

Creeping attachment after free connective tissue graft for treatment of gingival recession

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ترجع هذه المقالة بالتفصيل الجوانب الواردة في المقالات الأدبية حول زحف الارتباط، وبالإضافة تعرض حالة سريرية مع وصف تفصيلي ومتابعة للحالة لمدة سنة كاملة. تصف هذه الحالة زحف الارتباط التالي لوضع طعم نسيج ضام حر لمعالجة انحسار اللثة على القاطعة المركزية السفلية اليسرى. إن غالبية الحالات الواردة في المقالات والمتعلقة بزحف الارتباط كانت تالية لوضع الطعوم اللثوية الحرة وطعوم النسيج الضام الغائرة. وحسب معلوماتنا لم يسبق، في المقالات السنوية، ورود ذكر هذا النوع من زحف الارتباط عند استعمال النسيج الضام الحر فقط. إن حدوث زحف الارتباط في هذه الحالة يوضح أوجه التشابه في مراحل الاندماج التالية لاستعمال الطعم اللثوي الحر.

This paper reviews in details aspects of reported creeping attachment in the literature and in addition reports a clinical case with detailed descriptions and follow-up period of one year. The case report describes a creeping attachment that developed after using free connective tissue graft to treat a gingival recession on the lower left central incisor. Most of the cases on creeping attachment were reported in literature following free gingival grafts and submerged connective tissue grafts. To the author's knowledge, this type of creeping attachment using purely free connective tissue graft has not been previously reported in the dental literature. The developed creeping attachment in this case displayed a similar way of healing events that had been reported following free gingival grafts.

INTRODUCTION

Two mechanisms by which recession can heal as a result of soft tissue grafting of the denuded root surface have been reported in the literature. The bridging mechanism¹ which can be defined as the persistence of part of the graft over the denuded area, i.e., a portion of grafted tissue over the avascular surface will escape necrosis and survive by receiving circulation from capillaries in the vascular portion of the recipient site. This mechanism is the most encountered type of healing in the clinical practice. The second mechanism by which recession can heal as a result of grafting is known as creeping attachment,² and it is much less frequently encountered than the former.

The objective of this paper was to review in details aspects of reported creeping attachment in the literature and summarize the findings as well as to report a case of a unique creeping

attachment after free connective tissue grafting of deep and moderately wide gingival recession.

Creeping Attachment

Creeping attachment was first described by Goldman and colleagues² as "the postoperative migration of the gingival marginal tissue in a coronal direction over portions of a previously denuded root" following mucogingival procedures to correct insufficient or absent attached gingiva using free gingival grafts. This creeping attachment took place only sometimes after healing of the free gingival graft, particularly in the lower anterior segment and is not a predictable phenomenon.

This creeping attachment was also noted by Bernimoulin³ and co-workers after using free gingival grafts in an attempt to cover partially or totally a previously denuded root. The gingival attachment became firmly attached to the root surface and the probing did not show any deep sulcular depth.

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The creeping attachment was also reported following connective tissue graft by Harris⁴ using submerged flap technique in an attempt to cover the denuded root surface. More recently, this phenomenon was also reported following the use of dermal matrix allograft material (Alloderm) by Haeri and Parsell⁵ and their findings were comparable to the free gingival graft findings in the literature on creeping attachment.

Onset and Extent of Creeping Attachment

The onset of creeping attachment following graft procedure is not an immediate mechanism and it occurs sometimes following the initial healing which predominately happened by bridging rather than creeping.¹⁻⁵ As pointed out by Bell *et al.*,⁶ most of the studies on grafting over recession did not make a distinction between the two mechanisms of healing. In their study, these authors reported the results obtained in a series of patients after 2 weeks of placement of free gingival graft over areas of recession (bridging) and several months after surgery (creeping attachment). After 2 weeks, they showed three cases in which the graft over the root surface was lost (no bridging) and one case of bridging. In the case with bridging, 2 mm of root was covered. One year after treatment, some creeping attachment was observed in all cases. It amounted to an average of 0.89 mm of root coverage after one year with standard deviation as high as 0.46 mm. The authors also showed that creeping did not seem to occur at a constant rate but seemed rather to be the result of successive recession and creeping.^{6,7}

Ward⁸ observed creeping attachment of 1.5 mm after 6 months on two thirds of his cases after using the free gingival graft technique in areas of frenum pull. Matter⁹ investigated creeping attachment after free gingival graft procedures for

5 years. He discovered mean coverage of 0.89 mm, which amounted to 70% of total root coverage. There were no significant differences between attachment levels at 1 year and 5 years. This finding supported the findings of Golman and colleagues¹ that the coronal migration of gingival margin continued for period of time until a consistent gingival marginal level was reached. Matter⁷ reported that creeping reached the maximum after 1 year and it was negligible thereafter. On the other hand, Harris⁴ reported mean creeping attachment of 0.8 mm in his subjects using partial thickness double pedicle connective tissue graft.

Factors Influence Creeping Attachment

Matter and Cimasoni¹⁰ studied 20 cases of localized gingival recession treated by free gingival grafts in order to determine which conditions predisposed to creeping attachment. In their study, factors which influenced the degree of creeping attachment were: (1) width of recession, (2) position of the graft in relation to the denuded root surface, (3) position of the tooth in the arch, (4) the level of interproximal bone height, and (5) oral hygiene and ability to maintain optimum plaque control. In their study, the best results of coverage by creeping attachment were obtained in three cases where the recession had been classified as narrow (width less than 3 mm) and the graft placed over the denuded root surface. However, creeping attachment was less successful in areas of wide recessions (0% to 33%).

CASE REPORT

In the dental literature, most of the cases on creeping attachment were reported following free gingival graft which include epithelial layer together with underlying connective tissue, after

connective tissue graft submerged by the overlying flap, and after using allograft material (dermal matrix allograft).¹⁻¹⁰ This case report describes a creeping attachment that developed after using free connective tissue graft without the overlying epithelial layer to treat a gingival recession on the lower left central incisor which was placed directly over the denuded root. A dental literature search did not show that this type of creeping attachment using free connective tissue graft had been previously reported.

During clinical examination of a 50-year-old female at the Periodontal Clinic in 2000, it was observed that there was an inadequate band of keratinized gingiva less than 1 mm in an area of recession 4 mm apicocoronally (depth) and 2.5 mm mesiodistally (width) on the facial aspect of the mandibular left central incisor. The tooth is an abutment of a 3-unit fixed partial denture and restored with porcelain fused to metal retainer and had been placed 5 years earlier. There was mild to moderate marginal gingival inflammation. The recession defect was classified as Class II using Miller's classification of the marginal tissue recession.¹¹ There was minimal loss of interdental bone on the distal aspect with slight loss of soft tissue at the site next to the pontic area (Fig. 1a & b).

The patient's medical history was noncontributory but she had complained of gingival sensitivity during brushing of this tooth. The reason for this gingival sensitivity was explained to the patient and an autogenous free connective tissue graft surgical procedure was recommended to her to increase the amount of keratinized gingiva in this area and to achieve partial or complete coverage of the denuded root. The patient agreed to this treatment plan and signed the informed consent. Therapy was initiated with instructions for correct plaque control and brushing technique using modified Stillman's method of tooth

brushing, followed by scaling and root planing.

Surgical Procedure

At the surgical treatment, after local anesthesia had been achieved, the exposed root of the mandibular left central incisor was planed thoroughly with a Gracy's curette, followed by burnishing a tetracycline hydrochloride solution (50 mg/ml) over the root with a cotton tip for 3 minutes (Fig. 1c & d). The area on the central incisor that was to



Fig.1. (a) Lower left incisor (tooth # 31) with 4 mm depth gingival recession and minimum firm gingival tissue (keratinized gingiva) apically. (b) Slight loss of interdental bone distal to tooth # 31. (c) Root planing performed on exposed root surface of tooth # 31. (d) Root conditioning of exposed root with tetracycline hydrochloride. (e) Free connective tissue graft harvested from the palatal premolar area (donor site). (f) Primary closure of donor site with 4-0 silk suture.

receive the soft tissue graft was prepared by the technique proposed by Sullivan and Atkins^{1,7} starting with the removal of the epithelium of the inflamed marginal tissue by sharp dissection followed by an incision made in such a way to prepare sufficient area of recipient bed apically and laterally to the area of the recession. This was expected to provide sufficient collateral circulation and allow the survival of the graft apical to the recession.

A free connective tissue graft was harvested from the palate using the two incisions technique in the premolars and first molar area. A 3 mm-thick graft was obtained, trimmed and the epithelial collar removed (Fig. 1e). Then the donor wound was sutured to achieve primary closure (Fig. 1f). The graft was transferred and placed directly over the denuded root as well as the bed area and stabilized with suture by means of interrupted 4-0 silk suture materials at the coronal and apical corners (Fig. 2a).

The patient received routine postsurgical instructions, including a 0.12% chlorhexidine mouth rinse twice daily along with 400 mg ibuprofen 4 times daily for pain control as needed.

The patient was followed up weekly for the first three weeks to assess healing and then once monthly for the first three months followed by three-months recall schedule. The following measurements as shown in Table 1 were made or assessed and recorded: The recession depth (RD) that is the distance from the cemento-enamel junction (in this case it coincided with the retainer margin) to the gingival margin, and the recession width (RW) that is the distance from the mesial and distal marginal gingiva at the level of the retainer margin, as well as gingival thickness (GT) being the transgingival sounding used to measure the thickness labiolingually at the middle of the grafted tissue that overlies the root, and the

amount of keratinized gingiva (KG) that is the distance from marginal gingiva to the mucogingival junction.

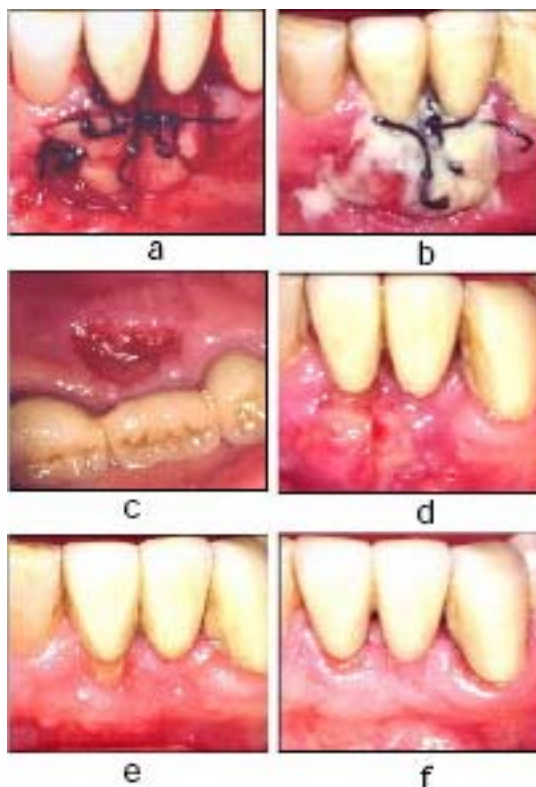


Fig. 2. (a) Graft stabilization on the recipient site with interrupted and cross mattresses suture technique. (b) Partial graft sloughing (necrosis) evident one week post surgery. (c) Secondary type of tissue healing at donor site one week post surgery. (d) Edematous phase of graft healing two weeks post surgery. (e) Six weeks post surgery, increased amount of firm gingival tissue apically and partial root coverage of exposed root surface through bridging mechanism were obtained 6 weeks after grafting (compare to Fig.1a). (f) Tremendous increase of the amount of firm gingival tissue as well as increased amount of root coverage by creeping attachment were evident one year post surgical grafting of the free connective tissue graft on tooth # 31 (compare to Figs.1a and 2e).

RESULTS

Table 1 summarizes the clinical measurements obtained through out the follow up periods. One week after the surgical procedure, the patient recorded no major problems, although survival problems were evident for the graft over

Table 1. Clinical measurements for lower left central incisor at different follow up periods in millimeters (mm)

	Recession Depth (RD)	Recession Width (RW)	Gingival Thickness (GT)	Keratinized Gingiva (KG)
Immediate before grafting	4.0 mm	2.5 mm	1.0 mm	0.5 mm
3 months follow up	2.5 mm	2.0 mm	3.0 mm	3.0 mm
12 months follow up	0.5 mm	1.0 mm	2.5 mm	5.0 mm

the previously denuded root (Fig. 2b). The donor site showed evidence of good healing with slight erythema with no exposure of the bone (Fig. 2c). After second week of healing, edematous phase of healing was evident and there was some necrosis of the graft and loss of coronal part. Bridging mechanism of healing took place during this period particularly in the apical part of grafted tissue over the root, which survived and escaped necrosis (Fig. 2d).

Six weeks post operative follow up showed a significant increase in the amount of keratinized gingiva as well as increase in the thickness of the gingiva. There was partial coverage of the previously denuded root which amounted to 37.5% root coverage (Table 2) and (Fig. 2e). Patient resumed normal brushing with no more complains of gingival sensitivity during brushing continuing regular periodontal maintenance was recommended for her. Patient failed to attend the first 3-month follow-up and only showed up for the regular maintenance one year after the surgery, when it was noticed that a significant creeping attachment (Fig. 2f) had developed, which almost covered entirely the previously denuded root of lower left central incisor which amounted to about 2 mm of coronal migration of the gingival margin and resulted in about 87.5% total root coverage (Table 2). The marginal tissue remained firmly attached and probing depth was minimal.

Table 2. Amount and percentage of root coverage obtained after free connective tissue graft on lower left central incisor (specify by the healing mechanisms)

	Amount of root coverage in millimeter (mm)	Percentage of root coverage (%)
Bridging mechanism	1.5 mm	37.5 %
Creeping mechanism	2.0 mm	50.0 %
Total	3.5 mm	87.5 %

DISCUSSION

This case support the presence of the two healing mechanisms of soft tissue graft as a procedure to cover the denuded root surface; the bridging mechanism as proposed by Sullivan and Atkins¹ which was evident in this case during the first three weeks of healing and resulted in about 1.5 mm of root coverage (37.5%), and the creeping attachment mechanism which first noticed by Goldman *et al.*¹² and which was observed one year after grafting.

Two mm coronal migration of the gingival tissue (creeping) in the present case exceeded the reported mean creeping of 0.89 mm reported by Matter⁷ after 5 year follow-up following surgery, but in agreement with the percentage of root coverage which in this case was about 50% of the total root coverage. Recently, 5 mm of a unique creeping attachment was reported by Otero-Cagide and Otero-Cagide¹³ after gingival grafting of a deep and wide recession (more than 3 mm) on a maxillary molar which was far more than the amount of creeping in our case and this may be attributed to the type of surgical technique used.

This degree of creeping attachment may be attributed to the original width of recession which was less than 3 mm (narrow) and the graft was directly placed over the denuded root surface. This agreed with the findings of Matter and Cimasoni¹⁰ who monitored creeping attachment after free gingival grafts on

20 patients for 2 years and reported that optimal coverage of denuded root surface was obtained in areas of narrow recession when the graft was placed directly over the receded area. It is not known if the harvested graft thickness played a role in the result achieved. In this case a thick graft about 3 mm thick was obtained.

The creeping attachment following purely free connective tissue graft without the overlying epithelium as in the present case displayed similar biologic events as reported in the dental literature following free gingival graft where the epithelial layer was present. This suggested that the connective tissue and not the overlying epithelium might be the determinant and the controller of the creeping attachment mechanism. This may be added to the findings of Karring *et al.*¹⁴ who demonstrated in animal study conclusively that the determinant for epithelial differentiation (keratinization or non-keratinization) was the underlying connective tissue. Therefore, well-designed animal and clinical trials, with careful observation of the healing process of autogenous soft tissue grafts over the long term, are needed to identify the role of genetic determinants inherent in the connective tissue in the mechanism of creeping attachment. This clinical phenomenon although is reported to occur nevertheless, the onset, duration and the amount of creeping attachment are still unpredictable.

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