The Modified Papilla Preservation Technique. A New Surgical Approach for Interproximal Regenerative Procedures

Pierpaolo Cortellini,* Giovanpaolo Pini Prato,* and Maurizio S. Tonetti†

A MODIFICATION OF THE PAPILLA PRESERVATION technique has been applied to achieve primary closure of the interproximal tissue over barrier membranes placed coronal to the alveolar crest. Fifteen patients with deep intrabony interproximal defects were treated. Defects had a probing attachment level loss of 9.9 ± 3.2 mm and a recession of the gingival margin of 1.7 ± 1.6 mm. The depth of the intrabony component was 5.5 ± 2.9 mm; while the suprabony component was 5.9 ± 2.0 mm. Titanium-reinforced teflon membranes were placed 1.3 ± 0.7 mm from the cemento-enamel junction, 4.5 ± 1.6 mm coronal to the interproximal alveolar bone crest. Primary closure over the interproximal portion of the membrane was obtained in 93% of cases. In 73% of the cases complete coverage of the membrane was maintained until its removal at 6 weeks. These data indicate that the modified papilla preservation technique can be successfully applied to obtain primary closure of the interdental space in regenerative procedures with barrier membranes. J Periodontol 1995; 66:261–266

Key Words: Guided tissue regeneration; periodontal diseases/surgery; polytetrafluoroethylene/therapeutic use; membranes, barrier; membranes, artificial; periodontal pockets/surgery.

A key goal in periodontal regenerative procedures is to obtain primary closure over the treated area and thus ensure adequate protection for the healing events. Satisfactory approaches are available when the surgical area is located on the buccal aspect, as in class II furcations or recessions. Conversely, primary closure of the interdental area is technically more demanding. Improved closure of the interdental area has been attempted by 1) careful preservation of the interdental tissue during the initial incision; 2) coronal positioning of the buccal flap; or 3) using free gingival grafts over implanted materials. Takei et al. proposed a papilla preservation technique to achieve primary closure of the interproximal space over periodontal bone implants. Achieving primary closure in the interdental space and maintaining it over time, however, is more elusive in most situations when a barrier membrane is used.

Furthermore, whenever regeneration of the suprabony component is attempted by overfilling the intrabony defect or by placing a barrier membrane coronal to the interproximal alveolar bone crest, a substantial coronal positioning of the flaps is required to obtain primary closure of the interproximal area. This objective can hardly be achieved with current surgical techniques. Therefore it is necessary to identify an efficacious and reproducible method to obtain both coronal positioning of the flap and primary closure of the interdental space prior to attempting regeneration of the suprabony component of the defect. This report describes a modified surgical approach to improve soft tissue handling to achieve this goal.

MATERIALS AND METHODS

Patient Population
Following completion of an hygienic phase consisting of scaling and root planing and oral hygiene instructions, 15 patients (5 males, 10 females) aged 30 to 51 years (mean age 39.3 ± 6.4) in good general health, gave informed consent to participate in this case series. A deep intrabony defect with a suprabony component was identified in each patient. The involved teeth were 7 incisors, 4 cuspids, 2 bicuspids, and 2 molars. All teeth, except one molar, were located in the maxillary arch. Defects had to be located in the interproximal area, and did not extend into a furcation.
Clinical Characterization of Selected Sites

Full mouth plaque scores (FMPS) were recorded as the percentage of total surfaces (4 aspects per tooth) which revealed the presence of plaque. Bleeding on probing was assessed dichotomously at a force of 0.3 N with a manual pressure sensitive probe. Full mouth bleeding scores (FMBS) were calculated. Probing depth (PD), marginal recession (REC), and probing attachment level (PAL) were recorded to the nearest mm by a single investigator. Clinical measurements were taken 1 week before the surgical procedure.

Intrasurgical Clinical Measurements

Intrasurgical clinical measurements were taken following debridement of the defects essentially as described by Durwin et al.13 1) distance from the cemento-enamel junction (CEJ) to the bottom of the defect (CEJ-BD); and 2) distance from the CEJ to the most coronal extension of the interproximal bone crest (CEJ-BC). The intrabony component of the defects (INTRA) was defined as INTRA = (CEJ-BD) – (CEJ-BC).

Surgical Procedure

The surgical technique used was a variation of the papilla preservation technique10 modified to allow not only the primary closure, but also the coronal positioning of the interdental tissue. A buccal and interproximal intrasulcular primary incision to the alveolar crest, involving the two teeth neighboring the defect, was performed. A horizontal incision with a slight internal bevel was then traced in the buccal gingiva at the base of the papilla. A buccal full thickness flap has been elevated. Note that the papilla covering the defect is still in place.

Figure 1. The modified papilla preservation technique. Initial incisions, elevation of the flaps, and defect debridement. Upper left. Preoperative buccal view. Upper right. A buccal and interproximal intrasulcular incision was performed. Subsequently, a horizontal incision with a slight internal bevel was traced in the buccal gingiva at the base of the papilla. A buccal full thickness flap has been elevated. Note that the papilla covering the defect is still in place. Lower left. The papilla has been mobilized by performing a buccal horizontal incision in the interproximal supracrestal connective tissue just coronal to the alveolar crest. Lower right. The papilla has been elevated with the full thickness palatal flap.

Figure 2. The modified papilla preservation technique. Surgical access to the interproximal defect. A 5 mm intrabony defect, with a 5 mm suprabony component, was identified following debridement of the interproximal area. Note the optimal visibility.
palatal gingiva of the interdental space at the base of the papilla. This incision was connected with the primary incision in the most apical portion of the buccal gingival margin of the neighboring teeth. A full thickness buccal flap was elevated to the level of the buccal alveolar crest (Fig. 1). The buccal and interproximal primary incision was then continued intrasulcularly in the interproximal space to reach the palatal line angle and extended to the palatal aspect. A buccal horizontal incision was performed in the interproximal supracrestal connective tissue, just coronal to the bone crest, to dissect the papilla (Fig. 1). The papilla was elevated towards the palatal aspect. Following extension of the palatal incision, a full thickness palatal flap including the interdental papilla was subsequently elevated to fully expose the interproximal defect (Fig. 1). The tissue thickness of the papilla was reduced. The defect was fully debrided and scaling and root planing performed (Fig. 2). To allow the coronal positioning of the buccal flap in the absence of tension, vertical releasing incisions extending into the alveolar mucosa were placed in the interproximal spaces mesial and distal to the teeth neighboring the defect. These incisions were divergent in a corono-apical direction, and preserved the interdental tissue. The buccal flap was then released with a split thickness incision. An interproximal titanium reinforced teflon membrane⁴ was adapted and positioned supracrestally as close as possible to the CEJ. The occlusive portion of the membrane extended at least 3 mm beyond the margin of the defect. The membrane was firmly secured to the neighboring teeth with teflon sling sutures (Fig. 3). The flaps were sutured as follows to obtain coronal positioning of the buccal flap and primary closure of the interdental space over the membrane:

1) A horizontal internal mattress suture was placed between the base of the palatal papilla and the buccal flap immediately coronal to the muco-gingival junction. The interproximal portions of the suture ran beneath the mucoperiosteal flaps and crossed each other above the titanium reinforcement of the membrane. Because the suture was anchored on the thick palatal tissue, the buccal flap was coronally displaced (Figs. 3 and 4).

2) A vertical internal mattress suture was subsequently placed between the buccal aspect of the interproximal papilla (i.e., the most coronal portion of the palatal flap which included the interdental papilla) and the most coronal portion of the buccal flap. When this suture was tied, primary closure of the coronally positioned buccal flap with the pre-

⁴Goretex, W.L. Gore & Associates, Flagstaff, AZ.
served papilla was achieved in the interproximal area. Coronal positioning of the interdental tissue was obtained over the membrane (Figs. 3, 5, and 6).

3) The vertical releasing incisions were sutured with a standard apico-coronal suture to release tension from the interproximal tissue.

4) Interproximal sutures were placed to close the mesial and distal extension of the flap. No surgical dressing was placed.

An infection control regimen was prescribed, essentially as previously described. Patients were instructed to rinse twice daily with 0.2% chlorhexidine and to use modified oral hygiene procedures until the removal of the membranes. In the first postoperative week patients were prescribed tetracycline HCl 250mg four times per day. Professional tooth cleaning was performed weekly while the membrane was in place. Membranes were removed 6 weeks post-operatively.

Outcome Measures
The primary outcome measures were 1) the position of the membrane immediately following surgery (day 0); 2) the possibility of obtaining and maintaining coverage of the membrane with the mucoperiosteal flaps; and 3) the posi-
The distance of the membrane above the interproximal alveolar crest at day 0 and of the null hypothesis of no difference in membrane position between day 0 and membrane removal were tested with the paired Wilcoxon ranked sum test. All calculations were performed using appropriate statistical software.1

**RESULTS**

**Defect Characteristics**

Patients’ oral hygiene and baseline defect characteristics are shown in Table 1. Patients’ FMPS and FMBS were 11.0 ± 2.3 and 10.9 ± 3.2, respectively. The selected defects displayed a PAL of 9.9 ± 3.2 mm with a REC of 1.7 ± 1.6 mm. The intrabony component was 5.5 ± 2.9 mm, with a suprabony component of 5.9 ± 2.0 mm.

**Membrane Position**

The titanium reinforced teflon membrane was positioned 1.3 ± 0.7 mm from the CEJ (CEJ-MEM), 4.5 ± 1.6 mm above the interproximal alveolar crest (coronal). The CEJ-MEM distance was significantly different from CEJ-BC both at membrane positioning and at membrane removal (P < 0.001, Wilcoxon ranked sum test; Table 2). At membrane removal (6 weeks) CEJ-MEM was 2.1 ± 1.2 mm. A statistically significant difference (0.8 ± 0.8 mm) was observed in terms of CEJ-MEM between membrane positioning at baseline and its removal at six weeks (P = 0.006, Wilcoxon ranked sum test; Table 2).

**Membrane Coverage**

At baseline, primary closure of the interproximal soft tissues over the membrane was obtained in 14 of 15 cases (93%). Exposure occurred in 2 cases at 3 weeks and in 1 case at 4 weeks. When membranes were removed at 6

---

**Table 1. Baseline Oral Hygiene and Defect Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean ± SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMPS</td>
<td>11.0 ± 2.3</td>
<td>7</td>
<td>14.4</td>
</tr>
<tr>
<td>FMBS</td>
<td>10.9 ± 3.2</td>
<td>5.5</td>
<td>17.3</td>
</tr>
<tr>
<td>PAL</td>
<td>9.9 ± 3.2</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>PD</td>
<td>8.4 ± 2.5</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>REC</td>
<td>1.7 ± 1.6</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>CEJ-BD</td>
<td>11.5 ± 3.9</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>CEJ-BC</td>
<td>5.9 ± 2.0</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Intra</td>
<td>5.5 ± 2.9</td>
<td>2</td>
<td>11</td>
</tr>
</tbody>
</table>

**Table 2. Position of the Membrane With Reference to the CEJ**

(comparison between position at insertion and at removal and relationship with the interproximal alveolar crest)

<table>
<thead>
<tr>
<th></th>
<th>Insertion</th>
<th>Removal</th>
<th>Significance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEJ-MEM</td>
<td>1.3 ± 0.7</td>
<td>2.1 ± 1.2</td>
<td>P = 0.006</td>
</tr>
<tr>
<td>CEJ-BC</td>
<td>5.9 ± 2.0</td>
<td>nd</td>
<td>—</td>
</tr>
<tr>
<td>Significance*</td>
<td>P &lt; 0.001</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*One sample Wilcoxon ranked sum test.
weeks, 11 sites (73%) still showed complete coverage of the membrane (Fig. 6).

DISCUSSION
The application of the modified papilla preservation technique to regenerative procedures allowed complete coverage of the teflon membrane and primary closure of the mucoperiosteal flaps in the interdental space in 93% of cases. This result was obtained in sites where the barrier membranes were coronally positioned 4.5 ± 1.6 mm above the alveolar crest. Furthermore, in 73% of the cases, the interdental tissue covered the membrane until its removal at 6 weeks.

The rationale for developing this procedure was twofold. First, it seems preferable to obtain good protection of the regenerating tissue through complete coverage of the membrane with the flaps. In fact, membranes exposed to the oral environment present a substantial degree of bacterial colonization. Further, the presence of bacteria on the membrane has been associated with lower PAL gains. Membrane exposure in the interproximal space has been reported as a very frequent occurrence; this is a consequence of the difficulties in obtaining primary closure in the interdental area and the subsequent occurrence of a certain degree of necrosis of the papillary tissue. This is true even when the membrane is placed at the level of the interproximal bone crest. Secondly, since the position of the membrane limits the extent of possible regeneration, an attempt to increase the amount of regeneration would require a more coronal position of the membrane. Positioning of the membrane coronal to the interproximal alveolar crest makes primary closure of the flaps in the interdental area even more difficult. This cannot be predictably achieved with conventional techniques.

The modified papilla preservation technique allows us to achieve the above objectives in single-rooted teeth and in lower molars without neighboring tooth. In molars with proximal teeth present, application of the described surgical approach did not result in the desired primary closure.

This method is technically more demanding in sites with narrow interproximal spaces; in addition, the narrow interdental soft tissue is more likely to undergo a necrosis in such instances.

Application of this method is contraindicated in situations where the coronal reposition of the buccal flap has a poor prognosis; e.g., inadequate vestibular depth.

Although the described surgical technique has been specifically designed for use with reinforced barrier membranes, it could be adapted to different regenerative approaches involving the interdental space. A requirement, however, is the establishment of a stable support for the crossed horizontal internal mattress suture.

In conclusion, the data presented in this paper indicate that the modified papilla preservation technique may be a suitable alternative to conventional surgical approaches for interproximal regenerative procedures in single rooted teeth.

Acknowledgments
The authors express their gratitude to Ms. Cristiana Paoli for the expert assistance with the artwork. This study was supported in part by Accademia Toscana di Ricerca Odontostomatologica, Firenze, Italy, and the Clinical Research Foundation for the Promotion of Oral Health, Bern, Switzerland.

REFERENCES