Nonincised Papillae Surgical Approach (NIPSA) in Periodontal Regeneration: Preliminary Results of a Case Series

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A new surgical approach has been developed to optimize the preservation of the gingival margin and papillae when treating periodontal defects. The flap is raised by one mucosal incision far away from the marginal tissues. This case series reports on the effectiveness of a nonincised surgical approach (NIPSA) in conjunction with a hydroxyapatite-based graft biomaterial and enamel matrix derivative in treating intrabony defects. Ten defects in 10 patients were treated. The follow-up period ranged from 6 to 18 months (mean: 10.8 ± 4.7 months). Probing pocket depth was 9.6 ± 2.3 mm before surgery and 2.3 ± 0.5 mm postsurgery. Clinical attachment level (CAL) decreased from 10.4 ± 2.7 mm to 3.1 ± 0.87 mm postsurgery. The gingival papilla height, keratinized tissue width, and buccal gingival margin remained stable over time. No wound dehiscence was recorded. Mean Early Healing Index was 1.5 ± 0.7. Results show a substantial CAL gain, limited postsurgical shrinkage, minimal morbidity, and early healing. Int J Periodontics Restorative Dent 2018;38(suppl):s105–s111. doi: 10.11607/prd.3195

Three key features seem to be critical for a successful outcome in the treatment of periodontal defects: The first is creating and maintaining space to retain the clot and whatever agent is applied to promote regeneration, the second is the maintenance of a primary wound closure, and the third is minimizing the postoperative soft tissue shrinkage of the marginal tissues. The loss of papillary height during early healing may result in esthetic, pho-
netic, and functional problems.1,2 Using conventional flap surgery to approach intrabony defects, lack of primary closure of the interdental area may occur in 70% to 80% of the treated sites, with flap dehiscence and biomaterial exposure.3,4 New surgical techniques designed to optimize primary wound closure have been described, stressing functional and esthetic outcomes of regenerative procedures.5–10

The most conventional flap designs to treat intrabony defects use a marginal detachment. In order to minimize the possibility of postsurgical gingival recession, several approaches have been described based on the principle of the papilla preservation technique.5 Cortellini et al proposed an intrasulcular flap to minimize surgical trauma, postsurgical complications, and patient discomfort. The minimally invasive surgical technique (MIST) provides a

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limited-access approach for the application of enamel matrix derivative (EMD) in the treatment of isolated deep intrabony defects. The 1-year case series revealed a complete resolution of the lesion in 54% of the cases with a clinical attachment gain of 4.8 mm and a mean postoperative gingival recession of 0.1 mm. A significant reduction in flap dehiscence was reported, with only 1 out of 13 treated sites presenting wound dehiscence in the early healing period.

A novel surgical procedure, termed nonincised papillae surgical approach (NIPSA), was designed to maintain the integrity of the interdental soft tissues covering intrabony defects. If successful, this would prevent biomaterial exposure associated with loss of papillary height, increase the amount of space for hard and soft tissue regeneration, and minimize gingival recession. The basic principle of the technique is the placement of only one buccal horizontal incision in the mucosa, as apically as possible from the periodontal defect and the marginal tissues, and the raising of a mucoperiosteal flap coronally, which permits apical access to the defect but leaves the marginal tissues intact. The present case series reports preliminary data on the clinical effectiveness of NIPSA in conjunction with a hydroxyapatite (HA)-based graft and EMD in the reconstruction of periodontal intrabony defects.

Materials and Methods

Ten patients (5 men and 5 women; age range: 30 to 60 years; 4 smokers) were included in the study. Inclusion criteria consisted of the following: age > 18 years; diagnosis of chronic or aggressive periodontitis; presence of one or more intrabony defects with probing pocket depth (PPD) > 5 mm and radiographic defect depth > 4 mm; full-mouth plaque score (FMPS) and full-mouth bleeding score (FMBS) < 30% (measured at four sites per tooth); no relevant systemic condition or disease; and no pregnancy or lactation. Excluded were third molars and teeth with type III mobility or with an incorrect endodontic or restorative treatment. Patients were informed about the purpose of the study and were required to provide written, informed consent.

The following clinical measurements were recorded at the time of the surgery and 6, 12, or 18 months after, using a PCP UNC 15 Hu-Friedy periodontal probe: (1) clinical attachment level (CAL), measured from the cementoenamel junction (CEJ) to the bottom of the pocket; (2) PPD, from the gingival margin to the bottom of the pocket; (3) recession depth (REC) on midbuccal aspect of the experimental tooth, from the CEJ to the gingival margin; (4) tip-of-the-papillae (TP), measured on the tooth axis from the midbuccal CEJ to the tip of the interproximal soft tissue papilla, with a positive value if the TP was coronal to the CEJ and negative if apical to the CEJ; (5) local bleeding score (bleeding on probing [BoP]), recorded as positive when bleeding on probing was present at the surgical site; (6) keratinized tissue (KT) width on the treated tooth, measured from the gingival margin to the mucogingival junction (MGJ), at the midbuccal point.

The following parameters were recorded immediately after completion of intrasurgical debridement to assess defect morphology: (1) intrabony component (INTRA) of the defect: the distance from the most coronal extension of the interdental bone crest (BC) to the bottom of the defect (BD) (BC–BD); (2) three-wall intrabony component (3w): from the crest of the three-wall intrabony component to the bottom of the defect (3w–BD); (3) number of bony walls: combination of the number of bony walls along the defect located entirely interproximally.

The capability to maintain primary wound closure during early healing was assessed using the Early Wound Healing Index (EHI), focused on the incision area. Postoperative pain was evaluated on the basis of the mean consumption of analgesics (mg of ibuprofen).

For each patient, a presurgical full-mouth professional prophylaxis appointment was completed 1 to 2 weeks before the surgical procedure, using ultrasonics to remove the supragingival calculus and only instrumenting the first 2 or 3 mm of the pocket. To preserve any residual fibers attached to the root cementum at the bottom of the pocket and to avoid possible posttreatment shrinkage, no conventional scaling and root planing was done. All patients received oral...
hygiene instructions. Surgeries were performed with healthy marginal tissues, depicting low or no inflammation in the marginal tissues at that time. Patients received 2 g of amoxicillin 1 hour before surgery and then 600 mg of ibuprofen at the beginning of the surgical procedure. Subsequent doses of ibuprofen were taken postoperatively to control pain and inflammation if necessary. Patients were instructed to record the quantity of analgesics taken during the first week postsurgery.

**Surgical Procedure**

The sequence of the procedure is presented in Figs 1 and 2. On the buccal aspect, only one apical horizontal or oblique incision is made in the alveolar mucosa, as far removed from the mesial or distal surfaces of the teeth. The incision is made to the bone level and the mucoperiosteal flap is elevated from the bone. The defect is then prepared with a spoon elevator to remove any remaining debris or denatured tissues. A curette is used to clean the bony surface and ensure that the bone is healthy and free of infection. A hydroxyapatite graft and EMD mix is placed in the intrabony defect to stimulate bone formation and periodontal healing. The suture and primary closure are then performed to maintain proper wound closure and support tissue healing.

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**Fig 1** Nonincised papillae surgical approach (NIPSA) in mandibular canine. (a) Initial. (b) Baseline after presurgery treatment. (c) Periapical radiograph. (d) Horizontal mucosal incision placed on healthy bone and granulation tissue filling the defect. (e) Periodontal probe showing the three-wall component. (f) Hydroxyapatite graft and EMD mix placed in the intrabony defect. (g) Suture and primary closure. (h–j) Probing depth and periapical radiograph at 18 months postoperative.
as possible from the interdental papillae and marginal keratinized tissues. It is important to develop a clear mapping of the limits of the defect in order to place the horizontal incision correctly, always situated on cortical bone, and preserving the suprabony soft tissue to protect the periodontal defect. Mesiodistally, the incision is extended enough to expose the cortical bone around the defect (horizontal width of the bony defect), allowing its correct debridement and the application of the regenerative biomaterial. Through the horizontal incision, the soft tissue is reflected apicocoronally by a full-thickness flap to expose the bone

Fig 2 Nonincised papillae surgical approach (NIPSA) in mandibular molar. (a) Probing depth before surgery. (b) Three-wall defect with a two-wall subcomponent. (c) Periapical radiograph. (d) Intrasurgical clinical measurements. (e) Hydroxyapatite graft and EMD mix preparation. (f) Hydroxyapatite graft and EMD mix placed in the intrabony defect. (g) Suture and primary closure. (h) One week after surgery, maintaining primary wound closure. (i, j) Probing depth and periapical radiograph at 12 months postoperative.
crest delimiting the intrabony component of the defect (vertical component). The marginal tissue must be kept unaltered, without raising or detaching the interdental papillae. Following flap reflection, the bony defect is examined carefully. During instrumentation, the flaps must be carefully protected with periosteal elevators and frequent saline irrigation. Root planing is performed, considering the attached fibers to cementum as its apical and coronal limits: The coronal level of remaining attachment is the most apical limit of this instrumentation, and the apical level of the papillae and marginal tissues is the most coronal, keeping these tissues unaltered. All of the above means that it is important not to instrument 1 mm of the root surface coronal to the bottom of the bony defect, and 2 to 3 mm of the coronal marginal tissues should be maintained unaltered. Soft tissues that are not attached to the root surface are removed carefully with mini curettes and power-driven instruments. Fibers attached to the root cementum are maintained, which is difficult to assess without magnification. The granulation tissue attached to the base of the papillae is cut with a microblade and removed carefully.

All surgeries were performed using ×2.8 magnifying loupes. Ethylenediaminetetraacetic acid (EDTA) was applied on the instrumented root surface for 2 minutes, then the area was carefully rinsed with saline and EMD was applied on the root, kept as dry as possible, followed by a composite graft of HA-bovine bone xenograft (Cerabone, Botiss Biomaterials) and EMD mix (Emdogain, Straumann). Once the intrabony defect filled, the flaps were repositioned. Horizontal mattress sutures, placed 3 mm away from the borders, were used as the first line of closure, promoting connective tissue contact between both edges of the incision, and single interrupted sutures were then placed as a second line of closure. A double-sling suture may also be used. No surgical dressing was placed, and no pressure was applied to the surgical area.

Patients were instructed to use chlorhexidine (0.2%) rinses twice a day. The sutures were removed after 7 days. Afterwards, patients were instructed to brush with a soft toothbrush and a roll technique. Patients were recalled for controls (prophylaxis as needed and oral hygiene reinforcement) at 1-week intervals during the first postoperative month and at 3, 6, 12, and 18 months.

Statistical Analysis

Ten patients were included in this preliminary evaluation, each contributing one intrabony defect. Therefore, the patient was regarded as the statistical unit. The values recorded for the different clinical parameters at the deepest preclinical point of the periodontal defect were compared between baseline and follow-up (from 6 to 18 months). Data are expressed as mean ± standard deviation (SD). The pre- and postsurgery recordings of the PPD, CAL, REC, KT, and TP were evaluated by Student t test. The level of significance was set at 5%.

Results

The intrabony component of the defect ranged from 5.0 to 12.0 mm (mean: 6.8 ± 2.3 mm). The threewall component varied from 0.0 to 6.0 mm (mean: 2.5 ± 2.5 mm). The number of bony walls fluctuated among defects.

PPD was 9.6 ± 2.3 mm before surgery and decreased to 2.3 ± 0.5 mm after surgery (P < .001), with a mean PPD reduction of 7.3 ± 2.4 mm. All defects had a PPD < 4 mm postsurgery. CAL improved from 10.4 ± 2.7 mm presurgery to 3.1 ± 0.87 mm postsurgery (P < .001), with a mean gain of 7.3 ± 2.4 mm. All defects showed a CAL gain ≥ 5 mm. REC, KT, and TP recordings remained at the same baseline values at follow-up. All defects presented positive BoP presurgery but negative at reevaluation.

Evaluating the EHI, no wound dehiscence was recorded in any of the 10 cases, with a complete flap closure in all. One week after surgery, the mean EHI value was 1.5 ± 0.7. Six defects showed EHI = 1 (complete flap closure: no fibrin line in the incision area), three showed EHI = 2 (complete flap closure: fine fibrin line in the incision area), and one showed EHI = 3 (complete flap closure: fibrin clot in the incision area). The mean analgesic consumption (in addition to the 600 mg of ibuprofen given before the surgery) was 840 ± 419.5 mg. In 6 out of 10 cases, only one extra dose of anti-inflammatory medication was required.
Discussion

NIPSA is a papillae preservation technique in which the interdental papillae and the marginal tissues surrounding the defect must not be altered in order to avoid postoperative soft tissue shrinkage. It is indicated for periodontal defects when buccal access allows an appropriate root and defect debridement followed by the application of the proper regenerative technology. A unique incision is placed apically and a mucoperiosteal flap is elevated only on the buccal side, leaving the lingual soft tissue intact. This access to the intrabony defect seems to offer several clinical and technical advantages. The flap can be easily stabilized to the attached marginal tissues, thus optimizing wound closure by primary intention, for the preservation of the blood clot. By leaving a great volume of supracrestal soft tissue intact, better preservation of the blood supply in the interdental area may eventually occur.15 Wound stabilization and preservation of the interdental papillae and marginal tissues at the time of flap reflection may also contribute to better keeping the presurgical status of the tissues and minimizing the postsurgical shrinkage.

During the elevation of a mucoperiosteal flap and placing a sulcular or papillary incision, the connection of the gingivoperiosteal plexus with the periodontal vascularity is severed15 and significant vascular trauma is induced, especially in the interdental areas.16 In this study, a horizontal incision was made in the alveolar mucosa well away from the marginal tissues, dissecting the supraperiosteal gingival vessels near the mucogingival junction.15 The nonincised gingival vessels show continuity with those of the periodontal ligament.18 Furthermore, Hayashi demonstrated a richer blood supply on the lingual periosteal aspect of the mandible and maxilla than on the buccal, where the apical incision is placed.19

The adoption of biologic products/compounds is based on their ability to induce or accelerate the processes of matrix formation and cell differentiation.20 These products enforce the healing process but lack the mechanical properties to help in the provision of space and blood-clot stabilization.21 The additional use of a graft seems to enhance the clinical outcome of amelogenins.22,23 In the present case series, 10 treated patients with deep intrabony defects were surgically treated with NIPSA in conjunction with an HA-graft EMD procedure. After a postoperative healing period ranging from 6 to 18 months, a mean CAL gain of 7.3 mm and a mean PPD reduction of 7.3 mm were observed, with no variations in REC. Previous case series investigating the use of different minimally invasive techniques in association with a graft biomaterial, together with a collagen-based membrane10 or EMD,11 in the treatment of single intraosseous defects reported a mean CAL gain of 4.8 mm, a mean PD reduction of 5.2 mm, and a mean REC increase of 0.4 mm.10–12

Primary wound closure is thought to aid in containing the clot and graft materials, providing blood supply to the surgical site, and preventing bacterial contamination and mechanical irritation of the surgical site.1,2,24 Using NIPSA, no wound dehiscence developed, with primary wound closure recorded in all 10 cases both in early healing as well as in subsequent revisions. One week after surgery, the mean EHI value was 1.5 ± 0.78. A mean EHI of 1.65 ± 0.75 has been reported using a microsurgery modified papilla preservation technique and EMD.13 Applying a different minimally invasive technique, a minimal wound dehiscence (< 2 mm) was recorded in 60% of the cases at 2 weeks post-surgery,10 while, in another,7.6% reported a small wound dehiscence at 1 week postsurgery. Hence, respecting the delicate terminal blood supply in the interdental papilla may help ensure the prerequisites for primary closure, thus avoiding the development of wound dehiscence during the early healing phase.25,26

Postoperative pain was not experienced by any of the patients, and six subjects only took the presurgical dose prescribed plus the 600 mg ibuprofen in the postoperative period. Only one patient, who received NIPSA and frenectomy, required more than two doses of 600 mg ibuprofen after surgery. This very positive patient perception is probably due to the very limited surgical trauma, the rather short operative time, and the lack of complications.

Conclusions

This case series demonstrates the potential efficacy of NIPSA associated with HA-graft EMD procedures.
in the treatment of isolated deep intrabony defects. Furthermore, this technique may also be applied in the treatment of other lesion types. A large study is necessary to confirm and extend the reported preliminary outcomes.

Acknowledgments

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