Controlled Clinical Evaluation of the Subpedicle Connective Tissue Graft for the Coverage of Gingival Recession*

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The purpose of this study was to clinically evaluate the 1-year coverage of gingival recessions by a subpedicle connective tissue graft according to the original technique compared to untreated recessions by measuring probing sulcus depth (PSD), height of keratinized tissue (HKT), and mucogingival junction location changes. Paired gingival recessions were selected in 15 patients. In each patient, one recession was randomly assigned for treatment (test group) and the other recession was left untreated (control group) for 1 year. Surgery consisted of a connective tissue graft covered by a double papilla full thickness flap. Height of recession (HR), PSD, HKT, and cemento-enamel junction to mucogingival junction distance (CEJ-MGJ) were recorded with a calibrated probe before surgery and 1 year postoperatively. The control group showed no statistically significant differences in any of the parameters. In the test group, HR mean decreased significantly ($P < 0.0006$) from 3.66 mm to 1.09 mm, representing a mean root coverage of 70.5%. HKT mean increased significantly ($P < 0.0006$) from 1.60 mm to 4.30 mm, and PSD mean showed no statistical difference. CEJ-MGJ remained statistically unchanged. The subpedicle connective tissue graft may provide a good amount of root coverage and a substantial increase of keratinized tissue. Connective tissue grafted beneath the alveolar mucosa does not induce its transformation into keratinized gingival tissue. J Periodontol 1994; 65:1107–1112.

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The laterally positioned flap for the coverage of gingival recession was first proposed by Grupe and Warren in 1956 and connective tissue graft was proposed to increase keratinized gingiva by Ede1 in 1974.

Langer and Calagna2,3 used subepithelial connective tissue graft to correct ridge concavities in a preprosthetic purpose. Furthermore, Langer and Langer4 introduced this technique in the treatment of gingival recession and Raetzke5 proposed the “envelope” technique using also a connective tissue graft for the same purpose. The advantages are obtaining a closer color blend and avoiding “keloid” appearance.6 Nelson’s modification7 using a double papilla flap or a laterally positioned flap over the connective tissue preserves the double blood supply around the recession and allows the coverage of the denuded root surface by the connective tissue graft plus the pedicle graft. The advantage is to give some blood supply to the part of the graft placed over the root surface and to enhance the esthetic appearance of the tissue covering the recession.

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Root coverage results have been evaluated with the flap procedures,8–12 free gingival grafts,14–19 and guided tissue regeneration (GTR) techniques.20 Successful cases have been reported22 using different connective tissue graft techniques. Quantified results have been reported with the “envelope” technique by Raetzke,6 who obtained a total root coverage in 5 of the 12 treated cases and an average of 80% coverage and Jahnke et al.23 observed a mean root coverage of 80% at 6 months postsurgery in 9 sites.

With his technique, Nelson1 reported an average of 91% coverage in 29 sites monitored from 6 to 42 months. Harris24 gave more information, at 12 weeks, the mean percent root coverage was 97.4% of the Class I or II treated defects of 20 patients, the probing depth decreased, and the keratinized tissue height increased. However, no control sites were available in these studies. As already pointed out, creeping attachment may occur until 1 year postoperatively19,25,26 and so the final results should be evaluated after that time. Furthermore, the subpedicle connective tissue graft increases the keratinized tissue height23 but the mucogingival junction location changes were not determined.
and so the role of connective tissue graft in the keratinized tissue height increase was not appreciated.

The purpose of this study was to clinically evaluate the 1 year coverage of gingival recessions by a subpedicle connective tissue graft according to Nelson's technique compared to untreated recessions used as control sites and to appreciate probing sulcus depth, keratinized tissue height, and mucogingival junction location changes.

**MATERIALS AND METHODS**

**Patient and Site Selection**

Fifteen (15) pairs of buccal gingival recessions were selected in 15 healthy patients attending a private practice. The patients consisted of 13 females and 2 males ranging from 20 to 56 years (mean age: 34.3). All the patients were informed of the type of treatment and agreed to have one recession treated as part of the study (test site) and the other one left untreated until one year later (control site). Recessions were selected on the following criteria: 1) indication for treatment; 2) at least 2 mm height; and 3) Class I, II or III marginal recession according to Miller's classification. Inside the pair of recessions, the test site was randomly selected using a randomized table. The recessions were located on 12 upper and 5 lower canines, 3 upper and 4 lower premolars, 1 upper and 5 lower incisors.

**Treatment Procedures**

After initial therapy and a period of observation, the decision to perform surgery was made and the recession to treat was randomly assigned in each patient. The surgical protocol of the subpedicle connective tissue graft was the one described by Nelson with the double papilla pedicles. After induction of local anesthesia, the exposed root surface was vigorously planed with curets and/or burs. A double papilla procedure was first prepared: an external bevel of the marginal gingival tissue was dissected on one side of the recession and an interval bevel was dissected on the other side. An intrasulcular incision was connected slightly coronally of the recession to horizontal incisions made in mesial and distal directions until 1 mm of the proximal line angle of the adjacent teeth. These horizontal incisions were extended by vertical incisions in the apical direction until the mucogingival junction and then in the oblique direction through the alveolar mucosa to allow rotation of the pedicles. The two papilla pedicles were reflected in full thickness mucogingival flaps and sutured together. Measurements taken from the entire recipient site were used to define the palatal donor site incisions. A partial thickness flap was dissected in the premolar to first molar area according to the "trap door" approach, to give access to the underlying connective tissue. The connective tissue graft was removed with a scalpel and care was taken to obtain a thickness ranging from 1.5 to 2 mm. The partial thickness flap was then sutured in the primary position. The graft was then placed on the recipient site so that it was located at the level of the cemento-enamel junction (CEJ) and extended at least 3 mm apically beyond the base of the recession. So positioned, the connective tissue graft was covered partly by keratinized gingival tissue and the other part beyond the mucogingival junction by alveolar mucosa. The sutured pedicles were positioned and sutured over the connective tissue. For the Class III recessions where coverage up to the CEJ was impossible, the coronal border of the graft and of the flaps were located at the adjacent gingival margin level.

The periodontal dressing and sutures were removed after 1 week. During the second week, the patients' hygiene in the area consisted of brushing with a very soft toothbrush and rinsing with 0.2% chlorhexidine. Normal mechanical oral hygiene was reinstituted during the third postoperative week. All the patients were then placed under a maintenance program with 3-month interval visits during 1 year.

**Measurements**

Recordings of the data were made at the baseline examination, immediately before surgery, and at the 1-year examination, except for the width of recession (WR) which was recorded at the initial examination only. The same operator recorded the same data on the same patients. All measurements were made on the test site and on the control site to the nearest 0.5 mm with a calibrated periodontal probe presenting 1 mm increments and 0.4 mm diameter tip.

The height of recessions (HR) was recorded between the most apical point of the CEJ to the most apical point of the gingival margin for Classes I and II. In Class III recessions, the height of recession was measured from a point at the mid-distance of a line joining the adjacent gingival margins to the gingival margin at the most extreme portion of the recession.

The height of keratinized tissue (HKT) and the location of the mucogingival line was recorded by measuring the CEJ to mucogingival junction distance (CEJ-MGJ).

Probing sulcus depth (PSD) was assessed at the midbuccal site.

**Statistical Analysis**

In order to provide descriptive results, group means and standard error of the mean (s.e.m.) were calculated for the following parameters: HR, HKT, CEJ-MGJ, and PSD, measured at baseline and 1-year after surgery. The change between these measurements was calculated as the difference between the 1-year postsurgery value and the baseline value, divided by the baseline value, and is expressed as a percentage.

Data were analyzed in a between-comparison for values recorded at the baseline examination and at the 1-year post-surgery examination, and for the calculated value of the change.

WR only recorded at the baseline examination was analyzed by a between-groups comparison.
The Wilcoxon’s signed rank test was used and a probability of \( P < 0.05 \) was accepted to reject the null hypothesis.

RESULTS
Ten Class I, 4 Class II, and 1 Class III recessions were assigned to the test group (5 incisors, 9 canines, and 1 premolar) and 13 Class I, 1 Class II, and 1 Class III recessions were assigned to the control group (1 incisor, 8 canines, and 6 premolars). Results are summarized in Table 1. The mean width of recession was 3.26 mm (s.e.m. 0.26) ranging from 2.5 to 5 mm in the test group and 3.19 mm (s.e.m. 0.16) ranging from 2 to 4.5 mm in the control group. The difference between the groups was not significant \( (P > 0.05) \).

The initial HR mean was 3.66 mm (s.e.m. 0.16) ranging from 3 to 5 mm in the test group and 3.03 mm (s.e.m. 0.20) ranging from 2 to 5 mm in the control group. The difference between the groups was statistically significant \( (P < 0.02) \). In the test group, the 1-year HR mean was 1.09 (s.e.m. 0.16) representing a mean root coverage of 70.9% and the differences between the initial heights and the 1-year heights were statistically significant \( (P < 0.0006) \). In the control group the differences between the initial and the final values were not significant (mean root coverage 1.6%). The differences between the changes (clinically called coverage) observed in each group were statistically significant \( (P < 0.0006) \). Of the 15 sites treated, 6 showed a 75 to 100% coverage and 9 showed a 50 to 75% coverage.

HKT were not statistically different between the groups at the initial examination. In the test group, HKT increased significantly \( (P < 0.0006) \) 1 year postoperatively. The initial HKT mean was 1.60 mm (s.e.m. 0.29) and the 1-year HKT mean was 4.30 mm (s.e.m. 0.24). In the control group, HKT did not change significantly. The difference was significant \( (P < 0.001) \) between the HKT changes in the test group and in the control group.

CEJ-MGJ showed no statistical differences between the groups at the initial examination. CEJ-MGJ changes at 1 year were neither significant in each group nor in the between groups comparison.

PSD was not statistically different in the within or the between groups comparisons.

Figures 1 to 5 are representative of the results observed.

DISCUSSION
The connective tissue graft placed under full thickness pedicle flaps is an effective technique for the treatment of gingival recession. The mean root coverage was 70.9% and the keratinized tissue increased from a mean value of 1.60 mm to a mean value of 4.30 mm in the treated recessions, while the untreated recessions remained unchanged during 1 year.

Statistically, HR means were different between the groups at the initial examination, but HR mean was more

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Table 1. Descriptive Results of the Parameters Measurements of the Treated (test) and Untreated (control) Recessions

<table>
<thead>
<tr>
<th>Parameter (mm)</th>
<th>Initial Mean (s.e.m.)</th>
<th>1-Year Mean (s.e.m.)</th>
<th>Change (%)* Mean (s.e.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR (n = 15)</td>
<td>3.26 (0.26)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>HR (n = 15)</td>
<td>3.66 (0.16)</td>
<td>1.09 (0.16)</td>
<td>-70.93% (4.04)</td>
</tr>
<tr>
<td>HKT (n = 15)</td>
<td>1.60 (0.29)</td>
<td>4.30 (0.24)</td>
<td>203.61% (51.84)</td>
</tr>
<tr>
<td>CEJ-MGJ (n = 15)</td>
<td>5.50 (0.40)</td>
<td>5.63 (0.35)</td>
<td>6.26% (6.79)</td>
</tr>
<tr>
<td>PSD (n = 15)</td>
<td>1.23 (0.12)</td>
<td>1.09 (0.10)</td>
<td>2.86% (13.28)</td>
</tr>
<tr>
<td>WR (n = 15)</td>
<td>3.19 (0.16)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>HR (n = 15)</td>
<td>3.03 (0.20)</td>
<td>2.96 (0.17)</td>
<td>-1.59% (1.10)</td>
</tr>
<tr>
<td>HKT (n = 15)</td>
<td>2.16 (0.31)</td>
<td>2.23 (0.34)</td>
<td>1.46% (3.19)</td>
</tr>
<tr>
<td>CEJ-MGJ (n = 15)</td>
<td>5.09 (0.27)</td>
<td>5.20 (0.31)</td>
<td>1.59% (1.51)</td>
</tr>
<tr>
<td>PSD (n = 15)</td>
<td>1.06 (0.12)</td>
<td>1.20 (0.15)</td>
<td>11.28% (10.46)</td>
</tr>
</tbody>
</table>

*1 year value = initial value \( \div \) initial value \( \times 100 \)
important in the test group which is less favorable for treatment. The mean root coverage (70.9%) was situated in the percentage range (56% to 97.8%) published with the grafts or the flaps or the GTR techniques.8\textsuperscript{20,23,24} Other criteria of success\textsuperscript{15} were respected: there was clinical attachment to the root, the sulcus depth was 2 mm or less, and there was no bleeding on probing.

The only study using the same surgical technique is the original study by Nelson.\textsuperscript{7} The mean root coverage observed in the present study (70.9%) is less than that achieved by Nelson (91%).\textsuperscript{7} Variations in case selection and methodology could explain this difference. In Nelson's study, some of the patients were rather young (14 adolescent and adult patients ranging from 12 to 52 years old); 29 recessions were treated in 14 patients, so the patient was not considered as a statistical unit; and the initial width of recession was not recorded. In the present study, some unfavorable factors exist such as the selection of 9 canines out of the 15 treated cases. Root prominence of canines especially when the tooth is facially positioned in the arch, may affect revascularization of the graft and reduce overall success.\textsuperscript{23} And many of the selected recessions could be considered as wide (3 mm and more)\textsuperscript{16,28} as the range was 2.5 mm to 5 mm (mean 3.26 mm; s.e.m. 0.26 mm).

Harris\textsuperscript{26} used a modified surgical protocol, since he treated the root surface with a tetracycline solution and he covered the connective tissue graft with partial thickness pedicle flaps. Although we cannot really compare the results, he obtained an impressive 97.4% mean root coverage at 12 weeks postoperatively. The envelope technique also gives good results as Raetzke\textsuperscript{8} reported 80% mean root coverage 2 to 8 months postoperatively and Jahnke et al.\textsuperscript{23} 78% and 80% at 3 and 6 months postsurgery, respectively.

At present, a clinician has the choice between two effective techniques of connective tissue grafting. The advantages of the technique described by Nelson\textsuperscript{7} is to provide a direct blood supply source to the connective tissue placed over the previously denuded root surface, and to improve the esthetics. In the technique described by Langer and Langer\textsuperscript{9} and the "envelope" technique,\textsuperscript{6,23} the grafted connective tissue is left exposed for the portion placed over the previously denuded root surface, and the esthetic result may not be as good.\textsuperscript{29} However, the lack of a direct blood supply to the portion of the grafted connective tissue placed over the previously denuded root surface may be compensated by a better double blood supply on the surrounding recipient bed avoiding displacement of flaps.\textsuperscript{6,23} The advantages of the two techniques could be combined by the connective tissue graft covered by a coronally positioned flap, so that the connective tissue is completely covered and there is a minimal displacement of adjacent tissue. But Jahnke et al.\textsuperscript{23} advocated that the "envelope" flap should provide more blood supply than the coronally positioned flap with vertical releasing incisions. In contrast to Nelson's\textsuperscript{7} technique, the coronally positioned flap and connective tissue graft do not increase the keratinized tissue

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**Figure 3.** Result at 1 year; a significant amount of root coverage was achieved but complete root coverage was not possible due to the Class III defect.

**Figure 4.** Initial situation of a Class II gingival recession located on a left canine.

**Figure 5.** One-year post-surgery; a complete root coverage can be observed in this Class II defect.
height, so this technique requires a minimal amount of existing keratinized gingiva.

Keratinized tissue height was substantially increased from an initial mean of 1.60 mm to a 1-year postoperative mean of 4.30 mm while it remained unchanged in the control sites. These are original data since Nelson only mentioned a zone of attached gingiva that was clinically adequate. This gain of keratinized gingiva is comparable to that observed with other techniques: from 1.6 mm to 4.8 mm for Harris; from 1.42 mm to 4.96 mm for Raetzke; and from 0.6 mm to 3.6 mm for Jahnke et al. Another original and interesting finding of the present study is that the CEJ-MGJ distance was not statistically different at the 1-year examination compared to the initial examination, in both the treated and untreated sites. Stability of the mucogingival junction clinically confirms that connective tissue grafted beneath the alveolar mucosa does not induce transformation of alveolar mucosa into keratinized tissue. Histological studies showed that deep palatal connective tissue has no ability to induce transformation of alveolar mucosa epithelium into keratinized epithelium. Clinical impression is here verified by a clinical study. However, we may agree with Miller’s statement that connective tissue may ultimately become the dominant tissue and in long-term healing, this alveolar mucosa with a thick connective tissue base may function as a masticatory mucosa.

Conclusion

Within the limits of this study: 1) subpedicle connective tissue graft provided 70.9% root coverage of gingival recession while untreated control sites remained unchanged at 1 year; 2) height of keratinized tissue significantly increased and probing sulcus depth did not change in the treated sites; and 3) connective tissue grafted beneath the alveolar mucosa did not induce its transformation into keratinized gingival tissue.

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REFERENCES


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