A New Technique of Periosteoplasty for Covering Recessions: Preliminary Report and First Clinical Results

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In this study a new technique for the surgical treatment of periodontal recessions is presented along with a report on the first clinical results.
A new technique of periodontal flap surgery was performed on 15 patients with severe periodontal recessions of the upper or lower front teeth. Root and soft tissue scaling was carried out with an open approach, then the periostium was incised and mobilised at the apical part of the mucoperiostium flap to be used for defect coverage before the mucoperiostium was reattached and fixed by sutures. Sulcus bleeding, periodontal probing depths, attachment loss and the length of the attached gingiva were registered for the affected teeth preoperatively and at three, six and 12 months postoperatively.
Every clinical parameter was improved by surgery. No sulcus bleeding was observed at any time during the postoperative follow-up. A mean reattachment of 5.5 mm was noticed 12 months postoperatively at a mean probing depth of 0.3 mm. The mean height of the attached gingiva was 0 mm before surgery, 2.3 mm at three and six months postoperatively and 2.2 mm at 12 months.
The periostium eversion technique is suitable for the treatment of gingival recessions, resulting in good gingival function and a clear improvement in aesthetics.

Key words: periosteoplasty, periodontal surgery, recession

INTRODUCTION

The main aim of periodontal surgery is to achieve a good function of the periodontium and, increasingly, aesthetically satisfying gingiva. Over the past few years surgical techniques have improved and some new techniques for achieving better results have been described. These techniques are based on the transplantation of free tissue grafts (Bjorn, 1963; Sullivan and Atkins, 1968; Nelson, 1987) or the application of membranes (Pinti Prato et al, 1992; Trombelli et al, 1994; Tinti and Vincenzi,1994; Trombelli et al, 1995; Roccuzzo et al, 1996), the transposition of periodontal flaps (Norberg, 1926; Allen and Miller, 1989; Grupe and Warren, 1956; Pennel et al, 1965; Cohen and Ross, 1968; Patur, 1977; Raetzke, 1985; Tarnow, 1986; Bahat el al, 1990) or a combination of both techniques (Summer, 1969; Bernimoulin et al, 1990; Langer and Langer, 1985; Langer and Langer, 1993). The rate of success has increased continuously and individualised techniques for achieving the best results in different kinds of recessions have been presented. The morphology of the recession dictates the best technique for root coverage which, in turn, leads to the best clinical results, as in all other fields of surgery. Here the aim is to achieve long-term coverage of the root surface with attached gingiva of normal height and in the correct position. The form of the gingival margin as well as the colour and texture of tissue should resemble that of the healthy neighbouring teeth. In other words, the results of the surgery should be invisible.
To gain an objective assessment of the clinical results, the percentage of root coverage should be

ascertained (Bernimoulin et al, 1990; Mlinek et al, 1973; Smukler, 1976; Caffesse et al, 1987; Caffesse and Espinel, 1981; Levine,1991; Bouchard et al, 1994) - clinical success depending on the extent of biological regeneration (Wildermann and Wentz, 1965; Caffesse et al, 1984; Gottlow et al, 1990). Complete biological regeneration is only seen in the apical and lateral part of the former recession in this case, while a long epithelial attachment is seen in the other parts of the root when conventional surgical techniques are used (Wildermann and Wentz, 1965; Gottlow et al, 1990).

This biological examination requires histological specimens that should only be taken during second-look surgery so as to avoid further periodontal damage in a patient with good clinical result. Nevertheless good clinical results are an important parameter for judging the success of a new surgical technique.

Therefore it can be stated that the best clinical results for covering extended denuded root surfaces are achieved by surgical techniques using a free soft tissue graft but this results in donor site morbidity (Gottlow et al, 1990).

To avoid donor site problems on the one hand and to exploit the advantages of a connective tissue graft on the other, a new surgical technique for root coverage has been developed over the last few years. The technique is based on transposition of the local periostium in combination with a mucoperiostium transpositional flap.

In this study the new periostium eversion technique will be presented, including a report on the first clinical results.

PATIENTS AND METHODS

Periodontal recessions of the upper or lower front teeth were to be covered surgically in 15 patients. The mean age of patients was 29 years (17–52 years). The periodontal defects were all located at the upper (3) or lower (2) canines and the upper (4) or lower (6) incisors. Miller class II defects were registered in two patients and Miller class III defects in 13 patients (Miller, 1985).

The depth of recession was between 4 and 8 mm.

In the first stage of treatment an intensive oral hygiene program was carried out to reduce preoperative plaque contamination to less than 30 % all over the dentition, a precondition for surgery (Lange, 1975).

Three months after achieving an approximal plaque index value of less than 30%, the preoperative periodontal situation was observed and registered for the teeth which were to be treated surgically. Periodontal bleeding after mild probing, attachment loss and the height of the attached gingiva was registered. The loss of periodontal attachment was registered at three different locations for each root, namely mesially, centrally, and distally at the labial root surface (Fig 1) and the highest value of attachment loss was noted. The width of the ceratinised gingiva was measured at the same positions as the attachment loss after retracting the lip manually and the lowest value was registered. Then the root surface was examined for visible plaque contamination which would preclude surgery.

Therefore no plaque contamination was seen before surgery, whereas some gingival bleeding was registered preoperatively in seven patients. The new technique of periosteoplasty was then used for every patient (Fig 2 a, b, c, d, e).

Surgery was performed under local anaesthetic. After marginal incision and lateral vertical incision a mucoperiostium flap was deflected. Then the root surface was cleaned mechanically by scaling and disinfected with a chlorhexidin solution (Chlorhexamed 0.06%, Blenda dent, Germany). In the next step the root surface was conditioned with a 40% acetic acid solution for 20 seconds and washed with a physiologic saline solution for 60 seconds (Fig 3).

After that preparation of the everted periostium flap commenced. The periostium was incised at the baseline and in the lateral part and was separated from the submucous connective tissue up to the borderline of the attached gingiva (Fig 4). The crestally pedicled periostium was everted and transposed coronally where it was fixed with interdental resorbable stitches (Fig 5). After that a coronal transposition of the mucoperiostium was performed and the mucoperiostium flap was also fixed with interdental resorbable stitches (Fig 6). During the first two weeks after surgery a chlorhexidin solution was used for plaque decontamination twice a day.

Clinical follow-up was performed once a week in the first postoperative month, every two weeks in the second postoperative month and once a

month after that. After three, six and 12 months the preoperative clinical examination was repeated and the results were compared to the preoperative values. In other words, gingival bleeding, attachment loss and the height of the attached gingiva were examined and compared to the preoperative situation. By comparing the attachment loss mesially, centrally and distally before and after the operation, the percentage of root surface coverage was calculated for each position. The mean percentage of these three values was stated to be the percentage of the whole root coverage.

Fig 1 Preoperative clinical situation.

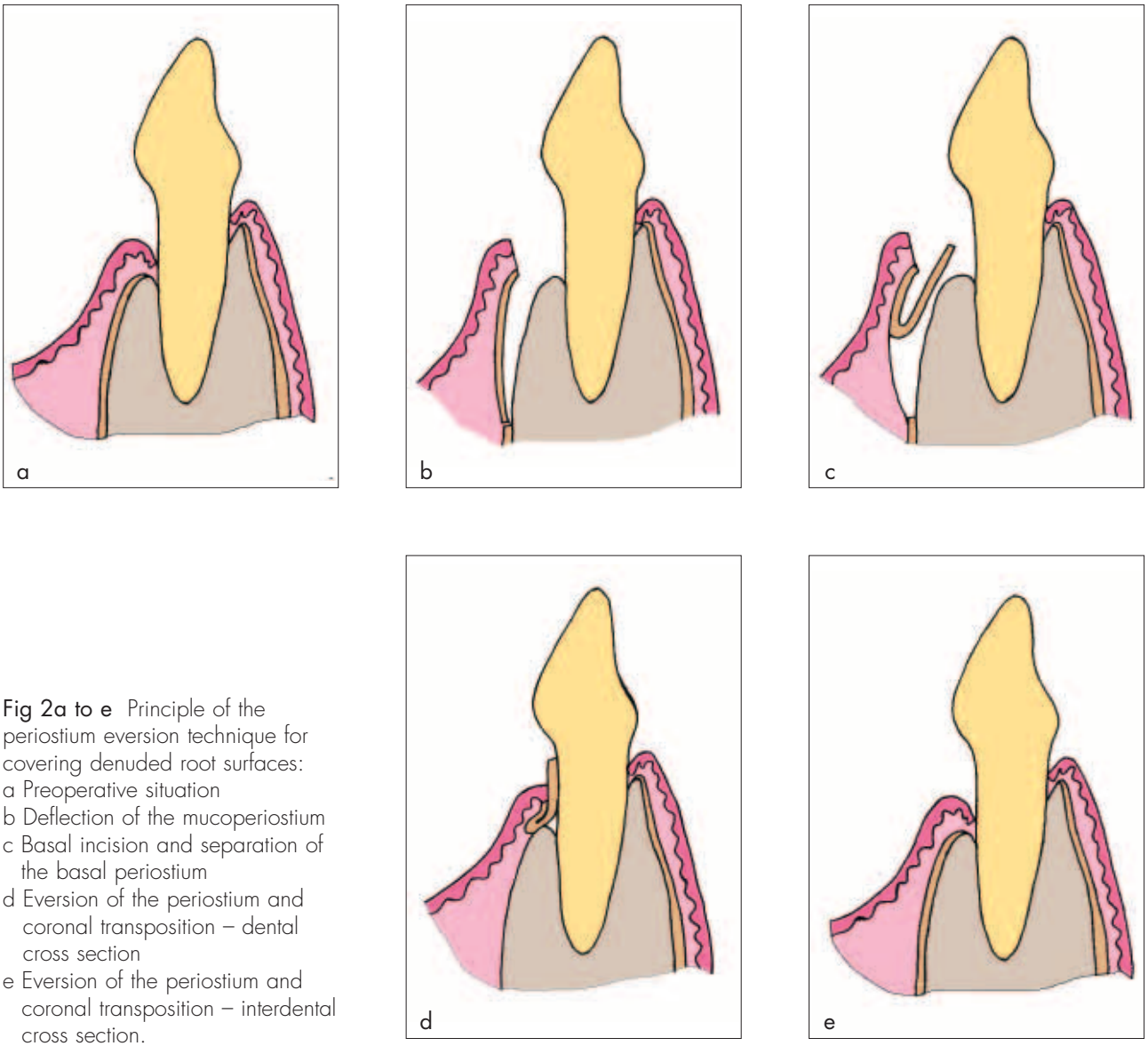

Fig 2a to e Principle of the periostium eversion technique for covering denuded root surfaces:
a Preoperative situation
b Deflection of the mucoperiostium
c Basal incision and separation of the basal periostium
d Eversion of the periostium and coronal transposition – dental cross section
e Eversion of the periostium and coronal transposition – interdental cross section.

Fig 3 Intraoperative situation after scaling and chemical decontamination of the root surface.

Fig 4 Intraoperative situation after mobilisation of the periostium flap.

Fig 5 Intraoperative situation after interdental fixation of the everted periostium flap.

Fig 6 Re-fixation of the mucoperiostium.

RESULTS

Postoperative healing was free of complications in every patient. Epithelialisation of the everted periostium used for root coverage was seen 14 days after surgery (Fig 7a, b). An improvement in the clinical situation was registered in every patient (Fig 7c).

There was no bleeding on periodontal probing at three, six and 12 months postoperatively. The mean periodontal probing depth was 1.2 mm preoperatively and 0.4 mm at three and six months. Twelve months after surgery the mean probing depth was 0.3 mm.

The mean attachment loss preoperatively was 5.8 mm. After three months no attachment loss was registered, while mean values of 0.3 mm were seen at six and 12 months after surgery. There was no attached gingiva in the region of the recession teeth preoperatively. The mean height of attached gingiva was 2.3 mm three months after surgery and 2.2 mm on average at six and 12 months postoperatively. In comparison to the neighbouring teeth, the height of attached gingiva was 0.3 mm less on average for the surgically treated teeth. The colour, texture and thickness of the gingiva in recession and neighbouring teeth were similar at 3, 6, and 12 months after surgery. The results of the clinical examinations are given in Table 1.

The percentage of root coverage was 100% at three months postoperatively and therefore complete. Six and 12 months after surgery, a mean value of 94.8 % was calculated, or a relapse in recession of 5.2%.

Fig 7a Preoperative clinical situation in a 21-year-old patient.

Fig 7b Clinical situation in the same patient two weeks postoperatively. Epithelisation of the periostium has already started.

Fig 7c Clinical situation in the same patient 12 months postoperatively.

DISCUSSION

The main aim of periodontal surgery is to achieve complete restitution of all periodontal tissue resulting in healthy and aesthetically satisfying periodontal conditions. Covering denuded root surfaces is one of the important goals of surgical periodontal treatment and the best results can be achieved by choosing the most appropriate technique. While small and flat recessions on single teeth can be treated successfully by using surgical flap techniques alone, in the case of large and deep defects with missing attached gingiva, the use of free gingiva or connective tissue grafts or membranes becomes more important for achieving the best possible results (Sato, 1995). The main advantage of using guided tissue regeneration techniques with membranes (GTR) over techniques using tissue grafts is to avoid donor site problems. These GTR techniques are used most successfully in periodontal recessions of between 4.5 and 5.5 mm if there is still ceratinised gingival (Pinti Prato et al, 1992; Trombelli et al, 1994; Tinti and Vincenzi,1994; Trombelli et al, 1995; Roccuzzo et al, 1996).

Using these techniques the percentage of root surface coverage is between 60 und 84 % in a follow-up period of six to 18 months. In the literature medium and long-term recessions of between 0.75 and 1.7 mm have been ascertained. The main problem arises if there is wound dehiscence followed by bacterial contamination of the membrane. The defect has to be covered after membrane removal by flap surgery (Sato, 1995), which is not successful in every case. Furthermore, GTR techniques are not so successful if there is little or no attached gingiva. In this case new ceratinised gingiva has to be created and other surgical techniques using connective tissue or free gingiva grafts have to be used which bring about a good regeneration of attached gingival (Tal et al, 2002; Harris, 2002). When using free connective tissue grafts, residual recessions of between 0.1 mm and 1.27 mm can be achieved and the percentage of root coverage is between 70 and 97% (Raetzke, 1985; Nelson, 1987; Paolantino, 2002; Harris, 1992; Jahnke etal, 1993; Allen, 1994; Harris, 1994, Bouchard et al, 1994; Borghetti and Louise, 1994). The results vary considerably depending on the surgical techniques used for transplant coverage or preparation and vascularisation of the transplant bed: the better the vascularisation of the transplant bed the higher the resulting percentage of ceratinised gingival (Harris, 2002). Furthermore, it can be assumed that there is a lower extent of root surface coverage when recessions of more than 5 mm in depth have to be treated (Harris, 2002). In these cases root coverage of between 70 and 92% is reported (Nelson, 1987; Allen, 1994). When comparing combined techniques of graft transplantation and flap surgery, transpositional flaps have better results than the envelope technique (Nelson, 1987; Allen, 1994).

In this study periodontal recessions of more than 5 mm were also treated by the new periostium ever-

Table 1 Clinical data and parameters.

Parameters	Preoperatively	Postoperatively 3 months	6 months	12 months
Plaque accumulation (pos./neg.)	0/15	0/15	0/15	0/15
Sulkus bleeding (pos./neg.)	7/15	0/15	0/15	0/15
Probing depths (mean) [mm]	3.2 ± 0.3	0.4 ± 0.1	0.3 ± 0.1	0.3 ± 0,1
Attachment loss (mean) [mm]	5.8 ± 0.2	0 ± 0.0	0.3 ± 0.1	0.3 ± 0.1
Height of ceratinised gingiva (mean) [mm]	0 ± 0.0	2.3 ± 0.2	2.3 ± 0.1	2.2 ± 0.1

sion technique. First reported on in 2001, it was originally used to cover onlay grafts in augmentative alveolar ridge surgery (Triaca et al, 2001) and adapted for use in periodontal surgery in this study. The technique is based on using the local periostium as a vascularised transplant for defect coverage. In comparison to other techniques of periostium transposition, the periostium is separated from the mucoperiostium flap after baseline incision, so that the basal part of the periostium is used for defect coverage after eversion. The periostium remains pedicled in the cestal part and can be elongated and coronally transposed without retraction forces. The vascularised periostium can be used for defect coverage in a similar way to a connective tissue graft and can be epithelialised by the neighbouring mucosa as a vital and well vascularised tissue, although if not be covered by a mucoperiostium flap. The principle of tissue regeneration in this new technique is therefore similar to the conventional technique of using connective tissue grafts in combination with a transpositional flap and thus the results of periostium eversion technique should be compared with the results for the conventional technique as described in literature. In this study the periostium eversion technique resulted in a rate of defect coverage of 94.8 % and a mean residual denuded root surface of 5.2% one year postoperatively. This result is very similar to the results of defect coverage in recessions of between 4 and 6 mm using a combination of connective tissue grafts and a mucoperiostium flap and surpasses the results of the envelope technique in this kind of defects (Nelson, 1987; Allen, 1994). Furthermore, the periostium eversion technique and the combined connective tissue graft and flap technique both show better long-term results for root coverage than GTR techniques for these special defects. When using membrane techniques, the extent of root coverage is between 72.7 und 82% (Muller et al, 2001; Kassab and Cohen, 2002).

An improvement in attached gingiva is similar for both the periostium eversion technique and the combined connective tissue graft and flap technique (Kassab and Cohen, 2002). The main advantage of the periostium eversion technique in comparison to all other techniques using free grafts is that there is no donor site morbidity (Gottlow et al, 1990). Although connective tissue grafts are only associated with minor donor site problems, they may only be harvested to a limited extent (Fowler and Breault, 2000), whereas periostium exists in every location of the alveolar ridge and can also be used for covering multiple recessions in the same patient. Furthermore there is only a low risk of transplant necrosis in well vascularised tissue 4. Although the incidence of necrosis is low in free connective tissue grafts as well, the well vascularised periostium flap has the possibility to react to bacterial contamination like any other vital tissue and the danger of necrosis and infection in this kind of flap is low. By using a vascularised graft there is the lowest risk of necrosis and infection and therefore a low risk for graft removal with the associated difficulties of second-flap surgery for defect coverage (Urbani et al, 1997; Lekovic et al, 1998; MacDonald et al, 1998; Zuchelli et al, 1998).

It can be concluded that the periostium eversion technique is highly suitable for covering extended denuded roots caused by recession. The technique is similar to a combined therapy of connec-

tive tissue graft and flap transposition. Its main advantage is that the periostium remains vascularised and that there are no donor site problems.
The biological mechanisms of tissue regeneration caused by this technique have to be examined in subsequent studies.

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