Human Histologic Evaluation of Root Coverage Obtained With a Connective Tissue With Partial Thickness Double Pedicle Graft. A Case Report*

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The use of a connective tissue graft combined with a pedicle graft has been proven an effective method to achieve root coverage. However, little is known about the histologic results in humans. A connective tissue with partial thickness double pedicle graft was performed on 2 teeth scheduled for extraction for prosthetic reasons. The procedures were clinically successful (100% and 83.3% root coverage). At 6 months postoperative, the teeth were extracted with conservative block sections and analyzed histologically. Two different healing patterns were seen. The first was characterized by a long junctional epithelial attachment that extended well beyond the original gingival margin and occasionally almost to the original bone level with minimal connective tissue adjacent to the tooth. The other pattern was a short junctional epithelium that stopped at the previously exposed root surface. In this pattern, there was predominately connective tissue adjacent to the tooth with some isolated areas of epithelium. No new bone or cementum was seen in any section. The use of a technique that combines a connective tissue graft with a pedicle graft can produce root coverage and a successful clinical result. However, the histological evaluation of this case report revealed that true regeneration was not seen in this study, only repair. J Periodontol 1999;70:813-821.

KEY WORDS
Gingival recession/surgery; grafts/gingival connective tissue/surgery; epithelial attachment/histology; tooth root, surgery.

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Case Report

The goal of this study was to examine histologically in humans the results obtained with a connective tissue graft combined with a partial thickness double pedicle graft.

**MATERIALS AND METHODS**

The most difficult part of the study was patient selection. The selection criteria were that the patient had to have 1 or more teeth scheduled for extraction by a dentist not involved with this study; the extractions had to be for orthodontic or prosthetic reasons; and the patient had to accept the extraction treatment plan prior to periodontal evaluation. The treatment plan for the extraction or extractions was evaluated independently by two periodontists not involved in the study. Both had to agree that the treatment plan was within the accepted standards of care, to avoid any possible ethical problem. The patient was well aware that the root coverage procedure would provide no benefit.

The patient had to be in good health with no contraindications to periodontal surgery. The defects had to have at least 2 mm of marginal tissue recession. Additionally, there had to be some soft tissue coronal to the cemento-enamel junction (CEJ) in the adjacent interproximal regions.

After a suitable patient was located and invited to participate, great care was taken to avoid any ethical problems. The possible risks, complications, and benefits were discussed. A written informed consent explaining these factors was explained and signed. The patient was advised she could discontinue participating in the study at any time.

The patient selected was a 47-year-old female scheduled for an immediate maxillary denture and an immediate mandibular overdenture retaining the roots of #22 and 27. Endodontic therapy had been completed on both teeth in preparation for the prosthesis. All other teeth were scheduled for extraction. Teeth #28 and 29 were selected for evaluation in this study. They were treated with partial thickness double pedicle grafts, allowed to heal, extracted with a block section, and histologically evaluated.

Preoperative photographs were taken (Fig. 1) and clinical findings were recorded. Tooth #28 had 2 mm of recession and #29 had 3 mm of recession on the buccal surface. Both had 2 mm probing depths on the buccal. There was no keratinized tissue on the buccal of #28 and 1 mm of keratinized tissue on the buccal of #29. There was a loss of papilla height on the mesial of #28 and the distal of #29.

Since the goal of this procedure was to obtain human samples for histologic evaluation, great care was exercised in the placement of the reference notches. Cole et al. suggested that to demonstrate new connective tissue attachment, the reference notch should be placed in the apical portion of calculus on the root. Unfortunately, this is not possible in most root coverage procedures, since there is seldom enough calculus in the area. Therefore, the gingival margin and bone level were selected as the reference points. Any attachment coronal to the gingival margin reference notch would be on the root surface that had been part of the recession defect; i.e., any connective tissue attachment coronal to the gingival margin notch would be new connective tissue. Additionally, any bone seen incisal of the bone level notch would be new bone.

After obtaining adequate anesthesia, the gingival margin reference notches were made with a 1/2 round bur. The notch was made so the apical extent of the notch was placed at the gingival margin of #28 and 29 (Fig. 2). The exposed root surfaces were aggressively root planed with hand instruments. Care was taken not to destroy the notches. A tetracycline solution (125 mg tetracycline/cc of saline) was burnished into the exposed root surface for 3 minutes with cotton pledgets. The area was then rinsed with water and then dried with a 3-way air syringe. The incisions were made to create the double pedicles and a recipient bed (Fig. 3). They were made similarly to the way they were originally described, except they were made slightly apical to the CEJ to allow retaining adequate papilla to secure the connective tissue graft. A partial thickness flap was reflected by sharp dissection as close to periosteum as possible. The portion of the flap between #28 and #29 was bisected with a single vertical incision. The bone level notch was placed with a 1/2 round bur, so that the apical edge of the notch was placed at the bone margin (Fig. 4). The rest of the procedure was accomplished as previously described. The double pedicles were then joined with 5-0 gut sutures. A connective tissue graft was obtained utilizing a scalpel with parallel blades.† The epithelial border of the graft was discarded (Fig. 5). The connective tissue graft was sutured into the recipient bed with 5-0 gut sutures (Fig. 6). Sling sutures were used to secure the double pedicles over the connective tissue graft in the area of the original recession.

† Harris Double Blade Graft Knife, H & H Company, Ontario, CA.
defect (Fig. 7). Isobutyl cyanoacrylate‡ was applied and a periodontal dressing§ was placed. No systemic antibiotics were utilized, but the patient was placed on 0.12% chlorhexidine solution|| for 4 weeks.

The patient was seen at 2 weeks postoperative. The dressing was removed, the area was deplaqued, and oral hygiene instructions were given. The patient was then seen at 1, 2, 3, 4, and 5 months for postoperative care, when the areas were polished and deplaqued. The patient was returned to normal brushing at 2 months postoperative. At 6 months postoperative the final clinical measurements were recorded (Fig. 8). Then teeth #28 and #29 were extracted with a small collar of tissue on the buccal surface. The teeth were then placed into a standard 10% formalin solution, decalcified, embedded in paraffin, sectioned, and

‡ Iso-Dent, Ellman International, Hewlett, NY.
§ Barricaid, Dentsply, L.D. Caulk Division, Milford, DE.
|| PeriGuard, Colgate-Palmolive Co., Caton, MA.
stained with hematoxylin and eosin. Random sections were evaluated. It was originally intended to evaluate serial sections but processing problems made this impossible.

RESULTS
The clinical results are summarized in Table 1. At 6 months postoperative, tooth #28 had no recession and #29 had 0.5 mm of recession on the buccal surface. Both had 0.5 mm probing depths on the buccal. There was 5 mm of keratinized tissue on the buccal of #28 and 3 mm of keratinized tissue on the buccal of #29. Complete root coverage was obtained on #28 and 83.3% of the exposed root surface was covered on #29. The results were esthetically pleasing and appeared clinically to be functionally adequate.

Two representative histologic sections obtained after extraction have been included in this report. Figure 9 shows the first healing pattern. A long junctional epithelial attachment extends apical to the gingi-
val margin notch and stops between the gingival notch and bone level notch. Additionally, there is an epithelial attachment in the bone level notch. Higher magnification of the gingival notch reveals epithelium completely filling the notch (Fig. 10). Higher magnification of the bone level notch demonstrates epithelium covering a significant portion of the notch (Fig. 11). The epithelial attachment is discontinuous with some areas where the connective tissue approximates the root surface. However, epithelial attachment is the predominant form of attachment. There was no new cementum, connective tissue attachment, or bone. Additionally, no resorption or ankylosis was detected.

Figures 12 and 13 show the second type of healing seen. The junctional epithelium stops in the gingival notch. Apical to that area there is minimal epithelium in isolated areas. Connective tissue approximates the root surface. This connective tissue does not appear to be inserting into cementum and there is no new bone. The fibers run parallel to the root surface in some areas and perpendicular in other areas. Higher magnification of the gingival notch area, in spite of the separation, shows that the epithelium stops in the gingival notch area (Fig. 14). Higher magnification of the bone level notch demonstrates a small area of epithelium in the notch with predominately connective tissue present (Fig 15). In this sample, connective tissue attaching to root surface without new cementum or bone is the predominant form of attachment. Additionally, no resorption or ankylosis was detected.

The patient tolerated the root coverage procedure and extractions without any problems. The conservative block sections did not result in any problems. When the dentures were placed the patient quickly adapted to the prosthesis and was very satisfied with the results. She was happy that she was able to possibly help other patients by participating in the study.

**DISCUSSION**

The use of a connective tissue graft combined with a pedicle graft is an effective method to obtain root coverage. Clinically, the tissue that covers a root after a root coverage procedure seems to attach tightly to the tooth surface. In the present study, there were shallow probing depths (0.5 mm) and no clinical signs of

**Table 1.**

<table>
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<tr>
<th></th>
<th>#28-B</th>
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<tbody>
<tr>
<td><strong>Preoperative</strong></td>
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<td>Recession</td>
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<tr>
<td>Probing Depth</td>
<td>2.0 mm</td>
<td>2.0 mm</td>
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<tr>
<td>Attachment Level</td>
<td>4.0 mm</td>
<td>5.0 mm</td>
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<tr>
<td>Keratinized Tissue Width</td>
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<td>1.0 mm</td>
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<tr>
<td><strong>Postoperative (6 months)</strong></td>
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<tr>
<td>Recession</td>
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<td>0.5 mm</td>
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<td>Probing Depth</td>
<td>0.5 mm</td>
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<td>Attachment Level</td>
<td>0.5 mm</td>
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<td>Keratinized Tissue Width</td>
<td>5.0 mm</td>
<td>3.0 mm</td>
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<tr>
<td><strong>Change</strong></td>
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<td>Recession</td>
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<td>Probing Depth</td>
<td>1.5 mm</td>
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<tr>
<td>Attachment Level</td>
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<td>4.0 mm</td>
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<tr>
<td>Keratinized Tissue Width</td>
<td>5.0 mm</td>
<td>2.0 mm</td>
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<tr>
<td>Root Coverage</td>
<td>100.0 %</td>
<td>83.3 %</td>
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inflammation at sites undergoing grafting procedures. These results remained stable during the study. Information on the type of attachment and human histologic evaluation of root coverage procedures is limited, which is why this study was undertaken. However, this study could not completely determine what type of attachment occurs after a root coverage procedure combining a connective tissue graft and a pedicle graft. Two different healing outcomes were demonstrated in this study. It is unknown if other histologic outcomes are possible or if the results would be different with a longer postoperative period. Certainly, additional human block sections are needed to determine what type of attachment occurs most commonly and if any factors effect the type of attachment.

The placement of 2 reference notches seems to be a useful procedure. The gingival notch provides the exact location of the preoperative gingival margin. Since this was made before root planing and biomodification of the root surface, any root coronal to the apical edge of the notch was part of the original defect. Therefore, any connective tissue attachment observed in postsurgical examinations coronal to the reference point is new connective tissue attachment. The bone level notch provides a good reference point for determining if new bone growth occurred. These locations seem to be a satisfactory modification of the Cole et al. technique of placing the notch in calculus when treating recession defects, since the procedure is easily accomplished clinically and of histologic value.
One shortcoming of this study was in the defects utilized, as deeper recessions would have been preferable. However, this was impossible to control. Quite often the defect treated will not be ideal, but significant information can still be obtained. Additionally, the separations seen in all of the histological samples are unfortunate, as this limits the ability to precisely evaluate the attachment to the root surface. The most probable cause of these separations is the method used to process the samples. The use of non-demineralized samples may reduce this problem.

Removing a conservative block section was technically more demanding than obtaining a large block. Great care was exercised to remove a collar of tissue only slightly larger than the original recession defect with minimal bone. The amount of tissue removed was not of clinical significance. It may be possible to remove a larger block section without creating a problem for the patient. However, until this is definitively determined, only small block sections should be taken to prevent possible complications.

The ultimate goal in periodontal therapy is regeneration. The establishment of a new connective tissue attachment with fibers inserting into new bone and new cementum on a previously diseased root surface is the ideal objective. Unfortunately, this result was not obtained in this study. Clinically, the result seemed healthy. However, based on the histology, the results would best be defined as repair and not regeneration. It is unknown if regeneration would produce a better result or provide greater stability than the results that were achieved.

Despite the histological findings reported here, the connective tissue with partial thickness double pedicle graft is an effective method to obtain root coverage. The results are functionally adequate...
and seem stable over time. However, this procedure, as performed in this study, did not produce true regeneration, only repair.

ACKNOWLEDGMENTS
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