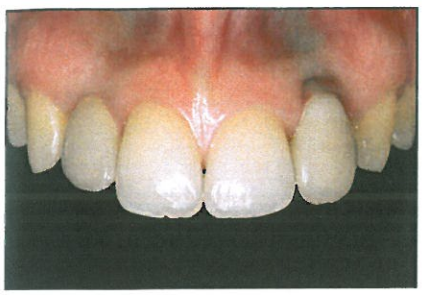
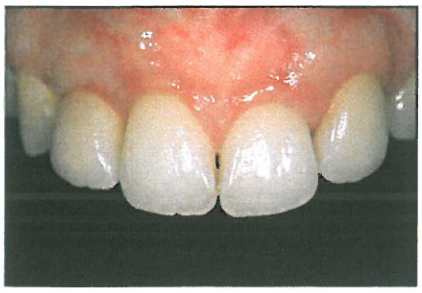


Fig 1a (left) *Soft tissue instability due to buccal bony dehiscence on the maxillary left lateral incisor.*

Fig 1b (right) *Clinical view 3 years postoperative. Both maxillary laterals have been treated with mucogingival bilaminar techniques.*



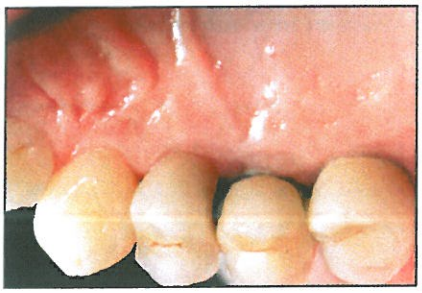
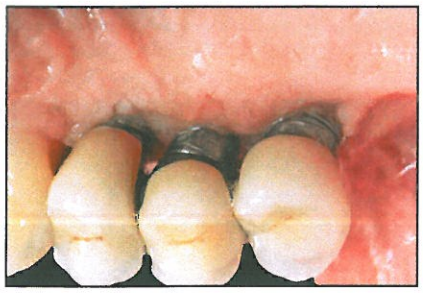


Fig 2a (left) *Palatal view of a three-unit partial denture anchored to implants.*

Fig 2b (right) *Palatal view at 24 months. Note the increased length of the implant structures.*



or a laterally positioned pedicle graft[16,17] enhance complete root coverage when treating periodontal recessions, and similar bilaminar procedures are highly recommended to treat mucogingival defects for implants (Fig 1).

Therapeutic solutions for bone loss

The three-dimensional morphology of a defect is best visualized at the time of surgery. The residual bony architecture will not only dictate the selection of the proper regenerative material, but also influence esthetics, functionality, and healing time. Soft tissue has to be inflammation free with the presence of an adequate band of keratinized tissue for flap design. The clinician has to decide whether or not to augment a minimal zone of keratinized tissue.

Horizontal bone loss

Implant horizontal bone loss is an overall reduction in height of the alveolar crest at right angles to the implant surface. The suprabony pocket refers to a deepening of the peri-implant sulcus circumferentially together with radiographic horizontal bone loss. A resective surgical approach is indicated to correct mild to moderate horizontal bone loss when there is no esthetic challenge.

The goal of resective surgery is the reduction of periodontal pocket depth, elimination of potential bacterial pathogens, and a soft tissue morphology gain that enhances oral hygiene and peri-implant health. After flap reflection, defect debridement and decontamination of the implant surface are of primary importance. Modification of the roughness of the implant surface and/or the elimination of the exposed threads are usually not performed.[18] Ostectomy and osteoplasty are recommended to create a bony base that will be compatible with the overlying gingival tissue to achieve the desired parabolic alveolar contours allowing for proper flap adaptation. A "ramp mattress" suturing technique is recommended to advance the vestibular gingival margin in a more coronal position compared with the palatal gingival margin[19] (Fig 2).

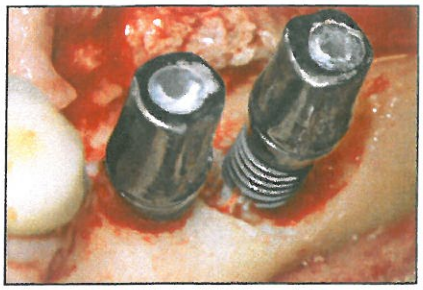
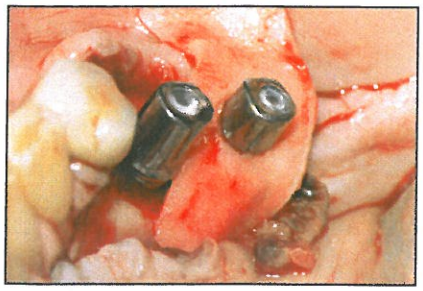


Fig 3a (left) *Lingual-occlusal view of a mainly three-wall vertical bony defect on the distal implant.*

Fig 3b (right) *The bony defect has been filled with a mixture of autogenous bone and a xenograft, then completely covered with a connective tissue graft.*



Vertical bone loss

A vertical bony defect refers to bone loss apical to the alveolar crest with a deepening of the peri-implant sulcus that is confirmed with radiographic imaging. The vertical bony defect can present with two different morphologies: a contained infrabony defect (funnel-shaped three-wall defect) or a non-contained one- to two-wall defect. A regenerative approach is highly recommended for these defects.

Intraoral autogenous bone graft mineralized allografts and/or xenografts are indicated when there is the clinical question of blood clot stability or space maintenance to accommodate bone regeneration by preventing flap collapse into the defect. The flap is positioned to completely cover the graft and the defect. An internal horizontal mattress suture is recommended to coronally advance both flaps because of the nonsubmerged environment; with no functional or esthetic adjustment. A more severe contained defect may be treated with a graft, a resorbable membrane, and possibly a connective tissue graft. The flap is coronally positioned to completely cover the graft and the barrier/membrane. An internal horizontal mattress suture (U-shaped) is recommended to coronally advance both flaps because of the non-submerged environment. When the implant prosthesis can be removed, the submerged procedure allows better blood clot protection and more predictable clinical outcomes (Fig 3).

Combined vertical bone loss

Combined vertical bone loss refers to more severe horizontal bone loss in combination with an infrabony component necessitating treatment of both the horizontal and vertical components. Such a clinical situation must be managed via a submerged environment, requiring the removal of the implant-supported prosthesis, to allow no functional activity on the implants for a 9-month healing period. A guided bone regeneration approach using a nonresorbable membrane with an intraoral autogenous bone graft is strongly recommended.[21,25] Three mandatory objectives to be fulfilled include: *(1)* the creation of sufficient space beneath the membrane, *(2)* the avoidance of epithelial and connective tissue cell participation during the healing process, and *(3)* the obtainment of primary, predictable soft tissue closure at the surgical site for a prolonged and uneventful period of 9 months. However, this clinical approach also creates functional and esthetic issues for the patient (Fig 4).

Loss of osseointegration

The clinical decision of whether implants should be removed or treated may be based on implant mobility, bone loss ≥ two thirds of implant length, recurrent acute abscesses on an implant adjacent to healthy implants, or teeth and surface characteristics.[20]

Even in cases of far advanced peri-implant bone loss, the remaining osseointegration of one third of implant length can provide implant stability. Contrary to a mobile tooth, the minimal mobility of an implant must be considered as the total loss of osseointegration.

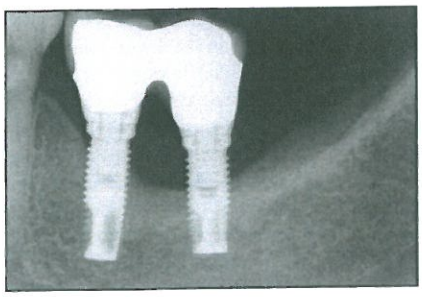


Fig 4a *Preoperative peri-apical radiograph. Chief patient complaint: recurrent acute abscesses.*

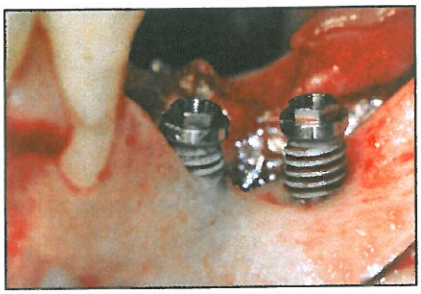


Fig 4b *Buccal view of combined vertical and horizontal bone loss at the distal implant. The horizontal component is prevailing compared with the vertical component.*

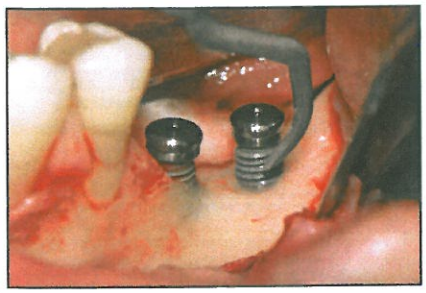


Fig 4c *Implant surface decontamination: power-driven instrumentation with carbon composite dedicated implant insert.*

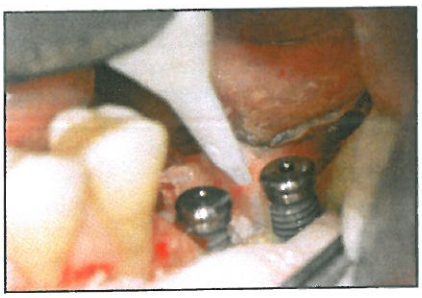


Fig 4d *Implant surface decontamination: air polishing with glycine. Cotton gauzes are used to prevent soft tissue trauma.*

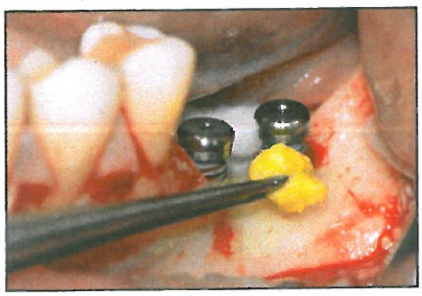


Fig 4e *Implant surface decontamination: tetracycline application.*

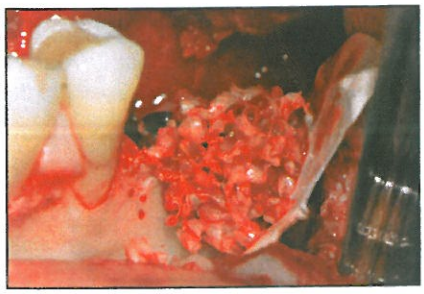


Fig 4f *A nonresorbable membrane in expanded polytetrafluoroethylene is secured with a fixation screw on buccal bone and reflected to position autogenous bone chips.*

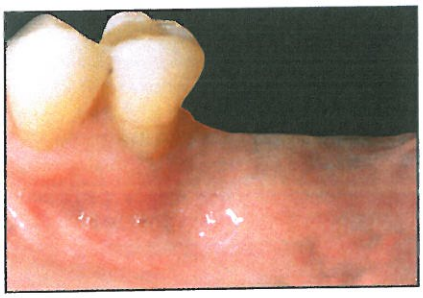


Fig 4g *Buccal view of a 9-month uneventful healing period. Primary closure and healthy tissue were preserved.*

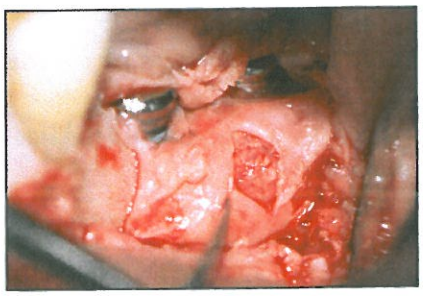


Fig 4h *Buccal view of the regenerated tissue after membrane removal. A small incision has been made on the connective tissue to evaluate its thickness.*

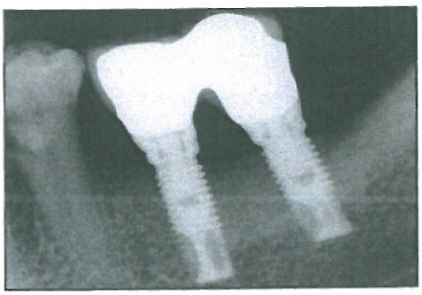


Fig 4i *Twelve-month follow-up periapical radiograph.*

Discussion

This study proposes a variety of surgical therapeutic approaches based on a clinical plaque-induced peri-implantitis etiology. The morphology of the peri-implantitis defect will dictate the surgical approach. The following treatment goals must always be fulfilled:

- the removal of bacteria and granulation tissue in the peri-implant pocket
- decontamination of the implant surface
- the creation of a band of keratinized tissue that will result in an adequate attachment apparatus to promote soft tissue protection
- a decrease in pocket depth and elimination of bleeding on probing
- the regeneration of vertical defects
- the facilitation of adequate plaque control to prevent re-infection and achieve predictability and longevity of clinical results

Regeneration results have been more predictable when the prosthesis is removed, thereby permitting a complete seal with an adequate dimension of keratinized mucosa. The bacterial plaque reduction is crucial together with decontamination of the implant surface. A mucogingival defect can be corrected with mucogingival surgical techniques. In cases of horizontal bone loss and in the absence of esthetic demands, the simplest and most predictable treatment appears to be an apically positioned flap combined with osseous resective surgery.[28]

Vertical bone loss can be corrected with a nonsubmerged or submerged solution. In a nonsubmerged case, the bony defect must be filled with autogenous bone or a bone substitute and further secured with a connective tissue graft or a resorbable membrane.[29] Such a solution provides bone regeneration limited to the infrabony component, with no functional or esthetic adjustment. In a submerged solution, the suprabony and infrabony components must be treated with autogenous bone associated with nonresorbable membranes. This solution provides bone regeneration to both the suprabony and infrabony components but creates functional and esthetic issues for the patient. For best long-term results, supportive therapy is as important as the surgery.

These indications for peri-implantitis treatment have been used successfully for a short time frame ranging from 2 to 3 years to 6 to 8 years with promising results. A follow-up evaluation should be monitored on a 3-month cycle for an indefinite period of time. It is necessary to continue to observe a larger number of cases for a longer period of time to verify whether the osseous regeneration is sufficient to ensure favorable long-term maintenance of the implants. It is impossible to evaluate re-osseointegration without histologic evidence of bone-to-implant contact.

Conclusions

In the absence of an evidence-based approach to resolve progressive peri-implantitis, the clinician has to apply traditional therapies and develop an appropriate treatment regime. Peri-implantitis refers to an inflammatory lesion regarding the loss of bone structure on an implant surface and requires a surgical technique based on defect analysis and clinical expectations.

Acknowledgment

The authors reported no conflicts of interest related to this study.

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