Calcium sulfate combined with guided tissue regeneration: A novel technique in treatment of gingival recessions

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Abstract

The presence of mucogingival problem around anterior teeth is a challenge to the clinician as not only biological and functional aspects has to be addressed but esthetic aspirations of the patient have to be met. The use of guided tissue regeneration (GTR) procedures for the treatment of gingival recession has shown encouraging results and is gaining clinical acceptance. However, maintenance of space under the membrane remains a problem for clinicians. Hence, this case study was an innovative attempt to evaluate the effect of adjunctive calcium sulfate placement along with collagen membrane GTR-based root coverage procedure.

Keywords: Calcium sulfate, coronally advanced flap, gingival recession, guided tissue regeneration

Introduction

Gingival recession affects larger portion of adult population which is the apical shift of gingival margin beyond cementoenamel junction (CEJ).[1-3] The main factors contributing to this phenomenon are toothbrush trauma,[4] iatrogenic factors[5] (uncontrolled orthodontic movement in terms of force), improper restorations, oral habits, and viral infections of the gingiva.[6] Compromised esthetics, hypersensitivity, higher incidence of root caries, and poor plaque control are associated with gingival recession.[2] Predictable correction of gingival recession defects remains a challenge for clinician. Several techniques such as the laterally positioned pedicle graft, coronally advanced flap (CAF), free gingival graft, and subepithelial connective tissue graft are used which have yielded promising results.[7]

Investigators have reported successful root coverage using surgical techniques based on the principles of guided tissue regeneration (GTR).[8-10] GTR based root coverage, however, offers the additional potential benefit of new attachment formation (bone, cementum, periodontal ligament, and connective tissue) along the previously denuded root surface.[11]

It is very difficult to maintain the space under the membrane since the membrane tends to collapse against the root surface. The use of bone graft under a membrane can prevent this and enhance clot stability and cell proliferation.[12]

Unlike demineralized freeze-dried bone allograft (DFDBA), calcium sulfate does not possess osteogenic properties, but it has been used successfully as a binder/filler, functioning as a scaffold-type material in composite grafts and also as a resorbable barrier.[13]

Doxycycline application to the root surface enhances the binding of fibronectin, which in turn favors the attachment and growth of fibroblasts on the root surface.[14]

The purpose of this unique study was to check the effectiveness of barrier and graft especially calcium sulfate along with root conditioning for the treatment of Miller's Class I recession.

Case Report

A 24-year-old male soldier reported to this establishment with the chief complaint of sensitivity and unsightly appearance in relation to 11 and 21. His medical history was noncontributory. He was a nonsmoker too. Periodontal evaluation was carried out using William's probe. The

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following measurements were noted: Recession depth (RD), recession width (RW), width of keratinized gingiva (KG), clinical attachment level (CAL), and probing depth (PD). RD and CAL were recorded relative to the CEJ. RD was measured at the midfacial aspect of the tooth, from CEJ to free gingival margin which was 3 mm. RW was measured 1 mm apical to the CEJ, which was 4 mm. KG was determined by subtracting RD from the CEJ-to–mucogingival junction (MGJ) measurement. CAL was 5 mm, and the PD was 2 mm. In addition, gingival thickness (GT) was measured at a buccal location 1 mm apical to bottom of sulcus using number 15 reamer endodontic instruments. No muscle pull affecting the area was present. Thus, diagnosis of Miller's Class I localized gingival recession was arrived upon [Figure 1].

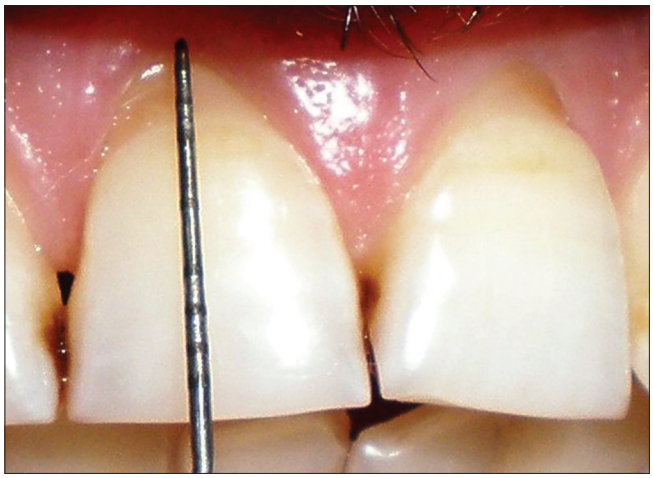

Figure 1: Class I localized gingival recession recession in relation to 11

Surgical protocol

Recession site was prepared according to the standard root coverage procedure described previously.[7] After achieving adequate local anesthesia, a sulcular incision was made from the mesiofacial line angle to the distofacial line angle of the teeth. The sulcular incision was extended horizontally into each adjacent papilla, at a level just coronal to the CEJ, to within 1 mm of the adjacent teeth. Starting at the terminal ends of the horizontal incision, two vertical incisions were extended apically well beyond the MGJ to allow adequate flap mobilization [Figure 2]. The vertical incisions diverged significantly while progressing apically to preserve blood supply to the flap. The trapezoidal pedicle flap was initially elevated split thickness in the papillary gingiva, then progressed full thickness from the osseous crest to the MGJ, and finally, split thickness again apical to the MGJ. Split-thickness dissection in the apical portion severed the periosteum to allow tension-free coronal positioning of the flap [Figure 3]. The accessible root surface was planned smooth with a hand instrument to eliminate any surface contamination. Subsequently, the root was conditioned with doxycycline hydrochloride (50 mg/5 ml in sterile solution) by light burnishing action using cotton tip applicator for 90 s followed by saline water irrigation. Next, papillae adjacent to the recipient tooth were deepithelialized with a 15C scalpel. Following flap reflection, intra-bone marrow perforations were made with a ½ round bur in the interproximal areas mesial and distal to the recipient teeth roots. A bovine collagen membrane (Guidor matrix barrier, Guidor AB, Huddinge, Sweden) was trimmed to cover 2–3 mm of bone surrounding the exposed root surface. The membrane was secured to the tooth at the level of the CEJ with one 6-0 resorbable monofilament (Ethicon/Johnson and Johnson) sling-tag suture engaging both membrane and papillae. The calcium sulfate graft (Capset, Lifecore Biomedical, Chaska, MN, USA) was mixed with saline to get a gel like consistency which was placed under the membrane using a sterile syringe. Finally, the pedicle flap was coronally positioned to cover the membrane and secured to the adjacent papillae with interrupted 6–0 resorbable monofilament sutures. Interrupted resorbable sutures were then used to close

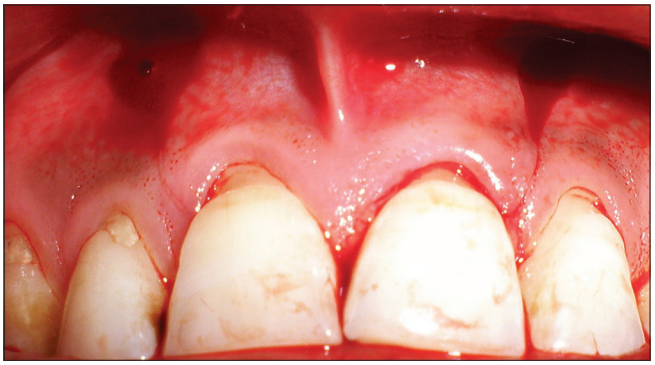

Figure 2: Vertical incision given mesial and distal to 11 and 21

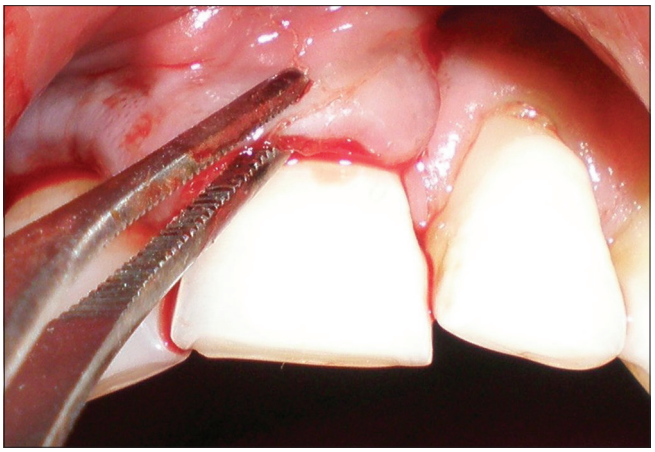

Figure 3: Coronal advancement of flap done

the vertical incisions [Figure 4]. Care was taken to ensure tension-free flap closure. No periodontal dressing was used. After surgery, routine postoperative instructions were given. A nonsteroidal anti-inflammatory analgesic was prescribed. No antibiotics were prescribed. Postoperative home care instructions included refraining from any mechanical cleaning of the surgical areas for 4 weeks. The patient was then

instructed to rinse twice daily with a 0.12% chlorhexidine gluconate mouthrinse for the next 2 weeks. Healing was uneventful at the end of 3 weeks [Figure 5]. After 4 weeks, patients resumed gentle toothbrushing. Patients were seen at 1 week, 2 weeks, 3 weeks, 3 months, and 6 months [Figure 6]. Professional prophylaxis without prophy paste and reinforcement of oral hygiene instructions were also performed if indicated at each posttreatment visit.

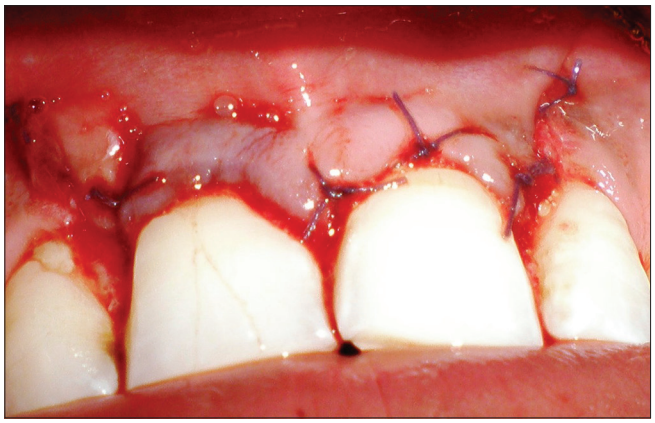

Figure 4: Sutures placed

Figure 5: Postoperative healing after 3 weeks

Figure 6: Postoerative view after 6 months

Results

After 6 months, 100% root coverage was achieved in 11 and 97% in 21. There was total reduction in both RD and width. Gain in CAL and KG was noted. No change was noted in PD. Slight increase in GT was also observed. During the healing period GTR was not exposed at any time.

Discussion

The periodontal literature describes several surgical procedures and clinical variations to cover root surface exposed by facial gingival recessions. The purpose of this case study was to determine the feasibility of adding bone graft, in particular calcium sulfate, along with collagen membrane-based GTR root coverage procedures. Our results indicate that calcium sulfate plus a collagen barrier could be used to successfully treat gingival recession defects.

CAF presents several advantages with respect to other techniques: (a) Reduced discomfort and pain for the patient (avoidance of second surgical site); (b) easy-to-perform surgical technique; and (c) excellent esthetic results. According to the literature, the mean root coverage obtained by CAF in the treatment of Miller Class I and II defects ranges from 60% to 99%.[15,16] Hence, in this study CAF was employed.

Collagen is a natural material that is well-tolerated by the host tissue. It is physiologically absorbable, and it behaves similarly to subepithelial connective tissue grafts by providing a collagenous scaffold for tissue repair. It may secondarily augment the volume of gingival tissues following *in vivo* expansion, enzyme degradation, and eventual replacement by the surrounding connective tissue.[17] The creation and maintenance of space between the root surface and the overlying GTR barrier is considered critical to the success of all GTR procedures, including those aimed at achieving root coverage.[18]

Literature is replete with studies of the addition of DFDBA may create and maintain extra space that is needed for new attachment formation.[7] On similar lines calcium, sulfate was used as it is easily available, cheap, and biocompatible. The use of calcium sulfate as a graft/barrier may act as a binder, facilitating healing, and preventing loss of grafting material. It is well documented that calcium sulfate acts as a barrier, is tissue compatible, and does not interfere with the healing process.[19] As a barrier, it prevents the colonization of the defect by gingival cells, allowing selective repopulation of the defect by periodontal ligament cells. Calcium sulfate is biocompatible, and it completely resorbs within 4–10 weeks, depending on the vascularity of the grafted site.[13]

It is possible that the addition of calcium sulfate in the present study had a positive influence on healing. Thus, achieving satisfactory root coverage and reductions in RD and RW. The increase of KG may be due to a potential space created by calcium sulfate and by the collagen membrane itself. A study[17] reported that collagen membranes prevent apical migration and further support new connective tissue attachment. This often results in increased overlying flap thickness. The gain in clinical probing attachment with no change in PD suggests that a new attachment formed.[20] However, because of lack of histologic evidence, it is impossible to determine whether this gain in attachment resulted from the formation of a long junctional epithelium, a new connective tissue attachment, or a combination of both types of healing.

Doxycycline has been shown to retain its antimicrobial effect when combined with calcium sulfate; thus, the addition of the doxycycline may have improved the response to grafting. The doxycycline binds not only to the graft material but also to the root surface.[7] This study demonstrated that this binding may facilitate graft incorporation into the bone, resulting in an improved regenerative outcome over calcium sulfate alone.

Conclusion

It is important to emphasize that this was a unique case study attempted to cover recession defects using a combination of principle of GTR and calcium sulfate. Though the result was encouraging, result needs to be interpreted with caution. A randomized controlled trial comparing collagen membranes with and without calcium sulfate is underway to evaluate the clinical efficacy of this combination approach. Results from this study indicate that use of calcium sulfate along with collagen membrane could be beneficial in promoting favorable clinical results.

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Conflicts of interest

There are no conflicts of interest.

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