Periodontal tissue repair in the aesthetic zone

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Figs. 1a–b_Pocket depth of 13 mm misially to tooth #23. The tooth is stable and the periapical radiography shows angular bone loss with the formation of an infrabony defect.

Figs. 2a-b_The presence of the papilla with no pocket depth between the lateral and the central incisor and between the canine and the first premolar suggest to place vertical relising incision at the base of those papilla and prererve the papilla over the infrabony defect with a buccal incision. The flap is then elevated full-thickness and the defect debrided and misured.

_Introduction

Periodontal regeneration (PR) has provided the practitioner with a more conservative therapeutic strategy for the treatment of infrabony periodontal defects. In fact, PR not only helps reducing periodontal pocket depth (PPD), but it also allows to gain clinical attachment level (CAL) with minimal negative effects on gingival recession (REC), which is particularly important when treating aesthetic areas.

In this paper, we will evaluate different approaches for periodontal regenerative therapy in the aesthetic area and we will suggest how regenerative treatment of infrabony defects may be tailored to even have a positive effect on REC. These approaches are different when compared to traditional guided tissue regeneration (GTR) techniques used for root coverage purposes; instead they help reducing REC by reestablishing a positive periodontal architecture via regeneration and improving the support for soft tissues during wound healing.

_Indication

Traditionally, periodontal therapy is aimed at reducing PPD and improving CAL by eliminating bacterial deposits and factors predisposing to bacterial accumulations. Osseous resection is often required or suggested when a negative osseous architecture is present. Apically positioned flaps or repositioned flaps with removal of the secondary flaps are often used. This therapeutic approach is very predictable and allows maintaining the patients' dentition in the long term even in complex cases. Unfortunately, however, it can only worsen gingival recession and patients treated with traditional periodontal therapy often complain of unaesthetic outcomes of the surgery and root hypersensitivity. Moreover, when deep infrabony defects are present, the practitioner is put on the hotspot of having to choose the lesser of two evils: either sacrifice a large amount of the supporting bone of the neighboring dentition or sacrifice the tooth with the deep bony lesion. PR is particularly indicated in such cases.

_Techniques

With most PR treatments, including the use of Enamel Matrix Derivative (EMD), bone grafts, Guided Tissue Regeneration (GTR) or combinations of the above, regeneration of bone, cementum and a functionally oriented periodontal ligament can be achieved in the infrabony defect with little increase of gingival recession.

More recently, minimally invasive approaches have been suggested. The Single Flap Approach (SFA) is the elevation of a single flap (either buccal or lingual), keeping intact the tissues on the other flap. The Minimally Invasive Surgical Technique (MIST) is an adaptation of the papilla preservation techniques with the intent to limit flap elevation and mesiodistal extension of the flap. With these approaches, the outcomes in terms of REC worsening were more encouraging and reduced the loss of soft tissue to almost nothing.

Finally, Coronally Advanced Flaps (CAF) in combination with regenerative approaches have been introduced with the intent of stabilising the soft tissue and providing a more stable wound for regeneration to occur. With this approach, a decrease in REC can be achieved, thus not only addressing the loss of attachment but also improving the aesthetic appearance of the area.

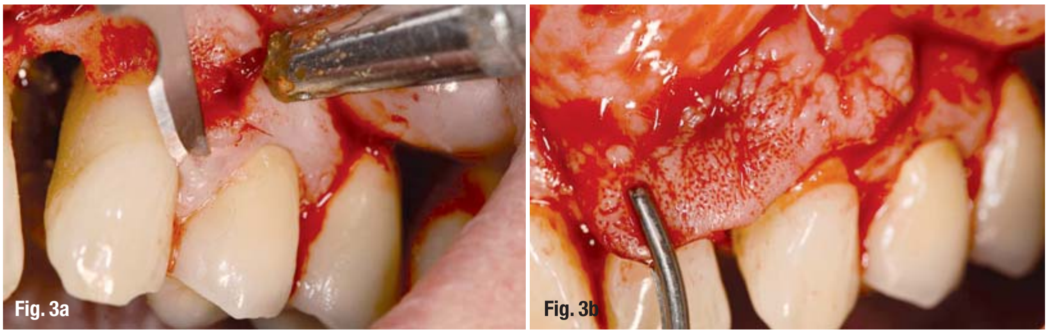
The Soft Tissue Wall technique is recommended for the treatment of infrabony defects in the aesthetic area, when one of the involved teeth has also experienced an apical migration of the free gingival margin.

_Soft Tissue Wall technique

In this approach, a horizontal incision is made at the base of the interdental papillae and extended to one tooth mesially and distally from the infrabony defect. A full-thickness trapezoidal flap (with the wider base apically positioned) is then elevated. The remaining facial portion of the anatomic papillae is preserved and de-epithelialised in order to create connective tissue beds to which the flap can be secured at the time of suturing. The papilla over the infrabony defect is dissected at its base and the entire interproximal supracrestal soft tissue is elevated in order to gain proper access to the defect.

After flap elevation, the granulation tissue is removed from the defects by means of metal curettes, followed by scaling and root planning using metal curettes and power-driven instrumentation.

Sharp and blunt dissection into the vestibular lining mucosa is performed to eliminate muscle tension and permit coronal displacement of the flap. Flap mobilisation is considered adequate



Figs. 3a–b_The mesial and distal papilla coronal to the relaxing incisions are de-epithelized and a periosteal relising incision at the base of the flap allows to move the flap coronally without tension.

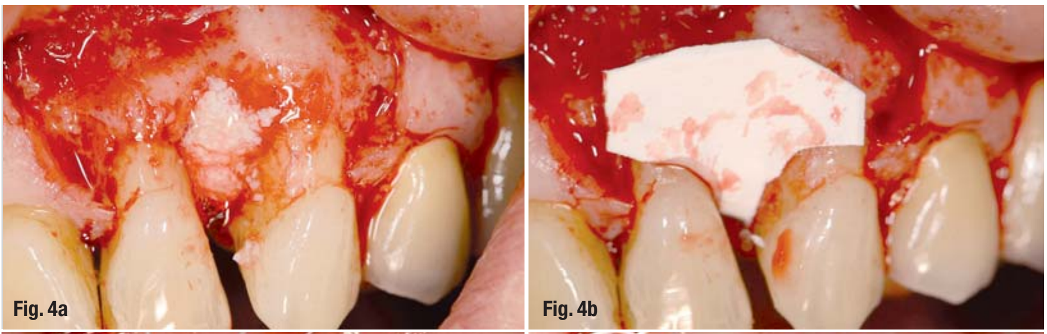
when the marginal portion of the flap is able to passively reach a level more coronal to the CEJ and to cover the de-epithelialised anatomic papillae.

Two sling sutures are used to stabilise the coronal displacement of the buccal flap. The root surface may be conditioned to remove the smear layer and to obtain a surface free of organic debris. Biological elements as enamel matrix derivative gel (Emdogain®, Straumann, CH) or filling biomaterials in combinations or not with growth factors delivery may now be applied to the defect. A tension-free primary closure of the interdental papilla upon the bony defect is achieved with an internal horizontal mattress suture and the vertical releasing incisions are closed with interrupted sutures.

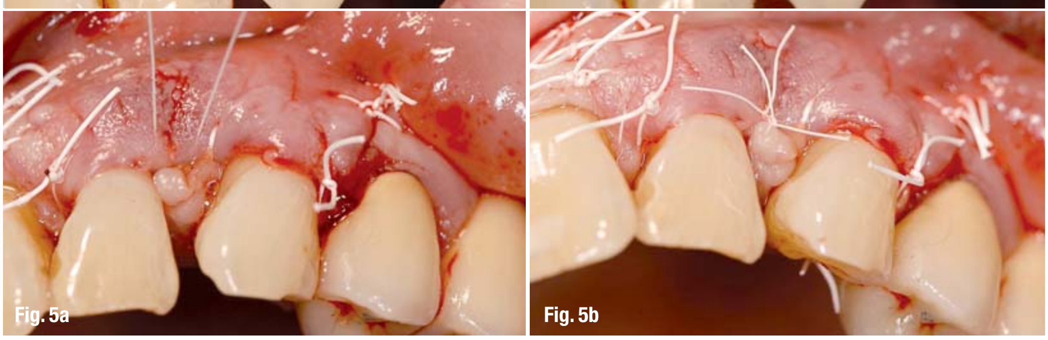
Usually, patients receive systemic antibiotic therapy and analgesic therapy to prevent post-operative pain and oedema and sutures are checked and removed eight days after surgery. Local plaque control is maintained by a 0.2 % chlorhexidine digluconate rinse (three times daily) for eight weeks. During this period, patients are recalled weekly for professional prophylaxis. At-home mechanical cleaning of the treated area is allowed four weeks after completion of the surgical procedure, using an ultra-soft tooth-brush and a roll technique in apico-coronal direction. Interproximal mechanical cleaning with dental floss is allowed two months after the regenerative procedure. After the initial eight weeks, recall appointments for professional supragingival tooth cleaning are scheduled at one-month intervals for one year post-treatment. No attempt to probe or for subgingival scaling is made before the twelve-month follow-up examination.

Two main hypotheses have been described to explain the mechanisms involved in the regeneration of new periodontal structures including new cementum, new boundle bone and a functionally oriented periodontal ligament.

The first suggested mechanism is the cell occlusion mechanism originally postulated by Melcher in 1976[1] and then revised and integrated by different authors. According to this concept, five cellular



Figs. 4a–b_The biomaterials are placed into the defect to promote regeneration and to stabilize the clot. In this case, Emdogain (Straumann, CH) was mixed with BioOss (Geistlich CH) graft and protected with a collagen resorbable membrane (BioGide, Geistlich, CH).



Figs. 5a–b_With a 5-0 Gore-Text suture, a sling suture suspended to tooth #22 and one suspended to tooth #23 will stabilize the flap coronally, firm on the teeth, creating a stable buccal Soft Tissue Wall. Now, an internal mattress suture with a 7-0 Gore-Tex will close the papilla, extrofletting the wound margins and allowing perfect adaptation of the flaps.

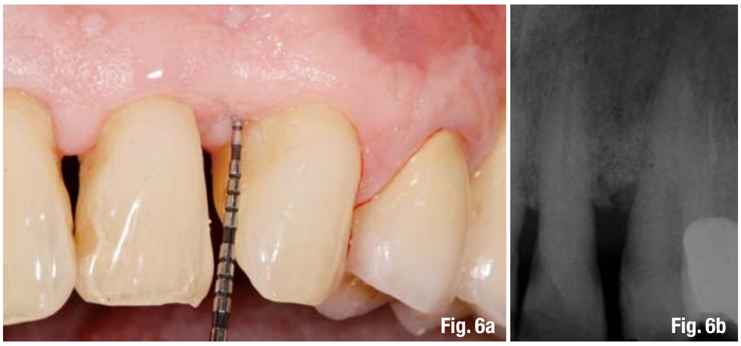
populations can populate the defect following a surgical intervention: (1) epithelial cells, which are the fastest proliferating and the fastest migrating cells of all five groups, (2) gingival connective tissue cells, (3) alveolar bone cells, (4) periodontal ligament cells, (5) cementoblasts. Guided tissue regeneration uses barrier membranes excluding from the wound area epithelial and connective tissue cells in order to allow the slower cell groups to populate the defect and determine the regeneration of the new ligament. Epithelial cells are in fact inhibited from growing via contact inhibition. Contact inhibition is the natural process of arresting cell growth when two or more cells come into contact with each other or with a solid surface. In a Petri dish cell culture, normal epithelial cells proliferate and migrate centripetally until reaching the borders of the Petri capsule. In GTR, epithelial cell migration stops when the epithelium covers the membrane and comes into contact with the root surface.

The second mechanism is the blood clot stability mechanism. The fibrin component of the blood clot can attach to the alveolar bone, gingival connective tissue and root surface. It has been demonstrated by Wikesjo and coworkers that when the blood clot is not allowed to attach to the root surface, epithelial down-growth occurs and new connective tissue attachment formation is precluded. Instead, if the fibrin attachment to the root surface is not disrupted by any mechanical or physical trauma, the epithelium migrates over the clot and stops migrating when meeting the clot-root interface.

Both of these mechanisms well explain how it is possible to direct wound healing toward regeneration, repair in relation to the adopted technique or biomaterial used, whether it is a membrane, a bone substitute or just a stabilised clot.

The first human histologic evidence of a newly regenerated periodontal ligament dates back to 1982 when Nyman et al.[2] used a Millipore filter on a mandibular incisor which was previously involved in periodontitis, allowing cells originating from the periodontal ligament to repopulate the root surface during healing. Since then, a number of publications have shown histological evidence of a newly regenerated ligament with various surgical techniques, different biomaterials and growth factors.

At the meantime, we should still keep in mind that epithelial down-growth is reversible. Already in the 1980's, Listgarten et al.[3] had demonstrated—in an animal model evaluating access flaps—that while the length of the junctional epithelium did not change between the three months and the twelve months postoperative dates, this measure was "pushed" in a coronal direction thus reducing sulcus depth and increasing the length of the connective tissue attachment.



Figs. 6a–b_The one-year result shows a pocket depth of 3 mm with a gain of 10 mm when compared to the baseline. In the radiographic image, biomaterial is still detectable with an optimal bone filling.

_Conclusion

In light of this, the importance of maintaining the structural integrity of the gingival tissues as opposed to a pocket elimination procedure (i.e. apically positioned flaps, osseous resective surgery) must be increasingly stressed, especially when surgical treatment in the aesthetic area is warranted.

Periodontal therapy has been reshaped profoundly by the great amount of research and literature produced in the last few decades. What used to be a discipline of large, invasive flaps, has now evolved to a discipline mainly encompassing non-surgical therapy, risk management strategies, and minimally invasive flaps for the treatment of localised defects. This transformation rendered periodontal therapy of the aesthetic area a much less invasive and more acceptable approach, which has to be embraced by all practitioners dedicating their profession toward this exciting and continuously evolving specialty._

Editorial note: A list of references is available from the author.

_contact implants

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