Italian Society
of Periodontology
and Implantology

Henry M. Goldman Prize 2015

Entire papilla preservation technique: A novel surgical approach for regenerative treatment of deep and wide intrabony defects

Serhat Aslan[1], Nurcan Buduneli[1]

[1]Ege University, School of Dentistry, Department of Periodontology, İzmir, Turkey.

SIdP – Proceedings Book H.M. Goldman - Rimini, 6 March 2015

SUMMARY

Primary wound closure and uneventful early wound stability over the biomaterials are the critical parts of a successful periodontal regeneration. Surgical elevation of the interdental papilla to access deep and wide intrabony defects interferes with the papillary blood supply that can end up with an impairment in healing process possibly even preventing the primary closure in the early healing phase. Subsequent bacterial contamination may deteriorate the healing process in later phases. A novel tunnel-like surgical technique designed to maintain the integrity of the interdental papilla is presented with the aim of providing an optimal environment for wound healing in regenerative approaches. Nine patients with one isolated deep and wide intrabony defect were treated with periodontal regeneration using the “entire papilla preservation technique”. Early healing was uneventful in all cases, and 100% wound closure was maintained during the entire healing period. At the 8-month evaluation, clinical attachment gain was 7.2±2.5 mm. Average probing depth reduction was 7.6±2.8 mm, associated with minimal increase in gingival recession (0.4±0.3 mm). “Entire papilla preservation technique” may be an alternative surgical approach to prevent exposure of regenerative biomaterials in the early healing phase and possibly enhancing the blood clot stability in intrabony defects.

INTRODUCTION

Regeneration of lost periodontal tissues is the ultimate target of periodontal treatment. In the early 1980s, Nyman et al. (1982) demonstrated for the first time new attachment formation by using guided tissue regeneration (GTR) technique. Various clinical studies using GTR technique reported clinical attachment gains superior than that obtained with open flap debridement (Cortellini et al. 1995, 1996). Both resorbable and non-resorbable barrier membranes have been successfully used to obtain periodontal regeneration. In the last three decades, different types of biomaterials have been investigated to achieve periodontal regeneration. Use of barrier membranes in combination with bovine-derived bone substitutes has been suggested to result in formation of new cementum, new periodontal ligament and new alveolar bone (Camelo et al. 2001).

Since the first papers by Heijl (1997), enamel matrix derivative (EMD) has attracted great interest in the research for periodontal regeneration. Human histologic studies have shown that EMD application enhances formation of new acellular cementum, periodontal ligament and alveolar bone (Sculean et al. 1999, 2000, Yukna & Mellonig 2000). Controlled clinical studies revealed comparable outcomes with EMD application or GTR in the treatment of intrabony defects (Pontoriero et al. 1999, Sculean et al. 2001,2006, Minabe et al. 2002).

Regenerative therapy outcomes are affected by various factors such as plaque control, percentage of the bleeding on probing, location and morphology of the defect, smoking habit, and exposure of the barrier membrane (Tonetti et al. 1993, Machtei 1994, Kornman & Robertson 2000, Farina et al. 2013). Membrane exposure may lead to bacterial contamination in the surgical area and deteriorate the process of periodontal regeneration particularly in the interproximal site (Nowzari et al. 1995, De Sanctis et al. 1996). Papilla preservation technique (Takei et al. 1985), modified papilla preservation technique (Cortellini et al. 1995), simplified papilla preservation technique (Cortellini et al. 1999), minimally invasive surgical approaches with papilla elevation (Cortellini & Tonetti 2007) or without papilla elevation (Cortellini & Tonetti 2009) aim at preservation of the interdental papillary structure during the early and late phases of wound healing to prevent contamination of the regenerating area and wound failure. Furthermore, especially the novel minimally invasive techniques (Cortellini & Tonetti 2007, 2009) aim at providing greater stability to the blood clot to enhance the regenerative potential. All the above-mentioned techniques, however, entail an incision of the defect-associated interdental papilla that may jeopardize the volume and integrity of interdental tissues. Azzi et al. (2009) proposed a pouch-and-tunnel technique for bone regeneration. This technique focuses on the idea of ensuring the integrity of interdental papillae.

This cohort study describes a novel tunnel-like surgical approach, the “entire papilla preservation technique”, for the regenerative treatment of deep and wide intrabony defects. The completely preserved interdental papilla is meant to stabilize the blood clot and to improve the wound healing process. Full access to the defect is provided with one buccal vertical releasing incision and the elevation of a short flap on the buccal side of the defect-associated tooth. EMD and bone substitutes are applied in the debrided defect to promote periodontal regeneration.

MATERIALS AND METHODS

Study population and experimental design - Nine systemically healthy patients with advanced periodontal disease and one isolated deep and wide interdental intrabony defect were included in the study. After completion of non-surgical periodontal therapy and pocket elimination procedures, all patients were enrolled for regenerative periodontal therapy and gave written informed consent. Eligible patients had one isolated intrabony defect with PD$\geq$8 mm, CAL$\geq$9 mm and at least 5 mm intrabony component involving predominantly the interproximal area of the affected tooth. Other inclusion criteria were having full-mouth plaque score (FMPS) $\leq$ 20% and full-mouth bleeding score (FMBS) $\leq$ 20%. Patients, who smoke, have systemic diseases hindering periodontal surgery, use medications that affect periodontal tissues, pregnant or lactating women, and patients having one-wall intrabony defects and defects that involve buccal and lingual sites were excluded from the study. Presence of inadequate endodontic treatment and/or restoration in the relevant teeth were the other exclusion criteria.
Clinical periodontal parameters were recorded at baseline, which is 3 months after completion of initial periodontal therapy. Final clinical outcomes were recorded 8 months after the regenerative periodontal surgery. Experimental sites were accessed with the entire papilla preservation technique and debrided gently. Intraoperative measurements and defect characterization were made during the surgery. Ethylenediaminetetraacetic acid (EDTA) gel and EMD were applied on the biologically compatible and air-dried root surface. Porcine-derived bone substitutes were placed into the defect and flap was sutured with simple interrupted sutures. Patients were enrolled in a stringent plaque control programme with recalls on a weekly basis for the first month and then monthly controls for professional tooth cleaning for the 8 months.

Surgical procedures - The surgical site was anesthetized using articaine-epinephrine 1:100,000. Trans-papillary infiltration was avoided to prevent physical (needle penetration) and chemical (prolonged vasoconstriction) trauma to the gingival tissues. Bone sounding was performed after anesthesia.
The "Entire papilla preservation" technique is a tunnel-like approach of the defect-associated interdental papilla. A magnifying loop with 3.3x magnification was used to increase visibility of the surgical site. Following a buccal intra-crevicular incision, a beveled vertical releasing incision was performed in the buccal gingiva of the neighboring interdental space and extended just beyond the mucogingival line to provide appropriate mechanical access to the intrabony defect (Fig. 1b).

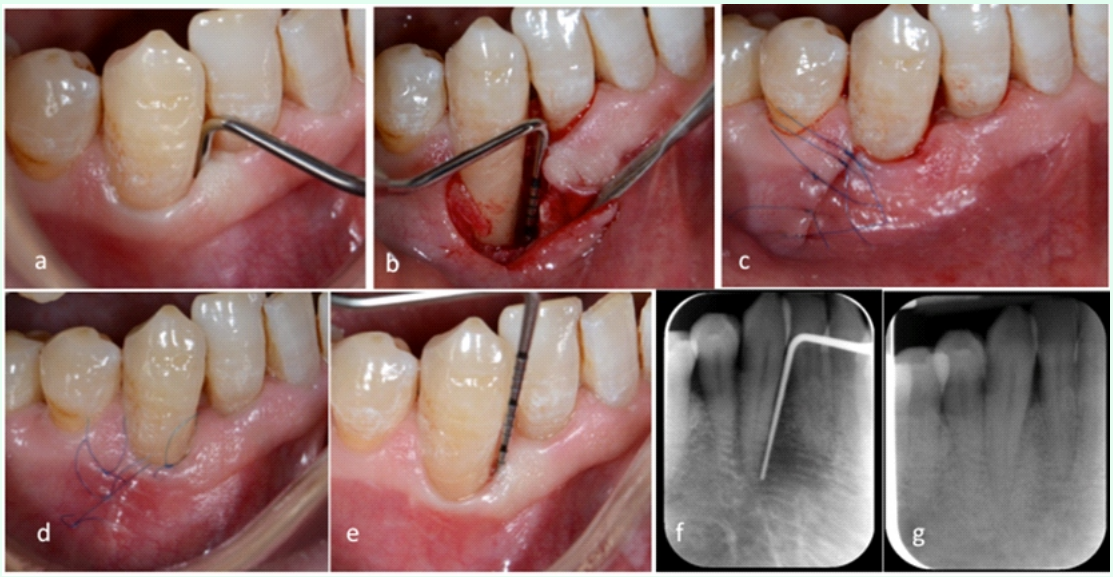

***Figure 1**. a) Lower right canine with 18 mm of pocket depth. b) Full access to the defect with entire papilla preservation technique. c) Primary wound closure of the surgical site. d) Excellent early wound healing at 10 days. e) 3 mm of probing depth obtained at 8 months. f) Baseline radiograph g) 8-month radiograph. Note the complete resolution of extremely deep intrabony defect.*

In the presence of malpositioned tooth with narrow neighboring interdental space, vertical incision was shifted one tooth away from the actual incision line. Particularly for narrow interdental papilla, an oblique interdental incision was made, followed by an intrasulcular incision directed to the adjacent tooth and vertical releasing incision was then performed (Fig. 2b). A microsurgical periosteal elevator was used to elevate a buccal full thickness muco-periosteal flap extending from the vertical incision to the defect-associated papilla. A specially designed angled tunnel elevator facilitated the interdental tunnel preparation under the papillary tissue. Utmost care was taken to elevate the interdental papilla in full-thickness manner up to the lingual bone crest. A microsurgical scissor was used to remove the granulation tissue from the inner aspect of the interdental papilla. Excessive thinning of the papilla was avoided in order not to compromise the blood supply. The granulation tissue was removed with a mini-curette (Fig. 2c). Any residual subgingival plaque or calculus was gently removed from the exposed root surface with an ultrasonic scaler. The surgical area was rinsed with sterile saline and root conditioning of the exposed surface was done applying 24% EDTA gel for 2 minutes to remove the smear layer (Fig. 2d). Then, the exposed root surface was rinsed with sterile saline and EMD was applied on the exposed root surface (Fig. 2e). Subsequently, a deproteinized porcine-derived bone substitute was placed into the intrabony defect and care was taken not to overfill the defect (Fig. 2f). Contamination with blood or saliva was prevented during biomaterial application. No periosteal releasing incision was performed. Gentle pressure was applied to the surgical area using saline-wetted gauze for 1 min to readapt the mucoperiosteal flap. Microsurgical suturing technique with 7-0 monofilament polypropylene suture materials was performed for optimal wound closure of the surgical area (Fig. 1c and 2g).

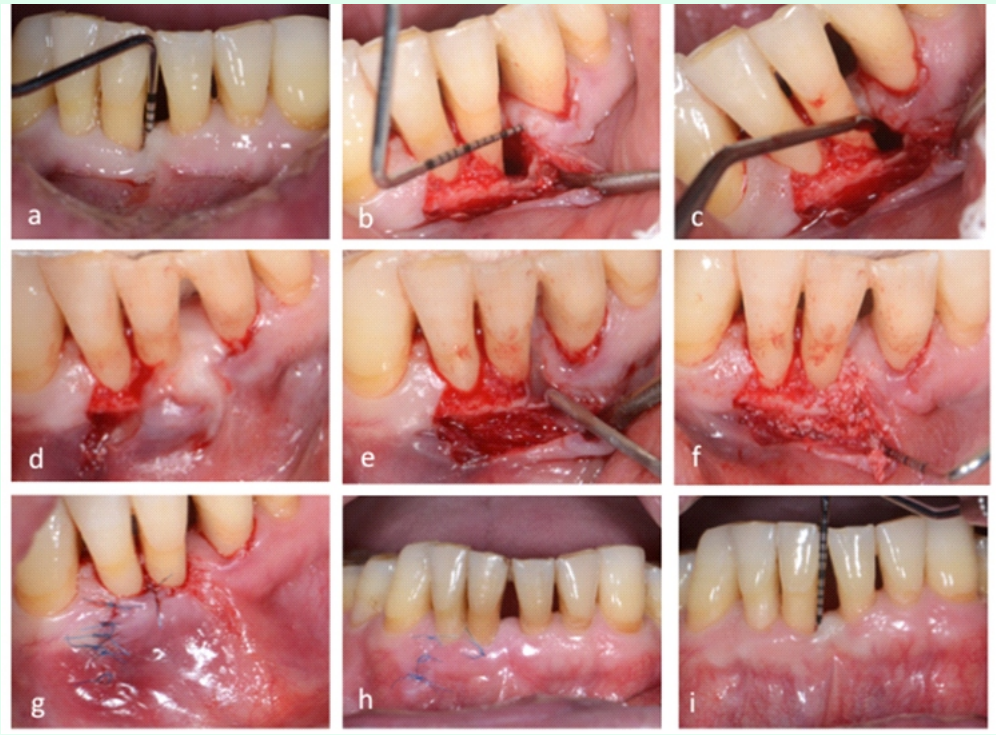

***Figure 2**. a) Twelve mm preoperative probing depth at the mesial side of the lower right central incisor. b) Same site after elevation of tunneled interdental papilla. Note the elasticity of alveolar mucosa and proper mechanical access to the defect area by the help of a vertical releasing incision. c) Gentle removal of granulation tissue over the alveolar bone. d) Application of 24% EDTA gel for 2 minutes to remove smear layer from the exposed root surface. e) EMD application. f) Placement of deproteinized porcine-derived bone substitute into the intrabony defect. Note that overfill of the defect is avoided. g) Closure of surgical area using 7-0 polypropylene suture material and microsurgical knots. Note the integrity of interdental papilla. h) One week after the surgery. Excellent wound healing following entire papilla preservation technique. i) Eight months after the surgery, 4.5 mm of probing depth was measured. 0.5 mm vertical loss of interdental papilla was calculated by comparing standardized photographs.*

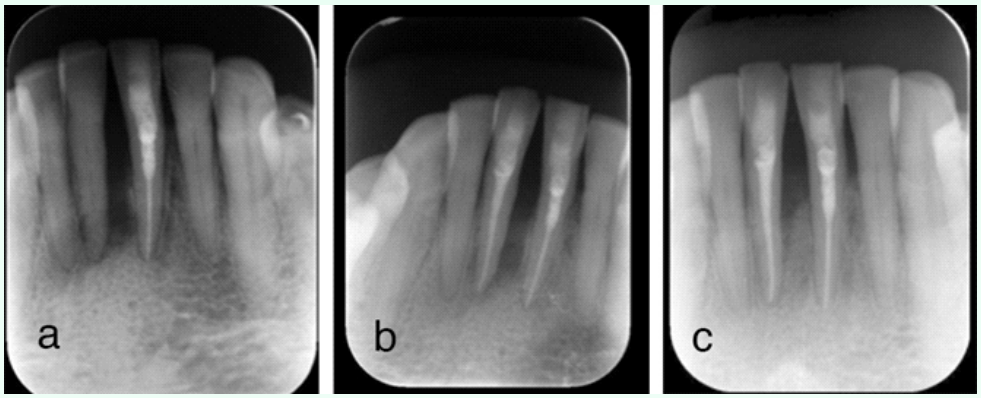

***Figure 3.** a) Initial radiograph of case presented in Fig.2 before endodontic treatment. b) Radiograph taken 3 months after endodontic treatment. Note the apical bone healing. c) Radiograph taken 8 months after surgery. Substantial amount of regeneration can be seen.*

Post-surgical care - After the surgery, patients received 600 mg ibuprofen and were instructed to take subsequent dose 8 hours later. Additional ibuprofen tablet intake was recorded if needed during the following days. To control bacterial contamination, patients were prescribed systemic doxycycline (100 mg b.i.d. for 1 week). The patients were asked to refrain from using mechanical oral hygiene measures for the post-operative 4-week period. During this period, the patients were advised to rinse with 0.12% chlorhexidine digluconate mouthrinse twice daily for 1 min. The sutures were removed 2 weeks after the surgery.

Clinical parameters - Full-mouth plaque scores (FMPS) were recorded as the percentage of total surfaces (4 sites per tooth) that revealed the presence of plaque (O'Leary 1972). Bleeding on probing was assessed dichotomously and full-mouth bleeding scores (FMBS) were then calculated (Cortellini 1993a). Probing depth (PD) and recession of the gingival margin (REC) were recorded to the nearest millimeter at the deepest location of the selected interproximal site. Clinical attachment level (CAL) was calculated as the sum of PD and REC. Primary closure of the surgical sites was evaluated on a weekly basis for the first month. Any adverse effects (haematoma, pain and discomfort, oedema) and painkiller intake were recorded.

Clinical characterization of the intrabony defects during the surgery - Defects were described as 1-,2-,3-wall or combination defects according to Papapanou et al. (2000). Depth of the intrabony component (INFRA) was measured as the distance between the crest of the marginal bone and the deepest location of the osseous defect.

Data analysis - Nine patients were enrolled in this cohort study. Data were expressed as mean±SD obtained from 9 defects in 9 patients. There was no missing data in any patient. Comparisons between baseline and 8-month PD, CAL and REC were made using the paired Student's t-test (=0.05)
The primary outcome variables were CAL gain, residual PD and REC change.

RESULTS

Nine subjects with periodontal disease (6 males and 3 females; mean age: 40.5±15.1; range 22-60 years) were included in this study. FMPS and FMBS at baseline were 15.22±1.39% and 9.33±2.50%, respectively. The average baseline CAL was 12.85±4.05 mm and PD was 10.42±3.59 mm. Depth of the intrabony components (INFRA) was 7.42±3.45 mm.

Primary wound healing of the vertical releasing incision, excellent continuity of interdental papilla and 100% wound closure was observed in all cases during the first 4 weeks of the early healing period. No adverse events were noted in any of the treated sites. Only one of the patients reported very limited discomfort for the first 3 days after the surgery.

Variables	Mean±SD	Minimum	Maximum
FMPS (%)	15.22±1.39	13	17
FMBS (%)	9.33±2.50	6	13
PD (mm)	10.42±3.59	8	18
CAL (mm)	12.85±4.05	9	20
REC (mm)	2.42±1.27	1	5
INFRA (mm)	7.42±3.45	5	15

Table 1. *Patient characteristics and clinical parameters measured at baseline.*

FMPS, full-mouth plaque score; FMBS, full-mouth bleeding score; PD, probing depth; CAL, clinical attachment level; REC; gingival recession; INFRA, depth of the intrabony component of the defect.

Variables	Baseline	8-month	Difference
PD (mm)	10.42±3.59	2.78±1.07	7.64±2.86*
CAL (mm)	12.85±4.05	5.64±2.37	7.21±2.59*
REC (mm)	2.42±1.27	2.85±1.40	0.4±0.3

Table 2. *Clinical outcomes at baseline and 8-month after treatment.*

PD, probing depth; CAL, clinical attachment level; REC; gingival recession.
Statistically significant difference compared to baseline ($p<0.001$).

The 8-month CAL was 5.64±2.37 mm with a CAL gain of 7.21±2.59 mm (range 5-13 mm). Differences in CAL between baseline and 8-month were both clinically and statistically significant ($p<0.001$).

Mean residual PD was 2.78±1.07 mm with an average PD reduction of 7.64±2.86 mm. Differences in PD between baseline and 8-month were clinically and statistically significant ($p<0.001$). All the sites except one site showed a PD<4mm on the 8-month evaluation.

There was 0.4±0.3 mm increase in REC between baseline and 8-month measurement and this difference was not statistically significant ($p>0.05$).

CONCLUSIONS

This novel surgical procedure termed as “entire papilla preservation”, based on a short buccal flap, a vertical incision positioned in the buccal gingiva of the neighboring interdental space and a tunneled interdental papilla, provides an adequate mechanical access to interproximal deep and wide intrabony defects and an excellent and uneventful post-operative healing phase. Furthermore, the application of this technique supports the use of amelogenins and bone-like materials.
Clearly, further clinical and histological research is required to evaluate and clarify the advantages and disadvantages of this novel technique.

CONFLICT OF INTERESTS AND SOURCE OF FUNDING STATEMENT

The study was funded solely by the institution of the authors. The authors declare no conflicts of interest related with this study.

REFERENCES

-Azzi R, Etienne D, Takei H, Carranza F. (2009) Bone regeneration using the pouch-and-tunnel technique. *Int J Periodontics Restorative Dent* **29**, 515-21.

-Burkhardt R, Preiss A, Joss A, Lang NP. (2008) Influence of suture tension to the tearing characteristics of the soft tissues: an in vitro experiment. *Clin Oral Implants Res* **19**, 314-9.

-Camelo M, Nevins ML, Lynch SE, Schenk RK, Simion M, Nevins M. (2001) Periodontal regeneration with an autogenous bone-Bio-Oss composite graft and a Bio-Gide membrane. *Int J Periodontics Restorative Dent* **21**, 109-19.

-Cortellini P, Pini Prato G, Tonetti MS. (1995) Periodontal regeneration of human intrabony defects with titanium reinforced membranes. A controlled clinical trial. *J Periodontol* **66**, 797-803.

-Cortellini P, Pini Prato G, Tonetti MS. (1996) Periodontal regeneration of human intrabony defects with bioresorbable membranes. A controlled clinical trial. *J Periodontol* **67**, 217-23.

-Cortellini P, Prato GP, Tonetti MS. (1995) The modified papilla preservation technique. A new surgical approach for interproximal regenerative procedures. *J Periodontol* **66**, 261-6.

-Cortellini P, Prato GP, Tonetti MS. (1999) The simplified papilla preservation flap. A novel surgical approach for the management of soft tissues in regenerative procedures. *Int J Periodontics Restorative Dent* **19**, 589-99.

-Cortellini P, Tonetti MS. (2007a) A minimally invasive surgical technique (MIST) with enamel matrix derivative in the regenerative treatment of intrabony defects: a novel approach to limit morbidity. *J Clin Periodontol* ***34****, 87-93*

-Cortellini P, Tonetti MS. (2009) Improved wound stability with a modified minimally invasive surgical technique in the regenerative treatment of isolated interdental intrabony defects. *J Clin Periodontol* **36**, 157163.

-De Sanctis M, Zucchelli G, Clauser C. (1996) Bacterial colonization of bioabsorbable barrier material and periodontal regeneration. *J Clin Periodontol* **23**, 1039-46.

-De Sanctis M, Zucchelli G, Clauser C. (1996) Bacterial colonization of bioabsorbable barrier material and periodontal regeneration. *J Periodontol* **67**, 1193-200.

-Farina R, Simonelli A, Rizzi A, Pramstraller M, Cucchi A, Trombelli L. (2013) Early postoperative healing following buccal single flap approach to access intraosseous periodontal defects. *Clin Oral Investig* **17**, 1573-83.

-Harrel SK. (1998) A minimally invasive surgical approach for periodontal bone grafting. *Int J Periodontics Restorative Dent* **18**, 161-9.

Heijl L. (1997) Periodontal regeneration with enamel matrix derivative in one human experimental defect. A case report. *J Clin Periodontol* **24**, 693-6.

-Kornman KS, Robertson PB. (2000) Fundamental principles affecting the outcomes of therapy for osseous lesions. *Periodontol 2000* **22**, 22-43.

-Machtei EE, Cho MI, Dunford R, Norderyd J, Zambon JJ, Genco RJ. (1994) Clinical, microbiological, and histological factors which influence the success of regenerative periodontal therapy. *J Periodontol* **65**, 154-61.

-Machtei EE. (2001) The effect of membrane exposure on the outcome of regenerative procedures in humans: a meta-analysis. *J Periodontol* **72**, 512-6.

-Minabe M, Kodama T, Kogou T, Takeuchi K, Fushimi H, Sugiyama T, Mitarai E. (2002) A comparative study of combined treatment with a collagen membrane and enamel matrix proteins for the regeneration of intraosseous defects. *Int J Periodontics Restorative Dent* **22**, 595-605.

-Nowzari H, Matian F, Slots J. (1995) Periodontal pathogens on polytetrafluoroethylene membrane for guided tissue regeneration inhibit healing. *J Clin Periodontol* **22**, 469-74.

-Nyman S, Lindhe J, Karring T, Rylander H. (1982) New attachment following surgical treatment of human periodontal disease. *J Clin Periodontol* **9**, 290-6.

-Pontoriero R, Wennström J, Lindhe J. (1999) The use of barrier membranes and enamel matrix proteins in the treatment of angular bone defects. A prospective controlled clinical study. *J Clin Periodontol* **26**, 833-40.

-Sculean A, Chiantella GC, Windisch P, Donos N. (2000) Clinical and histologic evaluation of human intrabony defects treated with an enamel matrix protein derivative (Emdogain). *Int J Periodontics Restorative Dent* **20**, 374-81.

-Sculean A, Donos N, Windisch P, Brecx M, Gera I, Reich E, Karring T. (1999) Healing of human intrabony defects following treatment with enamel matrix proteins or guided tissue regeneration. *J Periodontal Res* **34**, 310-22.

-Sculean A, Schwarz F, Miliauskaite A, Kiss A, Arweiler N, Becker J, Brecx M. (2006) Treatment of intrabony defects with an enamel matrix protein derivative or bioabsorbable membrane: an 8-year follow-up split-mouth study. *J Periodontol* **77**, 1879-86.

-Sculean A, Windisch P, Chiantella GC, Donos N, Brecx M, Reich E. (2001) Treatment of intrabony defects with enamel matrix proteins and guided tissue regeneration. A prospective controlled clinical study. *J Clin Periodontol* **28**, 397-403.

-Takei HH, Han TJ, Carranza FA Jr, Kenney EB, Lekovic V. (1985) Flap technique for periodontal bone implants. Papilla preservation technique. *J Periodontol* **56**, 204-10.

-Tibbetts LS, Shanelec D. (1998) Periodontal microsurgery. *Dent Clin North Am* **42**, 339-59.

-Tonetti MS, Pini-Prato G, Cortellini P. (1993) Periodontal regeneration of human intrabony defects. IV. Determinants of healing response. *J Periodontol* **64**, 934-40.

-Trombelli L, Farina R, Franceschetti G, Calura G. (2009) Single-flap approach with buccal access in periodontal reconstructive procedures. *J Periodontol* **80**, 353-60.

-Wachtel H, Schenk G, Böhm S, Weng D, Zuhr O, Hürzeler MB. (2003) Microsurgical access flap and enamel matrix derivative for the treatment of periodontal intrabony defects: a controlled clinical study. *J Clin Periodontol* **30**, 496-504.

-Yukna RA, Mellonig JT. (2000) Histologic evaluation of periodontal healing in humans following regenerative therapy with enamel matrix derivative. A 10-case series. *J Periodontol* **71**, 752-9.

-Zucchelli G, Mele M, Mazzotti C, Marzadori M, Montebugnoli L, De Sanctis M. (2009) Coronally advanced flap with and without vertical releasing incisions for the treatment of multiple gingival recessions: a comparative controlled randomized clinical trial. *J Periodontol* **80**, 1083-9

Henry M. Goldman Prize 2015

Italian Society of Periodontology and Implantology