
Neal Shepherd,* Henry Greenwell,* Margaret Hill,* Ricardo Vidal, † and James P. Scheetz‡

Background: The primary aim of this randomized, controlled, blinded clinical pilot study was to compare the percentage of recession defect coverage obtained with a coronally positioned tunnel (CPT) plus an acellular dermal matrix allograft (ADM) to that of a CPT plus ADM and platelet-rich plasma (CPT/PRP) 4 months post-surgically.

Methods: Eighteen patients with Miller Class I or II recession ≥3 mm at one site were treated and followed for 4 months. Nine patients received a CPT plus ADM and were considered the positive control group. The test group consisted of nine patients treated with a CPT plus ADM and PRP. Patients were randomly selected by a coin toss to receive the test or positive control treatment.

Results: The mean recession at the initial examination for the CPT group was 3.6 ± 1.0 mm, which was reduced to 1.0 ± 1.0 mm at the 4-month examination for a gain of 2.6 ± 1.5 mm or 70% defect coverage (P <0.05). The mean recession at the initial examination for the CPT/PRP group was 3.3 ± 0.7 mm, which was reduced to 0.4 ± 0.7 mm at the 4-month examination for a gain of 2.9 ± 0.5 mm or 90% defect coverage (P <0.05). There were no statistically significant differences between the groups (P >0.05).

Conclusions: The CPT plus ADM and PRP produced defect coverage of 90%, whereas the CPT with ADM produced only 70% defect coverage. This difference was not statistically significant, but it may be clinically significant. J Periodontol 2009; 80:397-404.

KEY WORDS
Allograft; extracellular matrix; esthetic surgery; gingival recession; platelet-rich plasma.

The supraperiosteal envelope or “tunnel” procedure was originally described by Allen.1,2 It is a highly predictable, minimally invasive procedure to achieve recession defect coverage with a connective tissue graft. Papilla esthetics are excellent because there is no papillary incision, and the papilla remains completely intact. A thick connective tissue graft is placed into the tunnel and positioned to cover the exposed root. The portion over the exposed root is not covered by the surrounding gingiva or mucosa because that tissue is not positioned coronally. In some instances, the semilunar area of healed connective tissue that was left exposed may be a slightly different color than the original tissue. This is generally not very noticeable except in the maxillary anterior area when there is a high lip line that exposes more facial gingiva.

The original tunnel technique was modified to allow coronal positioning of the surrounding tissue (E.P. Allen, Center for Advanced Dental Education, Dallas, Texas; course manual). This is accomplished by a microsurgical approach to achieve a split-thickness dissection that frees up the gingiva and mucosa. The papilla is kept intact without any incisions.

* Graduate Periodontics, School of Dentistry, University of Louisville, Louisville, KY.
† Private practice, Majorca, Spain.
‡ Department of Statistics, School of Dentistry, University of Louisville.

doi: 10.1902/jop.2009.080438
but it is lifted off the interproximal septum to facilitate coronal positioning. When the tunnel is performed in this manner and all connective tissue is covered, there are no color differences from the surrounding tissue. This approach also allows the use of an acellular dermal matrix allograft (ADM), which means that root coverage can be achieved without the need for a second surgical site to obtain palatal donor tissue.

Acellular dermal matrix is an allograft of human skin that has been lyophilized or freeze-dried.³ It differs from typical freeze-dried skin in that all cells have been removed, leaving a connective tissue graft covered by a basal lamina. The patented method of freeze-drying leaves the extracellular matrix, including vascular channels, intact. Standard methods of processing or freeze-drying skin typically destroy the structure of extracellular matrix. An advantage of having intact vascular channels is the more rapid revascularization of the allograft by host tissue.

ADM works best when completely covered by host tissue. This results in a perfect color match because all surface tissue is host tissue. The acellular dermal matrix underlies the host tissue and is incorporated as a graft that predictably thickens the host tissue, thereby making the host tissue more resistant to future recession.⁴ Papageorgakopoulos et al.⁴ compared the coronally positioned tunnel (CPT) to a coronally positioned flap (CPF) using ADM; they reported 95% defect coverage for the CPF versus 78% for the CPT. Despite the sizeable difference in defect coverage, the CPT was considered an excellent method of root coverage that had the advantages of reduced postoperative swelling and discomfort.

Platelet-rich plasma (PRP) contains growth factors that may enhance early healing, especially mitogenesis and angiogenesis.⁵⁻¹⁰ Improved early healing has the potential to improve the clinical outcome of a procedure by promoting more rapid soft tissue attachment to the tooth. Studies⁸,¹⁰⁻¹² of PRP with root-coverage procedures, including a CPF or a connective tissue graft, showed only a minimal effect on the clinical outcome. The effect when using a soft tissue allograft has not been tested.

The primary aim of this randomized, controlled, blinded clinical trial was to compare the CPT using ADM with and without PRP to determine if the PRP provided an advantage in terms of achieving predictable recession defect coverage. A second aim was to evaluate tissue thickness and determine if the PRP plus ADM provided a more predictable increase in host tissue thickness than ADM alone. The third and final aim was to determine if the use of PRP plus ADM enhanced creeping attachment compared to ADM alone.

MATERIALS AND METHODS

Study Design

Eighteen patients who had at least one site with a Miller Class I or II recession defect ≥3 mm underwent root-coverage surgery and were followed for 4 months.¹³ Nine patients in the positive control group were treated with a coronally positioned tunnel technique plus an ADM (CPT).⁸ The test group consisted of nine patients who were treated with a CPT technique plus an ADM combined with PRP (CPT/PRP). The surgical technique for the control and test groups was based on the CPT procedure described by Allen (E.P. Allen, Center for Advanced Dental Education, Dallas, Texas; course manual). A commercially available system¹ was used to prepare the PRP from a 20-ml blood draw. Patients were randomly selected to receive the test or control treatment using a coin toss. One operator (NS) performed all surgical procedures under the direction of a mentor (HG). The surgeon was trained in the procedures until considered proficient. All patients signed an informed consent approved by the University of Louisville Institutional Review Board. The study was conducted between July 1, 2007 and July 31, 2008 in the Graduate Periodontics clinic, University of Louisville.

Patient Selection

Eighteen patients who met the following inclusion criteria participated in this study: at least one Miller Class I or II recession defect ≥3 mm; the recession defect must have been on a non-molar tooth; and age between 18 and 90 years of age. Patients were excluded if any of the following criteria were present: debilitating systemic or infectious diseases (human immunodeficiency virus or hepatitis) or any disease that significantly affects the periodontium; a known allergy to any of the materials used in the study; requirement for antibiotic prophylaxis; cemento-enamel junction (CEJ) not identifiable; a root surface restoration at the recession site; failure to maintain an oral hygiene level ≥80% plaque-free surfaces; pregnancy or lactation; use of tobacco products; alcohol abuse; long-term steroid therapy; a previous root-coverage procedure, graft, or guided tissue regeneration involving the recession site; and failure to complete the informed consent. Patients were given oral hygiene instructions and an adult prophylaxis prior to inclusion in the study.

Baseline Data

Baseline data included the following: Miller classification of the recession defect,¹³ plaque index,¹⁴ gingival index,¹⁵ bleeding on probing using dichotomous scoring, recession (in millimeters), keratinized tissue (in
millimeters), probing depth (in millimeters), clinical attachment level (in millimeters), tooth mobility, \(^\text{16}\) creeping attachment measured from 8 weeks post-surgery until the final examination, tooth vitality tested using an electric pulp tester and a cold test, radiographs using the paralleling technique to take a preoperative periapical and bitewing radiograph, and gingival thickness at recession sites measured using an ultrasonic meter.\(^\text{¶}\)

**Surgical Treatment**

The surgical procedure for the positive control sites consisted of a CPT preparation without any vertical releasing incisions, which was reported previously.\(^\text{4}\) Briefly, the tissue was elevated using a split-thickness incision beyond the mucogingival junction and extended apically until enough release was obtained to permit adequate coronal positioning. The tunnel was dissected using a specialized microsurgical kit without the use of microscopes or loupes. The tunnel and the ADM were extended at least one tooth mesial and distal to the recession site. Interproximal papillae were elevated off the interproximal septum, on the facial and lingual aspects, to facilitate coronal positioning. In cases in which access was very difficult, an incision was made to release the papilla to prevent tearing the tissue as the tunnel was dissected. A bioabsorbable monofilament polyglyconate 5-0 sling suture at the line angles using a synthetic non-absorbable polybutester monofilament suture.\(^\text{‡}\)

The test sites were treated in an identical manner in terms of surgery and ADM graft. In addition, the ADM was hydrated in the platelet-poor plasma (PPP), and the PRP was used on the surgical site. First, liquid PRP was applied to the tunnel prior to suturing the ADM. Next, PRP was used over the ADM after it had been sutured. Finally, after the soft tissue was sutured, the PRP, in gel form, was placed over the entire area. According to the company literature, \(^\text{††}\) a 20-ml blood draw yields 3 ml platelet concentrate and \(~\text{1,200,000 platelets/μl.}\)

Postoperative instructions were given along with the following prescriptions: systemic doxycycline hyclate, 50 mg every day for 14 days; naproxen, 375 mg every 12 hours for 7 days; hydrocodone bitartrate, 7.5 mg, with acetaminophen, 750 mg, every 6 to 8 hours as needed for pain; a dose pack of 21 tablets of methylprednisolone, 4 mg; and chlorhexidine digluconate 0.12%, applied twice daily at the surgical site, until the end of the study period. An alternative steroid regimen was used if the surgery included more than three teeth: dexamethasone, 18 1-mg tablets to be taken over 9 days. Each dose was taken in the morning: three tablets per day for the first 3 days, then two per day for the next 3 days, then one per day for the last 3 days.

**Post-Surgical Management**

All patients were seen on days 3, 7, and 14 and then at 4 and 8 weeks postoperatively. The 4-month examination marked the end of the study period. Suture removal took place after 2 to 3 weeks of healing. Postoperative visits consisted of supragingival plaque removal and oral hygiene reinforcement. Any patient who developed an adverse reaction to the materials used or had attachment loss \(\geq 2.0\) mm was exited from the study and received the appropriate treatment. Eight weeks postoperatively was considered the baseline for measurement of creeping attachment, and mid-facial recession was recorded at that time. All baseline clinical measurements were repeated at the end of the 4-month evaluation period.

**Calibration**

All measurements were made by a blinded examiner (RV) using a 15-mm North Carolina probe. The ultrasonic meter was used to measure gingival thickness. Intraexaminer reliability was established by at least two examinations on three patients to achieve 70% exact measurements and 90% of measurements within 1.0 mm.

**Statistical Analysis**

Means \(\pm\) SD were calculated for all parameters. The statistical significance of the data was analyzed using two-way analysis of variance. The sample size of nine gave 67% statistical power to detect a difference of 1 mm in defect coverage between the groups.

**RESULTS**

Twelve females and six males with a mean age of 37 ± 14 years (range, 20 to 67 years) were included in the study. The CPT group consisted of three maxillary and six mandibular teeth: two maxillary canines, one maxillary premolar, one mandibular incisor, and five mandibular premolars. The CPT/PRP group consisted of two maxillary and seven mandibular teeth made up of the following tooth types: two maxillary canines, four mandibular incisors, one mandibular canine, and two mandibular premolars. Two patients who failed to return for all postoperative visits were exited from the study.

**Clinical Indices**

The mean plaque index was initially low; by 4 months, it had decreased slightly for the CPT group and...
increased slightly for the CPT/PRP group. There were no statistically significant differences between the initial and 4-month values or between the groups (P>0.05). The mean gingival index was initially low in both groups, although it was slightly higher in the CPT/PRP group and decreased to about the same level at 4 months for both groups. There were statistically significant differences between the initial and 4-month values (P<0.05) but not between the groups (P>0.05). There was minimal bleeding on probing at baseline and at 4 months (P>0.05). Mobility was low initially; it had decreased slightly at 4 months for the CPT/PRP group and increased slightly at 4 months for the CPT group (P>0.05).

**Probing Measurements**

Mean probing depth was ~1 mm initially and remained essentially unchanged at 4 months for CPT and CPT/PRP groups. There was no statistically significant difference between the initial and 4-month values or between the groups (P>0.05). The mean mid-facial clinical attachment level was located more apically initially, to a slightly greater degree than recession depths, but it increased significantly by 4 months, similar to the amount of recession defect coverage for both groups (P<0.05). There were no statistically significant differences between the groups. Initially, mean keratinized tissue was slightly >1 mm and increased by 0.4 and 0.6 mm for CPT and CPT/PRP groups, respectively (Table 1). The change from the initial examination to 4 months was statistically significant for CPT and CPT/PRP groups (P<0.05). There were no statistically significant differences between the groups (P>0.05).

**Table 1.**

<p>| Gingival Thickness and Keratinized Tissue Measurements for Test and Control Sites (mm; mean ± SD) |
|-------------------------------------------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Thickness at sulcus base</th>
<th>n</th>
<th>Initial</th>
<th>4 Months</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT</td>
<td>9</td>
<td>0.8 ± 0.2</td>
<td>1.2 ± 0.6</td>
<td>0.4 ± 0.7*</td>
</tr>
<tr>
<td>CPT/PRP</td>
<td>9</td>
<td>0.6 ± 0.1</td>
<td>1.0 ± 0.4</td>
<td>0.4 ± 0.3*</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---</td>
<td>---------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>Thickness at MGJ</td>
<td>n</td>
<td>Initial</td>
<td>4 Months</td>
<td>Change</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---</td>
<td>---------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>CPT</td>
<td>9</td>
<td>0.8 ± 0.1</td>
<td>1.4 ± 0.4</td>
<td>0.6 ± 0.4*</td>
</tr>
<tr>
<td>CPT/PRP</td>
<td>9</td>
<td>0.7 ± 0.2</td>
<td>1.3 ± 0.3</td>
<td>0.6 ± 0.3*</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---</td>
<td>---------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>Keratinized tissue</td>
<td>n</td>
<td>Initial</td>
<td>4 Months</td>
<td>Change</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---</td>
<td>---------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>CPT</td>
<td>9</td>
<td>1.3 ± 0.7</td>
<td>1.7 ± 0.7</td>
<td>0.4 ± 0.5*</td>
</tr>
<tr>
<td>CPT/PRP</td>
<td>9</td>
<td>1.4 ± 0.8</td>
<td>2.0 ± 0.4</td>
<td>0.6 ± 0.8*</td>
</tr>
</tbody>
</table>

MGJ = mucogingival junction.
* P<0.05 for initial to 4-month values.

**Gingival Thickness**

The mean gingival thickness at the sulcus base for the CPT group increased to 1.2 ± 0.6 mm at the 4-month examination (P<0.05; Table 1). For the CPT/PRP group, it increased to 1.0 ± 0.4 mm at the 4-month examination (P<0.05). There was no statistically significant difference between the groups (P>0.05). The mean gingival thickness at the mucogingival junction for the CPT group increased to 1.4 ± 0.4 mm at the 4-month examination (P<0.05); it increased to 1.3 ± 0.3 mm for the CPT/PRP group (P<0.05). There was no statistically significant difference between the groups (P>0.05; Table 1).

**Creeping Attachment**

Creeping attachment, or the mean change in gingival margin position from 2 to 4 months, increased from 0.8 ± 0.7 mm to 1.1 ± 1.0 mm, for a mean increase in recession of 0.3 ± 0.4 mm for the CPT group (P<0.05). There was essentially no change for the CPT/PRP group, which remained at 0.4 ± 0.7 mm (P>0.05). There were no statistically significant differences between the groups (P>0.05).

**Osseous Dehiscence**

The mean facial dehiscence defect depth at the initial examination was ~2.4 mm greater than the mean recession defect depth for the CPT group and ~3.0 mm greater for the CPT/PRP group.

**Gingival Recession**

The mean recession defect at the initial examination for the CPT group was 3.6 ± 1.0 mm, which was reduced to 1.0 ± 1.0 mm at 4 months, for a defect coverage of 2.6 ± 1.5 mm or 70% (P<0.05; Table 2). For the CPT/PRP group, the mean initial recession was 3.3 ± 0.7 mm, which was reduced to 0.4 ± 0.7 mm at 4 months, for a defect coverage of 2.9 ± 0.5 mm or 90% (P<0.05; Table 3). The mean root coverage, or the percentage of the root that was covered, rather than the recession defect, was 92% for the CPT group and 97% for the CPT/PRP group. Frequency data indicated that the predictability of obtaining ≥90% defect coverage in the CPT group was 33% (three of nine sites), whereas it was 67% (six of nine sites) in the CPT/PRP group (Tables 2 and 3).

**DISCUSSION**

The CPT is a technique that maximizes esthetics and minimizes postoperative complications and discomfort. There are no visible incisions with this technique, and the papillae are kept intact and incision free. This study compared the CPT using an ADM with and without PRP in 18 patients (nine patients per group). The use of ADM allowed root coverage without using palatal donor tissue. This means minimally invasive surgery was used at the recession defect site, and no
second surgical site was needed, which greatly minimized the amount of surgical trauma.

Recession defect coverage was improved with the use of PRP (Tables 2 and 3). The CPT group had 70% defect coverage, whereas the CPT/PRP group had 90% defect coverage (Figs. 1 and 2). This result for the CPT group was similar to a report by Papageorgakopoulos et al.4 in which 78% defect coverage was achieved with a CPT using ADM.

The primary difference in these two studies lies in the mixture of maxillary and mandibular sites. In the study by Papageorgakopoulos et al.,4 six of 12, or 50%, of CPT sites were maxillary. Defect coverage for maxillary sites was 95%, whereas mandibular sites had only 62% defect coverage. In the present study, three of nine sites were in the maxilla in the CPT group, whereas two of nine were in the maxilla in the CPT/PRP group, which is ~30% of the sites. Recession defect coverage was 100% for all maxillary sites, whereas for mandibular sites it was 85% for the CPT/PRP group and only 54% for the CPT group. Thus, the CPT for maxillary sites seemed to be a highly predictable procedure, whereas for mandibular sites the outcome was much less predictable.

The difference between the groups in this study, 90% versus 70%, was not statistically significant, but it was considered clinically significant (Tables 2 and 3). The use of PRP provided a distinct advantage in the more technique-sensitive mandibular sites, 85% versus 54%, but not in the more predictable maxillary sites where 100% coverage was achieved at each site. The lack of predictability for the mandibular sites may be due to the difficulty of achieving the same degree of flap release and passive coronal positioning as in the maxilla. Pini Prato et al.17 showed that the greater the coronal positioning, the more likely it is that complete defect coverage will be achieved. Increased flap tension also reduces the likelihood of complete defect coverage.18 The present study and the one by Papageorgakopoulos et al.4 were not designed to test the statistical difference between maxillary and mandibular sites. The number of maxillary sites was small in this study; thus, only means are reported without comment on the statistical significance between arches. Because the same trend was seen in maxillary and mandibular sites in two studies with different operators, this was considered an important observation that should be reported; however, further study is needed to confirm or refute these findings.

The surgical technique used was reported by Papageorgakopoulos et al.4 and was modeled on the technique described by Allen (E.P. Allen, Center for

**Table 2.**

Recession, Defect Coverage, and Root Coverage for Control Teeth Treated With the CPT Procedure Using ADM

<table>
<thead>
<tr>
<th>Patient Data</th>
<th>Recession (mm)</th>
<th>Defect Coverage</th>
<th>Defect Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient</td>
<td>Recession</td>
<td>Tooth #</td>
<td>Initial Recession Defect</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>20</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>21</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>25</td>
<td>3.5</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>12</td>
<td>3.0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>6</td>
<td>6.0</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>28</td>
<td>4.0</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>11</td>
<td>3.0</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>28</td>
<td>3.0</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>29</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Mean ± SD

<table>
<thead>
<tr>
<th>Defect Coverage</th>
<th>Frequency ≥ 90% Defect Coverage</th>
<th>Root Coverage</th>
<th>Frequency ≥ 90% Root Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6 ± 1.0</td>
<td>1.0 ± 1.0</td>
<td>2.6 ± 1.5*</td>
<td>70 ± 26</td>
</tr>
</tbody>
</table>

* P < 0.05 for initial to 4-month values.
Advanced Dental Education, Dallas, Texas; course manual). Allen’s technique is a microsurgical approach, which requires magnification, specialized instrumentation, a careful surgical technique, and 7-0 sutures. Allen’s recommended instrumentation and suturing technique were used, but not the same suture material or magnification. Another consideration is that the procedures in both of these studies were performed by residents in training. They were closely supervised by a mentor, but they did not have the same level of experience as a seasoned clinician. In this study and the one by Papageorgakopoulos et al.4, the residents clearly demonstrated a high level of skill as evidenced by their results of 95% defect coverage for the CPT in maxillary sites and for the CPF in maxillary or mandibular sites. This indicates that the CPT for mandibular sites is clearly more technique sensitive and less predictable. The use of PRP improved the percentage of defect coverage in these sites.

In the study by Papageorgakopoulos et al.4 and in the present study, patients generally reported no significant postoperative complications and minimal discomfort when the CPT procedure was used. Thus, the tunnel procedure seems to be an excellent approach to reduce surgical trauma and minimize discomfort. PRP may have provided a slight advantage; however, all of these assessments of discomfort are the subjective impressions of the investigators.

PRP also seemed to improve the stability of the result. Creeping attachment from 2 months until the end of the study was a mean loss of 0.3 mm for the CPT group, whereas there was no change for the CPT/PRP group. Previous studies4,19 of a CPF plus ADM at the University of Louisville showed a minimal gain20 or no change in creeping attachment, which indicated that the result was stable at 2 months. This is in contrast to the CPT plus ADM procedure in the report by Papageorgakopoulos et al.,4 who showed a mean loss of 0.2 mm between month 2 and the end of the study. In the present study there was no change between months 2 and 4 when PRP was used, indicating that the result was stable at 2 months. This suggests that PRP promoted more rapid attachment to the tooth and a more stable result at the 2-month time point for the CPT procedure.

Both treatment groups gained a mean tissue thickness of 0.4 mm (Table 1), which was a significant improvement (P <0.05). Previous studies4,19 at the University of Louisville showed a mean tissue thickness increase of 0.4 to 0.5 mm when a CPF plus ADM was used, which is consistent with the results in the present study. The tissue thickness increase

### Table 3.
Recession, Defect Coverage, and Root Coverage for Test Teeth Treated With CPT and ADM Plus PRP

<table>
<thead>
<tr>
<th>Patient</th>
<th>Recession Class</th>
<th>Tooth #</th>
<th>Initial Recession Defect</th>
<th>4-Month Recession Defect</th>
<th>Recession Defect Coverage</th>
<th>Defect Coverage (%; mean)</th>
<th>Frequency</th>
<th>Predictability</th>
<th>Root Coverage (%; mean)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>24</td>
<td>3.0</td>
<td>1.0</td>
<td>2.0</td>
<td>67</td>
<td>0.0</td>
<td>93</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>25</td>
<td>3.0</td>
<td>0.5</td>
<td>2.5</td>
<td>83</td>
<td>0.0</td>
<td>96</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>20</td>
<td>3.0</td>
<td>0.0</td>
<td>3.0</td>
<td>100</td>
<td>1.0</td>
<td>100</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>24</td>
<td>3.0</td>
<td>0.0</td>
<td>3.0</td>
<td>100</td>
<td>1.0</td>
<td>100</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>28</td>
<td>3.0</td>
<td>0.0</td>
<td>3.0</td>
<td>100</td>
<td>1.0</td>
<td>100</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>28</td>
<td>3.0</td>
<td>0.0</td>
<td>3.0</td>
<td>100</td>
<td>1.0</td>
<td>100</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>25</td>
<td>5.0</td>
<td>2.0</td>
<td>3.0</td>
<td>60</td>
<td>0.0</td>
<td>85</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>22</td>
<td>3.0</td>
<td>0.0</td>
<td>3.0</td>
<td>100</td>
<td>1.0</td>
<td>100</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>6</td>
<td>4.0</td>
<td>0.0</td>
<td>4.0</td>
<td>100</td>
<td>1.0</td>
<td>100</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

Mean ± SD | Mean (SD) | Frequency | Mean (SD) | Frequency |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 ± 0.7</td>
<td>0.4 ± 0.7</td>
<td>2.9 ± 0.5*</td>
<td>90 ± 16</td>
<td>6 of 9 (67%)</td>
</tr>
</tbody>
</table>

* P <0.05 for initial to 4-month values.
showed that ADM acts as a graft that is bound to host tissue, thereby increasing host tissue thickness.4 The results of this pilot study indicated that PRP might improve clinical healing. This was shown most clearly in mandibular sites where it was more difficult to achieve predictable recession defect coverage. The ADM in the CPT/PRP group was hydrated in the PPP fraction that resulted following centrifugation of the whole blood. This plus the PRP applied to the surgical site may have promoted more rapid healing and revascularization of the allograft tissue. The effect was not clinically measurable in maxillary sites where complete defect coverage was more predictable. In those sites there may have been benefits from the more rapid healing that were not detected in this study that measured only clinical outcomes. The type of soft tissue attachment to the tooth may be affected by more rapid early healing. A histologic study of CPT plus ADM surgery with and without PRP is needed to determine if PRP influences whether the attachment to the tooth is by long junctional epithelium or connective tissue. Cummings et al.21 reported that attachment to the tooth was similar for ADM and connective tissue grafts and consisted of long junctional epithelium and connective tissue attachment. A previous report12 indicated that a connective tissue graft in combination with a CPF produced 92% defect coverage with PRP and 89% defect coverage without PRP. Another study11 showed 86% defect coverage for both groups; however, that study reported median data rather than the mean data that are typically reported for recession defect–coverage procedures. These results are similar to this study in which 90% defect coverage was achieved with an allograft and PRP. Studies8,10 that used a CPF plus PRP without a graft showed ~80% defect coverage. Based on these results, there seems to be an advantage to using an autograft or an allograft for recession defect coverage. The use of a graft provides the advantage of increasing marginal tissue thickness. Baldi et al.22 showed that thicker tissue provided better defect coverage when a CPF alone was used. Thicker marginal tissue may also be more resistant to future recession.

The lack of a statistical difference between the groups in this study may have been due, in part, to the power, which was 67% for nine patients per group. Lack of power can lead to a type 2 error, or a false negative, which means that there was failure to reject the null hypothesis when it should have been rejected, and a difference between the groups was detected. Larger studies are needed to determine if there is a statistically significant difference between the groups. Irrespective of the statistical significance, there was, in our opinion, a clinically significant difference in defect coverage between the groups (90% versus 70%). Because there was a lack of statistical power, it is most appropriate to consider this a pilot study.

CONCLUSIONS

Within the limits of the design and the sample size of this randomized, controlled, blinded clinical pilot study, the following observations were made. The CPT plus ADM with the use of PRP improved recession defect coverage compared to sites treated without PRP (90%
versus 70%, respectively), although there were no statistically significant differences between the groups. The treatment of maxillary sites was highly predictable using the CPT plus ADM with or without PRP, PRP produced an improvement in the percentage of recession defect coverage in mandibular sites, which was considered clinically significant: 85% with PRP versus 54% without PRP. The soft tissue thickness was significantly increased for both groups; however, the difference between the groups was not statistically significant. A stable result was obtained by 2 months in the group treated with PRP, whereas the group without PRP tended to have increased recession.

ACKNOWLEDGMENTS

This study was supported, in part, by a grant from BioHorizons, Birmingham, Alabama. Harvest Technologies, Plymouth, Massachusetts, furnished the materials to prepare the PRP. Dr. Greenwell gives lectures sponsored by BioHorizons. Drs. Shepherd, Hill, Vidal, and Scheetz report no conflicts of interest related to this study.

REFERENCES


Correspondence: Dr. Henry Greenwell, School of Dentistry, University of Louisville, Louisville, KY 40292. Fax: 502/852-1317; e-mail: henry.greenwell@louisville.edu.

Submitted August 21, 2008; accepted for publication October 8, 2008.