The partly epithelialized free gingival graft (pe-fgg) at lower incisors. A pilot study with implications for alignment of the mucogingival junction


Abstract

Aims: A partly epithelialized free gingival graft (PE-FGG) is described for the treatment of isolated and multiple gingival recessions in lower incisors to improve root coverage potential and mucogingival junction (MGJ) alignment.

Methods: Twelve single gingival recessions in 12 patients and 16 multiple recessions in 7 patients at lower incisors were included. A FGG partly deprived of epithelium was harvested from the palate. The epithelialized coronal part of the graft extended from the CEJ to the "ideal" position of the MGJ of the recession site/s. The apical part of the PE-FGG deprived of the epithelium was inserted between the alveolar mucosal flap and the recipient bed periostium. An aesthetic evaluation was performed.

Results: Treatment resulted in 94 ± 11% and 96 ± 11% root coverage and 75% and 87.5% of the treated teeth completely covered in the single recession and in the multiple recession groups respectively. The 1-year KT was associated with the baseline extent of the epithelialized part of the graft in both groups. As a consequence, the MGJ resulted in properly aligned teeth in 14 of 19 patients. Three independent clinicians assigned an aesthetic score ranging from 6.36 ± 2.5 to 7.91 ± 1.7 in the single REC group and from 6.62 ± 2.2 to 7.87 ± 1.8 in the multiple REC group.

Conclusions: The application of the M-FGG resulted in high percentage of recessions completely covered with excellent alignment of the MGJ and appreciable aesthetic outcomes.

Conflict of interest and source of funding statement

This study has been supported by the Accademia Toscana di Ricerca Odontostomatologica (ATRO) and the European Research Group on Periodontology (ERGOPERIO). The authors declare that they have no conflict of interests.


During the last three decades several surgical techniques have been
proposed to treat single and multiple gingival recessions: pedicle flaps (laterally or coronally positioned), FGG, bilaminar techniques or regenerative procedures (Clauser et al. 2003, Cairo et al. 2008).

The FGG (Sullivan & Atkins 1968) provides root coverage and increased width and thickness of the marginal keratinized tissue (Jahnke et al. 1993, Paolantonio et al. 1997, Agudio et al. 2008, 2009). Historical comparisons and meta-analytic data (Roccuzzo et al. 2002, Oates et al. 2003, Clauser et al. 2003, Cairo et al. 2008, Chambrone et al. 2010), however, indicate that the potential of the FGG for recession reduction and complete root coverage is inferior to the potential of the coronally advanced flap (CAF) alone or combined with a graft (CAF+CTG). However, it should be underlined that the cited studies refer to treatment of recessions allocated mostly in the upper jaw (Cairo et al. 2008). The application of CAF alone or in combination with a CTG is seldom reported in the lower jaw where, on the contrary, the FGG has been frequently proposed. In the lower anterior area, recessions are frequently associated with poor mucogingival conditions due to lack of gingiva, presence of frena attachments, and shallow fornix (Pini Prato et al. 1995, Wennstrom et al. 2008). Probably the relative difficulty to coronally advance a flap in the lower jaw encourages clinicians to apply a passive graft that entails minimal mobilization of the mucogingival junction (MGJ) and is not influenced by muscular tractions or mucosal movements. However, the free grafts frequently result in a poor aesthetic appearance due to the unsatisfactory chromatic and texture tissue integration and the apical disalignment of the alveolar mucosa (Kerner et al. 2009). This is related at least in part to graft thickness and apico-coronal extent, necessary for its survival (Mörmann et al. 1981, Miller 1985, Borghetti & Gardella 1990). The apical extent of the epithelialized FGG is probably responsible for the apical disalignment of the MGJ. Goals of mucogingival procedures along with the resolution/reduction of the recession, minimal probing depth, and increase in keratinized tissue include also a nice chromatic and texture integration of the covering tissues with the adjacent resident soft tissues (Rotundo et al. 2008, Cairo et al. 2009, Kerner et al. 2009). Therefore, this manuscript reports a modified technique, the partly epithelialized free gingival graft (PE-FGG), with an apical de-epithelialized portion designed to overcome, at least in part, some of the aesthetic deficiencies associated with the conventional FGG. The surgical procedures were undertaken with a microsurgical approach in an attempt to optimize soft tissue manipulation (Cortellini & Tonetti 2001, Francetti et al. 2005, Burkhardt & Lang 2005).

Materials and Methods

Study design

This case series evaluated the outcomes of a PE-FGG in the treatment of RT1 gingival recessions (gingival recession associated with normal interdental attachment level, Cairo et al. 2011) located at lower incisors. A total of 28 gingival recessions in 19 consecutive patients (12 single recessions in 12 patients and 16 multiple recessions at neighbouring sites in 7 patients) were treated with a PE-FGG in a period comprised between January 2009 and February 2010. After surgery, patients were enrolled in a stringent postoperative supportive care programme with weekly recalls for 3 weeks, and then included in a 3-month periodontal supportive care programme for 1 year. Clinical outcomes were evaluated at 1 year.

Study population

Patients in general good health, presenting with at least one RT1 gingival recession located at lower incisors were considered eligible for this study. Patients were included after completion of cause-related therapy consisting of scaling, motivation, and oral hygiene instructions. All subjects gave informed written consent. Patients were enrolled 3 months after completion of cause-related therapy, when baseline clinical measurements were recorded.

Clinical measurements at baseline and at 1-year follow-up visit

The following clinical parameters were evaluated at baseline before mucogingival surgery and at the 1-year follow-up visit.

- Full mouth plaque scores (FMPS) were recorded as the percentage of total surfaces (4 aspects per tooth) with the presence of plaque (O’Leary et al. 1972).
- Bleeding on probing (BOP) was assessed dichotomously and full mouth bleeding scores (FMBS) were then calculated.
- Recession of the gingival margin (REC) was recorded to the nearest millimetre at the deepest location of the selected buccal site with a manual periodontal probe (PCP-UNC 15; Hu Friedy, Chicago, IL, USA).
- The width of the keratinized tissue was measured with the same periodontal probe at the deepest recession site(s).

Early healing events were evaluated at completion of surgery and after 3 weeks. The position of the most coronal part of the grafted tissue with respect to the CEJ was recorded at 1, 3 weeks, 3, 6, and 12 months.

The aesthetic outcomes of the procedure were evaluated at 1 year with the “root coverage aesthetic score” by three independent clinicians on standardized photographs (RES, Cairo et al. 2009, 2010).

Surgical approach

Following local anaesthesia, the exposed root surfaces were gently debrided and planed with curettes from the CEJ to the intracrevicular space (Fig. 1a). A horizontal partial thickness incision was traced at the MGJ to dissect the alveolar mucosa from the keratinized tissue. The incision was extended from one tooth mesial to one tooth distal with respect to the recession-associated experimental unit(s). The alveolar mucosa was dissected from the underlying periosteum to create an envelope of 4–5 mm apical to the bone dehiscence associated with the gingival recession(s). The keratinized tissue coronal to the first incision and neighbouring the recession(s) was de-epithelialized to expose the connective tissue and create a trapezoidal recipient bed having a large
exposed root surface and 2 mm in the epithelialized portion and 1.5 mm in the connective tissue. The graft was de-epithelialized to expose the apical base at the MGJ and a narrower coronal base just coronal to the CEJ of the experimental unit(s). The grafts were harvested from the palate in an area between the mesial aspect of the second bicuspid and the distal of the second molar with a modification of the window technique proposed by Langer & Langer (1985). The apico-coronal extent of the graft was calculated to cover the exposed root surface and 2–3 mm of bone apical to the dehiscence. This measure was recorded. The mesio-distal extent was calculated to completely cover the mesio-distal area of the surgical recipient bed. The FGG was epithelialized only in the coronal part. The apico-coronal extent of the epithelialized part was calculated as the amount of graft needed to cover the area from the CEJ to the “ideal” position of the MGJ at the recession site/s, calculated as an ideal line connecting the MGJ of the neighbouring teeth. This measure was also recorded. The apical extent of the graft was de-epithelialized to expose the connective tissue. The graft thickness was about 1.5–2 mm in the epithelialized portion and 1–1.5 mm in the apical part. The grafts were positioned with the coronal edge at the CEJ and they were eventually trimmed to fit at best the recipient bed. Special care was taken to align the apical border of the epithelialized part with the MGJ of the neighbouring teeth. The de-epithelialized apical part of the graft was enveloped between the dissected alveolar mucosa and the periosteum of the recipient bed and extended 2–3 mm apical to the bone dehiscence.

Interrupted sutures were positioned to stabilize the graft with the neighbouring keratinized tissue. Sling crossed sutures anchored to the periosteum apical to the graft and hanging to each experimental tooth were also positioned to ensure tight adaptation of the graft to the root surface (Fig. 1b). The alveolar mucosa was left free to reallocate on top of the connective portion of the grafted tissue. The palatal window was sutured and the exposed connective tissue protected with a periodontal dressing. No dressing was applied at the grafted sites.

The surgical procedures were performed with the aid of an operating microscope (Protégé System, Global Surgical Corp, St Louis, MO, USA) at a magnification from 4× to 16×. Microsurgical instruments were utilized, whenever needed, as a complement to the normal set of surgical instruments.

In the post-operative period patients were requested to avoid brushing, flossing, and chewing in the treated area. Prescription included ibuprofen 600 mg at the end of surgery and every 6 h in case of pain, and 0.12% chlorhexidine mouth-rinsing three times/day for 3 weeks. At week 1, sutures were removed (Fig. 1c) and patients resumed careful tooth brushing with a soft toothbrush (Vitis Surgical, Barcelona, Spain). At week 3, patients resumed full oral hygiene and mastication in the treated area. Patients were placed on a 3-month recall system.

Data analysis

Data were expressed as means ± standard deviation of 12 recessions in 12 patients for the group of single recessions and of 16 recessions in 7 patients for the group of multiple recessions. The primary outcomes were percentage root coverage and complete root coverage (i.e. number of experimental units completely covered). Secondary outcomes were recession reduction, extent of keratinized tissue, alignment of the MGJ, and patient-related outcomes. Comparisons between baseline and 1 year measurements were performed applying the paired Student t-test (α = 0.05). A regression analysis was performed on the whole defect population, to predict the width of keratinized tissue at 12 months as a function of the width of the epithelialized portion of the graft.

Results

Baseline patient and defect characteristics

All patients but one in the multiple recession group were women. Only one patient in the single recession group smoked (less than 10 cigarettes/day). In the single recession group mean age was 33.5 ± 13.9 (min 19, max 59) years. FMPS was 12.8 ± 6.5% and FMBS 4.1 ± 2.7%. The treated teeth were 12 central lower incisors. In the multiple recession group mean age was 25.3 ± 5.1 (min 18, max 30) years. FMPS 14.6 ± 5.7% and FMBS 5.6 ± 1.7%. The treated teeth were 2 lateral and 14 central lower incisors. Baseline defect characteristics are reported in Tables 1 and 2.
Surgical and 1-year outcomes

Patients reported no pain or discomfort during the surgical procedures. At week 1 all grafts were in place and appeared well nourished and alive. A slight oedema of the grafted tissue was consistently observed, along with the expected superficial desquamation of the epithelialized part. At week 3, the inflammatory signs were no longer detectable in any of the experimental units.

The CEJ was completely covered by the grafts at the end of surgery at all the treated sites and appeared still covered at all the sites at week 1 (Fig. 2). At week 3, 25% of the single recessions and 37.5% of the multiple presented with an exposed CEJ.

At 1 year, 75% and 87.5% of recessions were completely covered in the single and multiple sites respectively (Fig. 2).

The single recession group (Table 1) presented with 0.3 ± 0.5 mm of residual recession on average that accounted for 94 ± 11% root coverage. The total height of the grafts at time of surgery was 6.3 ± 0.9 mm. The epithelialized coronal portion measured 3.5 ± 0.5 mm that agreed well with the 3.6 ± 0.8 mm band of 1-year KT (p = 0.169 from baseline). The MGJ resulted aligned in five of seven patients.

A regression analysis on the whole defect population, predicting the width of keratinized tissue at 12-month as a function of the width of the epithelialized portion of the graft, indicated that the two measures were highly associated (Adj R-Square 0.93, p < 0.001). The regression coefficient was 1.07 (95% CI 1–1.14) indicating an excellent agreement between the width of the baseline epithelialized portion of the graft and the amount of keratinized tissue observed at 12 months.

One-year aesthetic outcomes

The aesthetic outcome was evaluated with the RES by three independent clinicians (Figs 3 and 4). In the single recession group the average scores of the three measurers were 7.91 ± 1.7 (min 5, max 10), 6.91 ± 2.3 (min 3, max 10), and 6.36 ± 2.5 (min 3, max 10). In the multiple recession group the scores were 7.87 ± 1.8 (min 4, max 10), 7.31 ± 1.7 (min 4, max 10), and 6.62 ± 2.2 (min 3, max 10).

Fig. 2. Percentage of sites with the CEJ completely covered at the different observation times in single and multiple recessions.

Table 1. Single recessions (12 patients–12 recessions): baseline and 1-year clinical outcomes. Differences between baseline and 1-year have been tested with the Student t-test. No significant difference was observed between the baseline epithelium extent of the graft and the 1-year amount of KT (*p = 0.169)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>1 year</th>
<th>Difference</th>
<th>Significance</th>
<th>% root coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC</td>
<td>3.5 ± 1.1</td>
<td>0.3 ± 0.5</td>
<td>3.3 ± 0.9</td>
<td>p &lt; 0.001</td>
<td>94 ± 11</td>
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<tr>
<td>KT</td>
<td>0.8 ± 0.6</td>
<td>3.6 ± 0.8*</td>
<td>2.8 ± 0.7</td>
<td>p &lt; 0.001</td>
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<tr>
<td>Graft height</td>
<td>6.3 ± 0.9</td>
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<tr>
<td>Epithelium extent</td>
<td>3.5 ± 0.5*</td>
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Table 2. Multiple recessions (7 patients–16 recessions): baseline and 1-year clinical outcomes. Differences between baseline and year have been tested with the Student t-test. The difference between the baseline epithelium extent of the graft and the 1-year amount of KT reached borderline significance (*p = 0.028)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>1 year</th>
<th>Difference</th>
<th>Significance</th>
<th>% root coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC</td>
<td>3.1 ± 1.2</td>
<td>0.1 ± 0.3</td>
<td>3 ± 1.2</td>
<td>p &lt; 0.001</td>
<td>96 ± 11</td>
</tr>
<tr>
<td>KT</td>
<td>0.5 ± 0.6</td>
<td>3.5 ± 0.7*</td>
<td>3 ± 0.7</td>
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Direct comparisons between FGG and subpedicle grafts, however, are very scarce. Paolantonio et al. (1997) reported better outcomes in terms of root coverage ($85.23 \pm 17.86\%$ versus $53.19 \pm 21.48\%$) and roots completely covered ($48.57\%$ versus $8.75\%$) comparing a subpedicle approach to a FGG approach. However, authors did not indicate the type of teeth treated with the two procedures, other than by showing a representative picture of the subpedicle graft in the upper jaw and one of the FGG in the lower jaw. This is relevant, since most of the published studies about FGG report treatment on lower incisors, while most of the studies dealing with CAF-based procedures have been performed on the upper jaw. In the lower anterior area, recedions are frequently associated with poor mucogingival conditions, due to lack of gingiva, presence of frena attachments, and shallow vestibule that make the application of CAF alone or in combination with a CTG very difficult (Pini Prato et al. 1995, Wennstrom et al. 2008). On the contrary, the application of a passive graft is not influenced by muscular tractions and mucosal movements and is expected to facilitate the healing of the soft tissues on the denuded root surface. To date, a comparison between CAF-based procedures and FGG in the area of the lower incisors is lacking in the scientific literature.

The excellent outcomes reported in the present case series could be explained at least in part with the peculiar design of the graft and with its technical execution as well as the choice of ideal clinical situations. The total surface of the graft was dimensioned to allow for a sufficient vascular supply. The apical de-epithelialized part of the graft was loosely placed between the alveolar mucosa and the periosteum: this might have improved the early nourishment of the grafts and facilitated their survival. In addition, the grafts were harvested attempting to obtain an even, regular thickness of about 1.5–2 mm in the epithelialized part and 1–1.5 mm in the apical part to favour revascularization (Mörmann et al. 1981). Lastly, the procedures were performed with a microsurgical approach, using an operating microscope and microsurgical instruments and materials. Such an approach has been demonstrated to increase the ability for soft tissue manipulation in several periodontal fields resulting into enhanced healing of the wound and enhanced clinical outcomes (Cortellini & Tonetti 2001, 2005, 2007, 2009, Wachtel et al. 2003, Burkhardt & Lang 2005, Francetti et al. 2005).

The outcomes observed at 1 year were obtained through a period of healing and soft tissue maturation that showed peculiar dynamics. In fact, at surgery grafts were positioned and stabilized to completely cover the CEJ that, at week 1, resulted in it being covered at all sites. However, from week 3 the CEJ was found exposed in a significant number of sites reaching a maximum of exposures at the 3-month examination. The observed CEJ exposure in the early wound healing could be explained at least in part with the expected shrinkage of the coronal portion of the grafted tissues (Silva et al. 2010). At 6 months, however, few sites showed a degree of creeping attachment that was increasingly evident at 1 year and resulted in a large number of sites completely covered. The coronal shift of the grafted tissues has been reported in the literature in sites treated with non-submerged FGG (Agudio et al. 2008, 2009). The apical shift of the gingival margin observed in the present study after PE-FGG is a common happening also after CAF and CAF+CTG. A recent randomized clinical trial demonstrated that the presence of a graft under a CAF is able to reduce the amount of the apical shift of the gingival margin in comparison to CAF alone (Cortellini et al. 2009).

Aesthetics is a weak point of the FGG. A recent study reports better aesthetic outcomes using pedicle grafts, submerged grafts, and envelope techniques compared to non-submerged grafts (Kerner et al. 2009): authors do not recommend FGG in case of aesthetic demand. FGG frequently result in an unpleasant aesthetic appearance due to soft tissue differences in colour and texture, differences in soft tissue thickness, and misalignment of the MGJ. The present technique was designed to address these problems, at least in part. The amount of epithelium left in the coronal portion of the graft...
extended from the CEJ to the “ideal” position of the MGJ of the recession sites and the apical de-epithelialized part of the graft allowed for a spontaneous reallocation of the alveolar mucosa on top of the connective apical portion of the graft. In fact, the alveolar mucosa covered the apical part of the graft, deprived of epithelium, allowing a substantial realignment of the MGJ in 14 of 19 treated patients. Interestingly, the amount of keratinized tissue measured at 1 year paralleled the apico-coronal extent of the epithelialized portion of the grafted tissue. A regression analysis indicated an excellent agreement between the width of the baseline, epithelialized portion and the amount of keratinized tissue observed at 12 months (Adj R-Square 0.93, p < 0.001, regression coefficient 1.07, 95% CI 1–1.14). It seems therefore possible to determine the 1-year KT width, and consequently the position of the MGJ, by properly dimensioning the apico-coronal extent of the epithelium on the graft at baseline.

The overall aesthetic outcome was evaluated with the RES (Cairo et al. 2009, 2010). The three independent experts applying the RES resulted in high scores. Overall, 4 sites of 28 got a perfect score of 10 and none got 0. These aesthetic evaluations well compare with the mean RES of 7.8 reported in a recent article, in which several techniques were examined, mostly CAF-based approaches (Cairo et al. 2009). It should be underlined that CAF-based approaches are generally considered more efficacious in terms of aesthetic performances than FGG. In this study, the performances of the PE-FGG in terms of root coverage potential and aesthetics in lower incisors are very close to the ones reported for CAF-based approaches. The interesting clinical and aesthetic outcomes obtained with the proposed technique have to be taken with caution and should be confirmed by independent studies. In particular, controlled studies are necessary to directly compare the performances of the PE-FGG with the performances of different approaches.

Acknowledgements

Authors kindly acknowledge Dr Debora Franceschi, Dr Francesco Cairo and Dr Roberto Rotundo for their invaluable help in scoring the aesthetic outcomes of the treated cases.

References


Principal findings: PE-FGG resulted in high proportion of recessions completely covered along with good aesthetic outcomes. The MGJ was aligned in 73.7% of the patients. Practical implications: The PE-FGG could help clinicians in successfully treating mucogingival problems at lower incisors.

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