Comparative Clinical Study of a Bioabsorbable Membrane and Subepithelial Connective Tissue Graft in the Treatment of Human Gingival Recession*

Alain Borghetti, Jean-Marc Glise, Virginie Monnet-Corti, and Jacques Dejou

Background: Connective tissue grafts and guided tissue regeneration (GTR) are the most current procedures in the treatment of gingival recession, but very few clinical comparative studies have been conducted.

Methods: The purpose of this study was to compare 2 types of treatment of gingival recession in the same patients. Fourteen pairs of Miller Class I defects were selected in 14 patients. In each pair, one recession was randomly assigned for treatment by GTR using a bioabsorbable membrane, and the other treated by subepithelial connective tissue graft (CTG). Height of recession (HR), clinical attachment level (CAL), probing sulcus depth (PSD), height of keratinized tissue (HKT), and distance from the cemento-enamel junction to the mucogingival junction (CEJ-MGJ) were recorded before surgery and 6 months postoperatively.

Results: The initial width and height of recession were, respectively, 3.73 mm (SD 0.56) and 3.85 mm (SD 1.15) for the CTG group, and 4.04 mm (SD 0.92) and 4.28 mm (SD 1.20) for the GTR group. The differences were not significant. CAL changes were not different. Both in the CTG group and in the GTR group, mean HR reduction was 2.89 mm (SD 1.18), representing a mean root coverage of 76% and 70.2%, respectively. The difference was not significant. HKT mean gain was significantly greater ($P = 0.0001$) with CTG (2.03 mm, SD 0.92) than with GTR (0.42 mm, SD 0.91). The GTR technique displaced the mucogingival junction significantly ($P = 0.007$) more coronally (2.35 mm, SD 1.44) than the CTG technique (0.78 mm, SD 1.23).

Conclusions: Within the limits of this study, no difference could be found between subepithelial connective tissue graft and GTR with a bioabsorbable membrane with regard to root coverage, but the GTR technique did not increase the height of keratinized tissue and displaced the mucogingival junction more coronally at 6 months. J Periodontol 1999; 70: 123-130.

KEY WORDS
Gingival recession/surgery; grafts, connective tissue; guided tissue regeneration; comparison study; membrane, barrier; tooth root/surgery.

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A GTR procedure with expanded polytetrafluoroethylene (ePTFE) membranes was proposed by Tinti and Vincenzi\textsuperscript{17} to promote new attachment to denuded root surfaces. The surgical technique improved the ability to create and maintain a space between the root surface and the membrane, where the blood clot forms and remains stable. Pini Prato et al.\textsuperscript{18} bent the membrane by passing a Teflon suture through the apical portion to create a concavity that faced the root surface. For the same purpose, Tinti et al.\textsuperscript{19} used a bent gold bar or a gold frame, Tinti and Vincenzi\textsuperscript{20} used a titanium-reinforced ePTFE membrane, and Roccuzzo and Buser\textsuperscript{21} used miniscrews. With these various space-making techniques, root coverage obtained by ePTFE membranes has ranged from 55\% to 84\%.\textsuperscript{16,18,22-24} But several problems have arisen with the non-resorbable membranes: they require a 2-step procedure, the regenerating tissue may be damaged during the removal of the membrane, and it may be difficult to cover the newly formed tissue.\textsuperscript{25} These problems can be avoided with bioabsorbable membranes, already available for the treatment of furcation involvement and intraosseous lesions. A bilaminar structure with a spacer construction of the internal layer and based on polylactic acid has been introduced as a bioabsorbable matrix barrier specially designed for gingival recessions.\textsuperscript{†} Root coverage reported ranged from 64\% to 82\%.\textsuperscript{15,24,26} The only comparative study of a bioabsorbable and a non-resorbable membrane\textsuperscript{24} involved 12 patients with a split-mouth design. The average clinical attachment gains and the mean root coverages were not different. The bioabsorbable membrane seemed to be as efficient as the non-resorbable membrane, and a questionnaire revealed the single-step surgery to be the patients’ choice.

Few comparative studies have been performed between mucogingival surgery and GTR. Pini Prato et al.\textsuperscript{18,27} treated 2 groups of patients with either an ePTFE membrane bent by a suture or by a 2-step procedure consisting of a free gingival graft and a coronally positioned flap. The amount of root coverage was similar, the clinical attachment gain was better with GTR, and the increase of keratinized tissue was better by mucogingival surgery. The only comparative study of connective tissue graft versus GTR was published by Ricci et al.\textsuperscript{16} but it included ePTFE membranes and involved 2 groups of patients. Root coverage was not different, but the clinical attachment gain was better in the GTR group.

The purpose of the present study was to compare subpedicle connective tissue grafts and guided tissue regeneration with a bioabsorbable membrane in the coverage of denuded root surfaces in pairs of defects selected in the same patients.

**MATERIALS AND METHODS**

**Patient and Site Selection**

Twenty-eight gingival recessions represented by 14 pairs of buccal gingival recession were selected.

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in 14 healthy patients treated in private practice. There were 11 females and 3 males ranging from 20 to 55 years of age (mean age, 37.5). All the patients were informed of the type of treatment and agreed to have one recession treated with connective tissue graft technique and the other using GTR. Recisions were selected based on the following criteria: 1) indication for treatment; 2) at least 2 mm height; and 3) Class I recession according to Miller’s classification.

The recisions were located on 13 upper and 2 lower canines, 2 upper lateral incisors, 1 upper and 1 lower central incisor, 2 upper and 5 lower first premolars, and 2 second lower premolars. Recisions ranged from 2.5 to 5 mm deep. No root therapy was performed on the teeth involved. No gingival augmentation procedure was performed prior to the recession treatment.

**Surgical Procedures**

After initial therapy, including oral hygiene instructions, occlusal adjustment if needed, scaling and eventually root planing, cases were reevaluated. In each pair of recisions, one site was randomly assigned for treatment by subepithelial connective tissue graft technique (CTG), and the other one was treated by GTR procedure.

**CTG technique.** The procedure was that described by Langer and Langer but without an epithelial collar. After root planing, an intrasulcular incision was connected to horizontal incisions made in a mesial and distal direction from the cemento-enamel junction (CEJ) up to 1 mm of the proximal line angle of the adjacent teeth. These first incisions were extended by vertical releasing incisions in the apical direction into the alveolar mucosa. A partial thickness flap was raised very gently to preserve the periosteum of the denuded root laterally and apically. At the donor site, a partial thickness flap was dissected in the premolar to first molar area using the trap door approach. The connective tissue graft was removed with a #15 blade and care was taken to obtain a thickness ranging from 1.5 to 2 mm. The graft was placed over the denuded root and sutured, its coronal margin located at the CEJ and its apical margin at least 3 mm apically beyond the base of the defect. The partial thickness flap was positioned coronally, but no attempt was made to completely cover the graft if the initial height of keratinized tissue (HKT) was poor. The flap was sutured in the chosen position with 4-0 non-resorbable suture.

**GTR technique.** The sites were treated using the technique described by Genon et al. This technique is illustrated in Figures 1 to 5. After root planing, an intrasulcular incision was connected to...
the horizontal incisions mesially and distally, according to the height of recession. These incisions were perpendicular to the bone surface. Two vertical releasing incisions extended apically into the alveolar mucosa so the flap could be coronally displaced. A full thickness, followed by split thickness, flap was raised in order to expose at least 3 mm of bone surrounding the denuded root. A resorbable matrix barrier† was trimmed and fixed over the root and the surrounding bone. The coronal margin of the membrane was placed at the CEJ. On the palatal aspect, an intrasulcular incision made it possible to raise a small full thickness flap to secure the knot subgingivally. The vestibular flap was then coronally positioned to totally cover the membrane and sutured in this position.

Postoperative Care
No periodontal dressing was used for either technique. The patients applied ice packs 15 minutes per hour for the 4 first hours. The patients were advised to avoid chewing and trauma, and not to brush the area for 10 days. Patients were prescribed a 0.12% chlorhexidine digluconate mouthwash twice daily for 3 weeks and ibuprofen 200 mg times 6 per day for 3 days. At day 10, sutures were removed and brushing with a very soft toothbrush was reintroduced. At 3 weeks, normal oral hygiene was allowed but not on the sites where the membrane was exposed until the exposed material was resorbed and fragmented off.

Measurements
Height of recession (HR), clinical attachment level (CAL), height of keratinized tissue (HKT), CEJ to mucogingival junction distance (CEJ-MGJ), and probing sulcus depth (PSD) were recorded at the initial examination and 6 months after surgery. Recession width was recorded at the initial examination only. The same operator recorded the same data on the same patient. All measurements were assessed at the midbuccal level to the nearest 0.5 mm with a calibrated periodontal probe.

Means and standard deviation (SD) for both groups were calculated for each parameter at the initial examination and at the 6-month postoperative examination, except for recession width. The change between measurements was calculated as the difference between the postoperative value and the initial value and expressed as a mean

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Table 1.

Mean Recession (mm) and Standard Deviation Before and After Surgery and Statistical Significance

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Recession Height</th>
<th>Significance</th>
<th>Postsurgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>3.85 (SD 1.15)</td>
<td>P&lt;0.0001</td>
<td>0.96 (SD 0.97)</td>
</tr>
<tr>
<td>GTR</td>
<td>4.28 (SD 1.20)</td>
<td>P&lt;0.0001</td>
<td>1.39 (SD 1.40)</td>
</tr>
</tbody>
</table>

* Significantly different; P<0.0001.
† Not significant.

Table 2.

Mean Height of Keratinized Tissue (mm) and Standard Deviation Pre- and Postsurgery and Statistical Significance

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Keratinized Tissue Height</th>
<th>Significance</th>
<th>Postsurgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>1.6 (SD 0.71)</td>
<td>P&lt;0.0001</td>
<td>3.64 (SD 1.40)</td>
</tr>
<tr>
<td>GTR</td>
<td>2.07 (SD 0.75)</td>
<td>NS†</td>
<td>P=2.5 (SD 0.98)</td>
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</tbody>
</table>

* Significantly different; P<0.0001.
† Not significant.

Table 3.

Mean Distance Between CEJ and Mucogingival Junction (mm) and Standard Deviation Pre- and Postsurgery and Statistical Significance

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CEJ to Mucogingival Junction</th>
<th>Significance</th>
<th>Postsurgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>5.46 (SD 1.30)</td>
<td>P=0.031</td>
<td>4.67 (SD 1.39)</td>
</tr>
<tr>
<td>GTR</td>
<td>6.28 (SD 1.23)</td>
<td>P&lt;0.0001</td>
<td>3.92 (SD 1.41)</td>
</tr>
</tbody>
</table>

* Significantly different; P<0.0001
The change reported to the initial value was expressed by percentage.

**Statistical Analysis**

The normal distribution of each criterion data (first validity criterion of parametric tests) was checked using the Kolmogorov-Smirnov test ($P = 0.05$). The equality of variances (second validity criterion of parametric tests) was then evaluated using the Cochran test ($P = 0.05$).

Statistical evaluation of the results was carried out in 3 stages: 1) evaluation of the initial homogeneity of the 2 groups (CTG and GTR) by Student $t$ test for paired data ($P = 0.05$); 2) comparison of the changes after surgical procedures of the pre- and postoperative data in each group (Student $t$ test for paired data ($P = 0.05$); and 3) comparison of the changes after surgical procedures in values between CTG and GTR (Student $t$ test for paired data; $P = 0.05$).

**RESULTS**

The mean initial width of recession was 3.73 mm (SD 0.56) and 4.04 mm (SD 0.92) for the CTG group and GTR group, respectively. The difference was not significant. Means and standard deviations are summarized in Tables 1 to 5 for each parameter. HR changes were not statistically different between the two groups. Mean change was 2.89 mm (SD 1.18) for both CTG and GTR groups, representing 76% and 70.2%, respectively, of root coverage. Four sites had 100% root coverage for each technique. Clinical attachment gain was 2.73 mm (SD 1.45) for CTG group and 2.88 mm (SD 1.34) for GTR group. The difference between the CAL changes was not statistically significant. The difference between HKT changes was statistically significant ($P = 0.0001$). HKT mean gain was 2.03 mm (SD 0.92) for CTG group and was statistically significant. HKT mean gain was 0.42 mm (SD 0.91) for GTR group and was not significant. CEJ-MGJ means decreased significantly by 0.78 mm (SD 1.23) for CTG group ($P = 0.03$) and by 2.35 mm (SD 1.44) for GTR group ($P < 0.0001$). The difference between the groups was statistically significant ($P = 0.007$).

No statistical differences were observed with PSD.

**DISCUSSION**

Subepithelial connective tissue graft and guided tissue regeneration using a bio-absorbable membrane showed no statistical difference for gingival recession coverage (Figs. 6 to 9). The relative values expressed as a percentage were 76% and 70.2%, respec-
tively, but the difference was not significant and the absolute values of the change expressed in mm were the same.

In order to have a valid comparison, the study was designed to minimize patient and site factors. Therefore, pairs of defects were selected on the same patients; i.e., different from series of defects treated on different patients. Only Class I sites were selected because lack of keratinized tissue could be less favorable for GTR technique. Treatment of Class II recession could be examined in another study. The mean width of recession and the mean height of recession were not statistically different at the initial examination.

The 76% of root coverage with connective tissue graft is in the percentage range (69% to 97%) of numerous studies. The 70.2% of root coverage using a bioabsorbable membrane is close to the 64.5% on 9 patients observed by Pini Prato et al., and to the 72.7% observed by Genon-Romagna and Genon on 34 sites. Roccuzzo et al. reported a slightly better root coverage of 82.4% on 12 patients on deeper recessions. The few comparisons available between mucogingival and GTR techniques were carried out on 2 groups of patients. Root coverage was similar in both series, whichever procedure used. Pini Prato et al. reported 73% with GTR using ePTFE membrane and 72.3% with a 2-step procedure consisting of free gingival graft then a coronally positioned flap. Ricci et al. observed 80.8% with GTR using ePTFE membrane and 77% with subpedicle connective tissue graft. The present study also showed similar root coverage with mucogingival and GTR techniques, and using the most current procedures in each technique.

A clinical attachment gain was observed in the 2 groups, but was not significantly different. The clinical attachment level was improved by reduction of HR but not by PSD change. Pini Prato et al. observed a better clinical attachment gain with ePTFE membranes than with coronally positioned flaps; probing depth reduction was greater with GTR. However, initial pocket mean value was greater in the GTR group, and it was not reported whether the initial difference between the groups was statistically significant. Ricci et al. reported a better clinical attachment gain with ePTFE membrane than with a subpedicle connective tissue graft, while HR reduction was not statistically different.
between the 2 groups. PSD initial values and PSD changes could have explained this, but they were not reported.

Keratinized tissue height was substantially increased by connective tissue graft from an initial mean of 1.6 mm to a postoperative mean of 3.64 mm. This is explained by the surgical technique close to the one described by Langer and Langer,9 who suggested positioning the flap coronally but not completely covering the graft, especially if the initial keratinized tissue height is weak. We coronally displaced the flap in such a position that we could expect a minimum of 3 mm of HKT. For example, if only 1 mm HKT was present before surgery, we left around 2 mm of connective tissue graft exposed. One of the advantages of this technique as opposed to GTR is the ability to adapt the coronal displacement to the pre-existing keratinized tissue and thus increase HKT. Cemento-enamel junction to mucogingival junction distance measurements showed that the mean coronal displacement of the mucogingival junction was 0.78 mm. The GTR technique increased HKT from 2.07 mm to 2.5 mm, but the difference was not significant. In this procedure, the membrane must be totally covered by the flap, so the initial keratinized tissue was maintained and the mucogingival junction was coronally displaced by 2.35 mm. With the same type of membrane, Pini Prato et al.26 reported a small increase of 0.66 mm at 6 months, and Roccuzzo et al.24 observed no difference, either with the bioabsorbable or the non-resorbable membrane at 6 months. However, the follow-up period should be longer to evaluate this parameter. Pini Prato et al.,27 with an ePTFE membrane, reported a height of keratinized tissue slightly greater at 18 months (0.56 mm), but a significant increase at 4 years (1.84 mm). They suggested that the long-term increase was associated with an apical shift of the mucogingival junction.

From a clinical point of view, we consider that the choice between CTG and GTR using a bioabsorbable membrane in Miller Class I cases is not dependent on the expected root coverage or clinical attachment gain, and may not be dependent on the initial keratinized tissue height. Technique selection can be based on other criteria, such as esthetics, necessity of increasing keratinized tissue height, time required, donor site, or financial implications.

CONCLUSIONS
Within the limits of this study, we conclude that: 1) subepithelial connective tissue graft and GTR techniques showed no difference in the coverage of Miller Class I recessions and 2) at 6 months, the height of keratinized tissue was increased with CTG technique only.

REFERENCES


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