Subpedicle connective tissue graft versus free gingival graft in the coverage of exposed root surfaces
A 5-year clinical study


Abstract. The authors compared the clinical results obtained in gingival recession correction treatment using free gingival and bilaminar connective subpedicle grafts. 35 patients were treated with free gingival grafts (Group A) and 35 with subpedicle grafts (Group B). Class I and II Miller gingival recessions were chosen for treatment by the 2 procedures. The degree of gingival recession (GR), keratinized tissue (KT) and the exposed root surface area (ERSA) were measured preoperatively and again 5 years post-surgery. Bilaminar connective grafting showed better results in reducing the amount of GR while both techniques significantly increased the width of KT (p>0.05). The mean % of root coverage obtained in patients in group A was 53.19%±21.48, whereas for the group B, 85.23%±17.86 of exposed root surface was covered post surgical intervention (p<0.001). In group A, only 3 patients (8.75%) showed a complete resolution of gingival recession after treatment, whereas in group B, 17 subjects (48.57%) presented with complete coverage. On the basis of these results, the authors conclude that the subpedicle graft promises better results in the coverage of exposed root surfaces when compared with the free gingival graft.

Key words: subpedicle graft; free gingival graft; root coverage
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The first discussion of "mucogingival surgery" was proposed in 1957 by Friedman who grouped within this term all surgical procedures aimed at preserving the keratinized gingiva, to eliminate abnormal frenae and muscular insertions and to increase the depth of the vestibulum.

Over the last decade, the clinical indications for mucogingival surgery have been heavily revised. In fact, in the 70s, an adequate width of gingival keratinized tissue was considered of paramount importance for the maintenance of gingival health (Lang & Loe, 1972). However, subsequent animal (Wennstrom & Lindhe, 1982, 1983a, b) and human studies (Miyasato et al. 1977, Dorfman et al. 1980, 1982, Wennstrom 1987) have demonstrated that even minimal or inappreciable amounts of keratinized tissue are consistent with a healthy condition of gingival tissues if adequate plaque control is maintained.

Therefore, the need to increase the amount of keratinized gingiva has been greatly reduced. The term "mucogingival surgery" has been superseded by that of "soft tissue plastic surgery", a term coined by Miller (1988), whose clinical objective was to provide coverage of exposed root surfaces if it incurred aesthetic or functional problems (i.e. dentinal hypersensitivity; root caries). Nowadays surgical techniques no longer have any scope in increasing the amount of keratinized tissue.

The free gingival graft has, for many years, represented the principal surgical technique, as introduced by Bjorn in 1963, for increasing the width of attached gingiva. Nevertheless, many authors (Pennel et al. 1969, Bernimoulin et al. 1975, Rateitschack et al. 1979) have observed a low degree of predictability of favorable results with this technique, in the coverage of exposed root surfaces. In fact, using the free graft technique, the portion of the graft placed on the denuded root surface does not receive an adequate blood supply with consequent partial necrosis of the grafted tissue. However, in recent years, Miller (1989) has greatly re-appraised the free gingival graft technique for gingival recession correction, suggesting a surgical method based on
thick gingival grafts and citric acid conditioning of the root surface. The author (Miller, 1989), using these revised surgical techniques, has obtained successful root coverage %s ranging from 90 to 100% in class I and II gingival recessions.

Other authors (Langer & Langer 1985, Raetke, 1985, Nelson, 1987) have modified the gingival graft technique in order to increase the degree of predictability of a therapeutic result by improving the blood supply to the grafted tissues, this increased vascular component being the rationale for the bilaminar techniques. Langer & Langer (1985) suggested covering the grafted tissue with a coronally placed gingival flap; Raetke (1985) introduced the envelope flap, whereas Nelson (1987) used a laterally sliding flap or a bipapillary technique onto the free connective tissue graft.

In spite of an abundance of case reports in the scientific literature evaluating clinical results employing bilaminar techniques (Langer & Langer 1985, Raetke 1985, Nelson 1987, Jahnke et al.1993, Harris 1992, Borghetti & Louise 1994), papers comparing directly, on a long term basis, the results obtainable with such techniques with those offered by the free gingival graft technique, are scarce.

On the basis of these considerations, the aim of the present study was to evaluate the long-term clinical efficacy of free gingival grafts in comparison with subpedicle connective tissue graft (bilaminar technique) for the coverage of exposed root surfaces.

Material and Methods

Patients

70 systemically healthy patients (32 male and 38 female) aged between 25 and 48 years (mean age 31.8±6.5) attending a private practice, agreed to participate in the study. All of the patients had requested a surgical root coverage procedure for aesthetic reasons. None of the participants in the study showed probing depths exceeding 2 mm, or any clinically appreciable gingival inflammation in the experimental sites chosen. Each patient received initial and reinforced oral hygiene instruction and was deemed as being highly motivated towards oral health maintenance. None of the patients used a traumatic brushing technique, nor were hard bristle brushes or abrasive toothpastes employed, these variables were kept constant throughout the study.

At the beginning of the study, each patient displayed the presence of plaque in less than 20% of periodontal sites and bleeding on probing in less than 10%. All patients selected for the study had at least one gingival recession classified in I or II Miller classes (Miller, 1985 b) in the right side of the mouth for dexterous subjects and in the left one for left-handed patients. This characteristic was chosen in order to examine marginal tissues which could be exposed to the less traumatic forces by oral hygiene measures yielding comparable results. If the patient had more than one gingival recession, the more pronounced was chosen for the experimental study.

After having signed an informed consent for participating in the study, each patient was randomly assigned to one of the two experimental groups: group A (35 patients) had the gingival recession treated by a free gingival graft whereas group B subjects (35 patients) were treated by a bilaminar technique.

Clinical measurements

Recordings of clinical data were made immediately before the surgical treatment and at the 5-year examination. Recording of data was always performed by the same operator in the same patient in both clinical examinations. All measurements were made at the experimental site to the nearest 0.5 mm by a Michigan 0 probe, presenting 1 mm increments.

The height of the gingival recession (GR) was measured between the most apical point of the cemento-enamel junction (CEJ) to the most apical point of the gingival margin; the width of keratinized tissue (KT) was measured from the most apical point of the gingival margin to the mucogingival junction. The area of the exposed root surface (ERSA) was evaluated as follows: standardized photo-slides were taken at 1:1 ratio by a macro lens furnished camera provided with a rigid positioner to guarantee the image reproducibility. The positioner was made by 2 telescopic metallic arms connected at one side to a stent with the occlusion in thermoplastic paste and at the other side to the photocamera (Fig. 1). 2 kinds of stents were used: one for photographing central and lateral incisors and one for cusps and premolars. Translucent mm paper was then superimposed to each slide on a diaphanoscope and the ERSA was calculated always by the same examiner summing the number of 1×1 squares superimposed to the gingival recession with an approximation of 0.5 mm². The % of root coverage was calculated by comparing presurgical and postsurgical ERSA.

Surgical procedures

After induction of local anesthesia, group A patients were treated as follows: the exposed root surface was carefully planed by Gracey curettes; for preparing a recipient bed for the free gingival graft, a horizontal incision was made at the level of the CEJ in correspondence to the base of adjacent papillae to the line angles of the neighboring teeth from which vertical incisions were realized to the apical extent of the recipient bed, 3 to 4 mm apical to the recession; such delimited tissue was then removed by a partial thickness incision. The graft of adequate size and of about 2 mm thickness was then harvested from the palate in correspondence to the bicuspid area by a partial thickness incision with a #15 blade; within 1 min of removal, the graft was then sutured to the recipient bed by two lateral 5–0 silk sutures and was then stabilized by a tooth-suspended 3–0 silk crossed suture; an attempt was made to place the coronal margin of the graft in correspondence to the CEJ. The grafted tissue was then compressed for about 5 min onto the recipient bed.

Bilaminar grafts were realized in group B patients. Briefly, after local anesthesia and careful root planing, the recipient site was prepared by elevating a partial thickness flap around the denuded root. Horizontal incisions were realized at the bases of adjacent papillae at the level of CEJ; 2 releasing vertical incisions were made in correspondence to the line angles of the neighboring teeth; fenestration of periosteum was accomplished in the apical area of the recipient site and the vestibular aspects of interdental papillae was dissected. Donor connective tissue, without an epithelial collar, was harvested from the palate raising a partial thickness flap in the bicuspid area with a #15 blade. The connective tissue was placed beneath the partial thickness flap in the recipient area with its coronal margin placed in correspondence to the CEJ.
An attempt was made to cover as much as possible the grafted connective tissue by the partial thickness flap which was coronally repositioned. Interproximal 5-0 silk sutures were used to hold the recipient flap and the graft in position. Finger pressure was applied to the recipient area for about 5 min.

Groups A and B patients were subjected to the same postsurgical treatment consisting of the placement of noneugenol periodontal dressing over the recipient area, the administration of analgesics and the prescription of 0.2% chlorhexidine rinses 2×daily for 3 weeks following surgery. The dressing and sutures were removed 7 to 10 days after surgery; home care instructions were given, specifying the use of cotton swabs with chlorhexidine 1% gel until healing had progressed sufficiently to allow gentle brushing and flossing. Professional prophylaxis was done weekly for the first month and then at 3-month interval.

A probability of $p<0.05$ was accepted to reject the null hypothesis.

**Results**

Results obtained at the end of the present study are summarized in Tables 1–3. In no site treated with either technique, did probing depth exceed 2 mm after surgical treatment.

As Table 1 shows, experimental groups did not significantly differ between themselves in terms of GR in the presurgical evaluation; on the contrary, after surgery, group B sites reduced the amount of GR to a significantly better degree in comparison to group A sites. However, both surgical techniques significantly reduced the entity of GR as compared to presurgical condition.

The KT significantly increased in both experimental groups after surgical treatment without any significant difference between the groups. The ERSA was significantly reduced in both groups after surgical treatments; however, in the postsurgical evaluation, the ERSA was significantly smaller in group B patients. The mean % of root coverage obtained in group A patients was 53.19%±21.48, whereas in group B 85.23%±17.86 of the exposed root surface was covered after surgical treatment. The % of root coverage between groups A and B was significantly different ($p<0.0001$).

In group A, only 3 patients (8.57%) showed a complete resolution of gingival recession after treatment, whereas in group B, 17 subjects (48.57%) had their recessions completely covered.

**Discussion**

The aim of each intervention of plastic surgery on gingival tissues is the correction of gingival recessions when they cause functional or aesthetic troubles, and, nowadays, the indication to the surgical procedure derives from the amount of keratinized gingiva available. However, in each experimental site observed during the present study, the width of keratinized gingiva underwent a significant increase after both surgical techniques without significant differences between themselves (Table 2). The free gingival graft and the subpedicle connective tissue graft demonstrated statistically significant differences in correcting gingival recessions (Table 1). Starting from very similar values of recession, sites treated by subpedicle grafts showed a mean post surgical recession of approximately 0.5 mm, while sites treated by free grafts showed a mean residual recession of 1.5 mm ($p=0.000$).

Similarly bilaminar techniques demonstrated the best efficacy in reducing the width of the exposed root surface area ($p=0.000$, Table 3).

It is, furthermore, important to underline that only 3 patients, over 35 treated by free gingival graft, had their recessions completely covered, whereas about 50% of patients treated by subpedicle grafts had a complete resolution of the lesion.

The results obtained in the present research are in substantial agreement with those from Sbordone et al. (1988), who observed in 24 gingival recessions, better results using subpedicle grafts in comparison to free gingival grafts. However, while Sbordone et al. (1988) obtained a mean root coverage of 52% with subpedicle grafts, the present study obtained, with the same technique, 85% of mean root coverage. Furthermore, free grafts presented in this study offered a better root coverage in comparison to those of Sbordone et al. (1988) (53% versus 11%). These variances may be due to case selection or technical differences in surgical procedures; furthermore, the longer observation period in this experiment could have influenced our results.

Very few studies directly compared
the clinical efficacy of free gingival grafts with those of subpedicle grafts; we therefore tried to extrapolate data from studies in which the authors separately applied these surgical techniques.

The literature on free gingival grafts reports very different results with %s of root coverage ranging from 11% to 100% (Mlinek et al. 1973, Matter & Cimasoni, 1976, Matter, 1980 Holbrook & Ochsenbein, 1983 Miller, 1985 Ibbot et al. 1985, Bertrand & Dunlap, 1988 Sbordone et al. 1988, Borghetti & Gardella 1990, Tolmie et al. 1991). These differences may be attributed to differences in the severity of gingival lesions and in surgical techniques, i.e., the use of citric acid conditioning of the root and the thickness of the grafted tissue. In the present paper, free gingival grafts showed results in good accordance with the mean values reported in the literature; in our research, we did not use citric acid conditioning of the root surface, because it has been demonstrated in man that citric acid con-

Fig. 2. Case treated by bilaminar connective tissue graft (bilaminar technique). (a) Class I gingival recession of a maxillary cuspid. (b) The connective tissue graft is placed onto the root. (c) Clinical result.

Fig. 3. Clinical case treated by free gingival graft. (a) Class II gingival recession of a mandibular central incisor. (b) The free gingival graft is sutured in position. (c) Clinical result at the 5-years re-evaluation. In this case, the good result in root coverage could have been influenced by creeping attachment due to the long observation period.
Table 1. Mean distance (mm) of CEJ from the free gingival margin before and after surgery in patients treated by free gingival grafts (Group A) and subpedicle grafts (Group B), and statistical significance of differences between and within experimental groups.

<table>
<thead>
<tr>
<th></th>
<th>Before surgery</th>
<th>Significance of differences within groups</th>
<th>After surgery</th>
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<tbody>
<tr>
<td>group A (free grafts)</td>
<td>3.11±0.28</td>
<td>p = 0.000</td>
<td>1.50±0.39</td>
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<tr>
<td>significance of differences between groups</td>
<td>p = 0.529</td>
<td></td>
<td>p = 0.000</td>
</tr>
<tr>
<td>group B (subpedicle grafts)</td>
<td>3.43±0.39</td>
<td>p = 0.000</td>
<td>0.58±0.46</td>
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Table 2. Mean width of keratinized gingiva (mm) before and after surgery in patients treated by free gingival grafts (group A) and subpedicle grafts (group B), and statistical significance of differences between and within experimental groups.

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<tr>
<td>group A (free grafts)</td>
<td>1.57±0.34</td>
<td>p = 0.000</td>
<td>5.23±0.48</td>
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<tr>
<td>significance of differences between groups</td>
<td>p = 0.424</td>
<td></td>
<td>p = 0.091</td>
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<tr>
<td>group B (subpedicle grafts)</td>
<td>1.94±0.43</td>
<td>p = 0.000</td>
<td>4.75±0.93</td>
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Table 3. Mean area (mm²) of exposed root surface before and after surgery in patients treated by free gingival grafts (group A) and subpedicle grafts (group B), and statistical significance of differences between and within experimental groups.

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<th>Significance of differences within groups</th>
<th>After surgery</th>
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<tr>
<td>group A (free grafts)</td>
<td>7.54±1.15</td>
<td>p = 0.000</td>
<td>3.70±1.30</td>
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<tr>
<td>significance of differences between groups</td>
<td>p = 0.323</td>
<td></td>
<td>p = 0.000</td>
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<tr>
<td>group B (subpedicle grafts)</td>
<td>9.79±1.51</td>
<td>p = 0.000</td>
<td>1.62±1.40</td>
</tr>
</tbody>
</table>

Conditioning does not affect clinical results of free gingival grafts (Ibbot et al. 1985, Bertrand & Dunlap 1988).

More homogeneous data are reported by different authors on subpedicle grafts, although realized with different techniques: Raetzk (1985) and Jahnke et al. (1993) reported a mean root coverage of about 80%, a value very close to ours; Borghetti & Louise (1985) observed a % of 70.9%, while the best results are those from Nelson (91%) (1987) and Harris (97.4%) (1992). These data suggest that bilaminar techniques can offer more predictable results, independent of the technical skill of the periodontist.

The best results obtainable by subpedicle grafts in covering gingival recessions in comparison to traditional free gingival grafts, have been attributed to the more abundant blood supply to the grafted tissue, in particular to that part which is placed on the avascular denuded root surface.

The present study was based on a 5 year follow-up; due to the long time observation period, the formation of a creeping attachment could have influenced our results, considering also the good compliance of our patients.

In the present study, free gingival graft and subpedicle graft have not been performed in the same patient according to the “split mouth” protocol, and therefore it cannot be excluded that individual variance could have affected our results. However, all our patients presented a noticeable degree of homogeneity for the anatomical characteristics of gingival lesions (as shown by the low standard deviation values; Table 1), for the oral hygiene level and for the compliance towards supportive treatment, strictly observed by all participants after surgical treatment. It is also opportune to underline that a comparative evaluation according to the “split mouth” protocol in mucogingival surgery may be affected by the brushing modalities used by different subjects, right or left handed.

On the basis of the results presented, here we can conclude that the subpedicle graft (bilaminar) technique seems to offer better results in comparison to free gingival grafts in the coverage of exposed root surfaces in the Miller class I and II categories.

Acknowledgement

The Authors wish to thank Dr. Damian Mc Nally for his kind review of the manuscript.

Zusammenfassung

Gestieltes Bindegewebstransplantat im Vergleich mit dem Gingivatransplantat bei der Deckung freiliegender Wurzeloberflächen. Eine klinische Studie über 5 Jahre

Bei der Therapie von Gingivavarexionen verglich die Verfasser die klinischen Resultate zwischen der Behandlung mit freien Ginigivatransplantaten und zweischichtigen gestielten Bindegewebstransplantaten. 35 Patienten wurden mit freien Gingivatransplantaten (Gruppe A) und 35 mit gestielten Transplantaten (Gruppe B) behandelt. Für die Behandlung mit diesen beiden Therapieverfahren wurden Gingivavarexionen Klasse I und II nach Miller gewählt. Der Rezessionsgrad der Gingiva (GR), das keratinisierte Gewebe (KT) sowie die freiliegende Wurzeloberfläche (ERSA) wurden präoperativ und 5 Jahre post operationem vermessen. Die zweischichtige Bindegewebstransplantation zeigte bessere Resultate hinsichtlich der Verringerung des GR, während beide Methoden das KT signifikant verbreiterten (p > 0.05). Die Abdeckung der Wurzeloberflächen betrug bei den Patienten der Gruppe A durchschnittlich 53.19±21.48%, während bei Gruppe B nach dem operativen Eingriff durchschnittlich 85.23±17.86% der exponierten Wurzeloberfläche gedeckt waren (p < 0.001). Nach der Behandlung wiesen nur 3 Patienten der Gruppe A (8.75%) eine vollständige Rückbildung der Gingivavarexion auf. In der Gruppe B hatten 17 Versuchsprobanden (48.57%) eine vollständig abgedeckte Wurzeloberfläche. Auf der Grundlage dieser Resultate folgern die Verfasser, daß das gestielte Transplantat im Vergleich mit dem freien Gingiva-transplantat bessere Resultate bei der Deckung freiliegender Wurzeloberflächen verspricht.

Résumé

Greffe de tissu conjonctif sous-pédiculé VS greffe gingivale libre dans le recouvrement des surfaces radiculaires exposées. Une étude clinique de 5 années

Les résultats cliniques obtenus en corrigeant une récession gingivale en utilisant soit des
References


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