

Osseous surgery in periodontal treatment

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Introduction

In periodontally involved patients, periodontal therapy usually results in various degrees of soft-tissue margin recession, the amount of which is related to the initial probing depths and attachment levels, to the depth of infrabony defects, if present, and to the patient's tissue biotype.¹ The decision concerning if and what type of periodontal surgical corrective therapy should be performed is usually made after the effect of initial cause-related measures has been evaluated.

The indications for periodontal surgery are, in general, accessibility for proper scaling and root planing, and defects correction and pocket depth reduction. The final objective of the surgical therapy should be: the establishment of a proper and stable tissue morphology, which facilitates the patient's self-performed plaque control.²

The choice of a specific surgical approach (conservative–reconstructive–resective) is mainly related to the depth of the defect/s, in relation to the amount of remaining periodontium, if they are suprabony or infrabony at the area of the dentition where they are present, and to the overall treatment plan of each individual patient.

Taking the above-mentioned factors into consideration, since surgery represents a “corrective phase” of periodontal therapy, the rationale for the surgi-

cal approach can be simplified by the type of defect/s that surgical treatment should correct. For this reason in presence of deep isolated infrabony defects, the approach could be reconstructive. With shallow, multiple infrabony or suprabony defects, the approach could be conservative or resective. Both types of approach will result in pocket depth reduction and in various degree of soft tissue margin alteration ie, gingival recession.³

Gingival margin recession

Gingival margin recession is an inevitable consequence of periodontal therapy. Since it occurs primarily as a result of the resolution of inflammation in the periodontal tissues it is seen both following nonsurgical and surgical therapy.⁴ Irrespective of the treatment modality used, initially deeper pocket sites will experience more pronounced signs of recession of the gingival margin than sites with shallow initial probing depths.⁵⁻⁷ A general finding in short-term follow-up studies of periodontal therapy is that nonsurgically performed scaling and root planing causes less gingival recession than surgical therapy, and that surgical treatment involving osseous resection results in the most pronounced recession. However, data obtained from long-term studies reveal that the initial differences seen



in amount of recession between various treatment modalities diminish over time due to a coronal rebound of the soft tissue margin following surgical treatment.^{7,8} Lindhe and Nyman⁹ found that after an apically positioned flap procedure the buccal gingival margin shifted to a more coronal position (about 1 mm) during 10 years of maintenance. In interdental areas denuded following surgery, van der Velden¹⁰ found an upgrowth of around 4 mm of gingival tissue 3 years after surgery, while no significant change in attachment levels was observed. A similar finding was reported by Pontoriero and Carnevale,¹¹ 1 year after an apically positioned flap procedure for crown lengthening. From the data of the above mentioned studies, we can conclude that in general periodontal conservative/reconstructive treatment, modalities aimed at pocket correction (access flap, modified Widman flap, replaced flap, regenerative surgery) will result in an initial minor soft-tissue recession but, on the other hand, this tissue recession may continue for a period of 5 to 10 years before reaching marginal stability. Periodontal resective treatment modalities aiming at pocket elimination (apically positioned flap with osseous resective surgery) will result in an immediate surgical soft-tissue recession followed by a coronal regrowth of the gingival margin, during a period of 6 to 12 months of healing when they reached marginal stability.

The different degree of post-surgical tissue alterations, together with the different attainment of gingival margin stability associated with the two different surgical “approaches,” should be taken into consideration when the corrective phase of periodontal treatment must be

performed in areas of esthetic concern such as the maxillary anterior sextant.

In the presence of shallow infrabony or suprabony defects in the esthetic area, the surgical options available – conservative or resective – could be selected according to the following considerations.

When a natural dentition is treated, the primary concern is to limit the soft tissue recession both in the buccal radicular and in the interproximal aspects. For this reason, a conservative approach should be considered as a reasonable choice in order to minimize – in the short/medium term – the unesthetic result and give the patient more time to adapt to the inevitable soft tissue recession.

The papilla preservation technique in association with a thinned palatal flap can be used in such cases,¹² or a palatal approach without the use of a buccal flap can be utilized if the defects are confined only to the palatal aspects. On the other hand, when the characteristics of the defects are associated to teeth to serve as prosthetic abutments for a maxillary anterior restoration, with the crown margins to be located within the sulcus, a resective approach should be preferred. This is in order to obtain, through surgical technique, a proper gingival morphology and to achieve, after a relatively short period of healing (6 to 12 months), a gingival margin stability for prosthetic finalization, minimizing, over time, gingival recession and crown margin exposure. In anterior prosthetic cases, the apically positioned flap with osseous resection technique can be used to eliminate soft/hard-tissue defects and to establish and maintain proper gingival contours after surgery.

History

The removal of superficial radicular and interproximal alveolar crestal bone has been utilized for over a century in conjunction with periodontal disease treatment. The earlier rationale for osseous surgery was that the bone surface was considered infected or necrotic and had to be removed. Widman,¹³ however, reshaped the alveolus to facilitate flap replacement; Neumann¹⁴ also tried to recontour bone to mimic more normal anatomy to facilitate the reduction of pockets by allowing the gingival tissues to follow a more physiological contour. A classic article by Schluger¹⁵ in 1949 outlined the principles of osseous surgery for the purpose of recontouring the bone so that the elimination of the periodontal pocket was predictable and less likely to return over time.

Definitions

The following pertinent definitions are, according to Friedman:¹⁶

- *Osseous surgery*: periodontal surgery involving modification of the bony support of the teeth.
- *Osteoplasty*: reshaping of the alveolar process to achieve a more physiological form without removal of supporting bone.
- *Ostectomy*: the excision of bone or portion of a bone. In periodontics, an ostectomy is done to correct or reduce deformities caused by periodontitis in the marginal and intra-alveolar bone and includes the removal of supporting bone.

Indications and endpoints of osseous resective surgery

Residual pockets following cause-related therapy (CRT) are associated with increased risk of periodontal disease progression in the long term.¹⁷ A large retrospective study¹⁸ showed that residual probing depth (PD) ≥ 4 mm after active therapy was a risk factor for disease progression and tooth loss during supportive periodontal therapy (SPT), thus suggesting that surgical treatment of residual pockets is strongly recommended.

An apically positioned flap with osseous resective surgery (ORS) is a treatment option for the elimination of residual pockets associated with shallow to moderate infrabony defects at posterior teeth.¹⁹ This approach was associated with higher pocket reduction and a lower incidence of disease progression in the long term, compared with the modified Widman flap.^{20,21} Osseous resective surgery is the combined use of both osteoplasty and ostectomy to re-establish the marginal bone morphology around the teeth to resemble “normal bone with a positive architecture,” albeit at a more apical position. By definition, “normal bone with a positive architecture” means that the surface of interdental bone is coronal to that of the facial and lingual radicular bone. The endpoints of osseous resective surgery are minimal probing depths and a gingival tissue morphology that enhances good self-performed oral hygiene and periodontal health.¹⁹

Soft tissue management

Because the immediate endpoints of osseous resective surgery are not only the elimination of the intrabony or hemiseptal osseous defects, but also minimal (≤ 3 mm) probing depths and a gingival anatomy that facilitates periodontal maintenance, the soft tissue flap must be properly managed.¹⁹ The flap should be thin and of even thickness with the final position of its margins at the level of the osseous crest (that is, an apically positioned flap margin); the interproximal areas are generally not covered by gingival tissues and therefore heal by secondary intention.

A precise anchorage of the flap in the desired position can be enhanced by initially performing a split-thickness or a thinned full-thickness flap that is then secured with periosteal sutures.

Mesial and/or distal vertical releasing incisions extending into the alveolar mucosa are also utilized if the flap cannot be sufficiently mobilized. In the palatal area, the flap cannot actually be apically positioned. The palatal flap should be thinned and scalloped to place the gingival margin at the crest of bone. The apical positioning of the flap allows the gingival margin to coincide finally with the osseous crest.¹⁹

Hard tissue management

Osseous resective surgery reshapes the abnormal inverted bone topography, caused by periodontitis, to a form that resembles the normal physiological positive architecture.²²

After exposing the alveolar bone by flap elevation, buccal and/or lingual cra-

ter walls are reduced to the base of the osseous defect using bone chisels and round burs or diamond stones under continuous saline irrigation.

All the walls of bone of an intrabony or hemiseptal defect are removed so that the prior apically located base of the defect is now even with the adjacent bone. This anatomical situation is the abnormal and its correction is performed by removing the facial and/or lingual bone over the roots to a level where its radicular osseous margin is apical to the interproximal bone level.

This recreates the physiological scalloped appearance of the alveolus from a facial and/or lingual view. Clinically, the best guide for the proper bony architecture seems to be the configuration of the cemento-enamel junction of the adjacent teeth.²⁰

Healing and maturation

Following osseous surgery for elimination of bony defects and the establishment of “physiologic contours” and repositioning of the soft tissue flaps to the level of the alveolar bone, healing will occur with crestal bone demineralization. The extent of the reduction of the alveolar bone height resulting from this demineralization process²³ is related to the thickness of the bone in each specific site.^{24,25} The fibroblasts in the supra-alveolar tissue adjacent to the tooth surface proliferate,²⁶ and new connective tissue is laid down. During the phase of tissue regeneration and maturation, a new dentogingival unit will form by coronal-growth of the connective tissue. This coronal tissue regrowth often continues for a time period of more than 6 to 9 months.

If the wound healing occurs in the vicinity of a plaque-free tooth surface, a free gingival unit will form, which has all the characteristics of a normal free gingiva.²⁷

Summary and conclusions

In maxillary anterior teeth selected to serve as abutments for a prosthetic restoration, an apically positioned flap combined with bone recontouring should be the standard procedure to facilitate restorative therapy in terms of proper gingival morphology (where to locate the crown margins) and in terms of finalization time. In such cases, however, specific considerations should also be made when resective surgery is performed. The increased abutment length and the widening of the interproximal spaces, as a consequence of the resective approach, often need to be compensated by changing the form and contour of the prosthetic crowns.

These modifications, made at the time of prosthetic finalization, may substantially differ from the initially planned ideal crown morphology, proportion, disposition derived from the pretreatment es-

thetic evaluation obtained by the facial, labial, and dental analysis. The consequence of excessive, not planned, prosthetic compensations may, in some instances, severely compromise the final esthetic result. It would be of great benefit to the clinician to be able to predict the outcome of the surgical resective treatment prior to initiating the therapy in order to anticipate the amount and the degree of the prosthetic compensation that should be made in the definitive restoration. In other words, it could be possible, by a combination of periodontal and prosthetic pretreatment evaluations, to improve, or at least not to jeopardize, the dentofacial esthetics in this category of patient. As a base for treatment decisions, a careful pretreatment analysis of the surgical/postsurgical tissue modifications and how they may affect the esthetic result should be performed. It should include the following features:

- Smile line level
- Patient's genetic biotype
- Gingival margin level and tooth position
- Defect/s depth and location
- Post-surgical and healing soft-tissue alterations



Figs 1 to 3 Upper anterior sextant of periodontally involved patient with high smile-line level, before therapy.



Fig 4 Provisional bridge.



Fig 5 Osseous defects and crestal inverted architecture after flaps elevation.



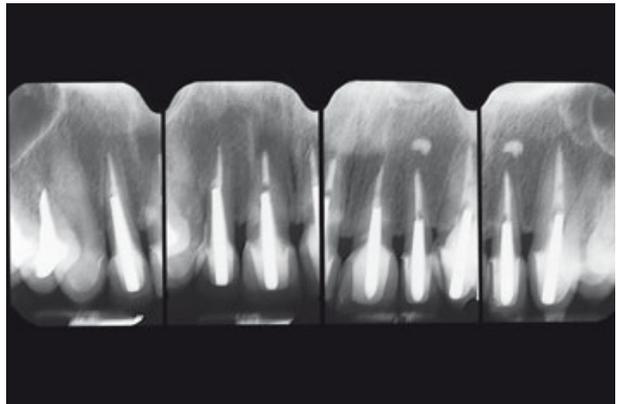
Fig 6 Newly obtained proper bone architecture after osseous defects elimination and crestal morphology re-creation.



Fig 7 Flap positioned at the crestal level.



Fig 8 Final healing at 9 months postsurgical therapy before prosthetic finalization.



Figs 9 and 10 Clinical and radiographic at prosthetic finalization.



Fig 11 Final esthetic result during smile.



Figs 12 and 13 Upper anterior sextant disclosing tissue asymmetry in a periodontally healthy patient with high smile-line level, before therapy.



Figs 14 and 15 Provisional bridge.

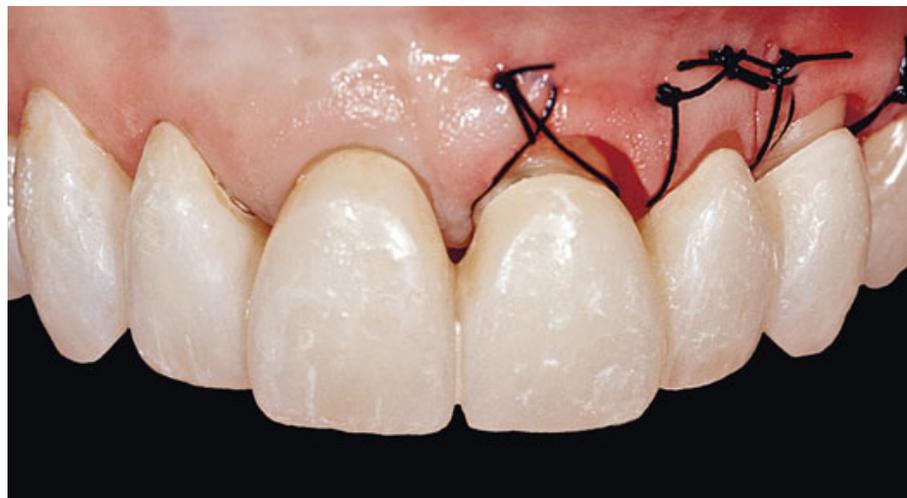


Fig 16 Provisional bridge.



Figs 17 and 18 Prosthetic finalization and smile disclosure.

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