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Case Report

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Root Coverage Effectiveness of Subepithelial Connective Tissue Graft

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Abstract

Several periodontal plastic surgical techniques have been proposed to obtain root coverage. All of these procedures are able to provide significant root coverage for Miller class I and II recession defects. However, only the subepithelial connective tissue graft in conjunction with a coronally advanced flap appears to be consistently effective across all the clinical parameters. It is therefore currently considered the gold standard in gingival recession therapy. The major shortcomings of connective tissue graft procedures include the patient's morbidity associated with the second surgical site and the limited availability of palatal donor tissue. For these reasons, alternative procedures using membranes, enamel matrix derivative, platelet rich fibrin and soft tissue substitutes such as acellular dermal matrix and xenogeneic dermal matrix have been introduced. When comparing clinical results, the use of these different alternatives is associated with inferior outcomes. Other drawbacks can be related to their cost and ethical concerns. Moreover, there is also limited available data focusing on the long-term outcomes following treatment with these biomaterials. In conclusion, the clinician's decision should consider the clinical situation, the availability of palatal donor tissue as well as the patient's preferences.

Keywords, Gingival Recession, Connective Tissue Graft, Soft Tissue Substitutes, Complete Root Coverage

Introduction

The subepithelial connective tissue graft (SCTG) has been proposed to obtain root coverage of gingival recession defects. The major shortcomings of this procedure include patient morbidity associated with the second surgical site and limited availability of palatal donor tissue. For these reasons, alternative surgical procedures using membranes, enamel matrix derivative, platelet rich fibrin and soft tissue graft substitutes have been proposed and tested. The aim of the present paper is to discuss the value of using subepithelial connective tissue graft in the surgical management of gingival recessions.

Observations

Case Description

A 26-year-old female patient consults in the Department of Periodontology, presenting gingival recessions affecting multiple adjacent teeth in the esthetic area. Her chief complaint was the unfavorable aesthetic appearances during the smile due to root exposure. All the recessions fell into Miller class I (Figure 1). The patient showed an unremarkable medical and periodontal history. Gingival recessions were caused by traumatic tooth brushing.

Figure 1: Baseline: gingival recessions affecting multiple adjacent teeth in the maxilla and mandible, leading to aesthetic damages.

Initial Therapy

Following the clinical examination, the patient received sessions of prophylaxis to remove microbial deposits, including instruction in proper oral hygiene measures, scaling and professional tooth cleaning. She was instructed to use a coronally directed roll technique to minimize toothbrushing trauma to the marginal soft tissues. Surgical treatment was not scheduled until the patient could demonstrate an adequate standard of plaque control.

Surgical Technique

In both sides of the maxilla, we performed the coronally advanced flap modified by Zucchelli and De Sanctis associated with a subepithelial connective tissue graft [1]. After local anesthesia, we measured the marginal gingival recessions with a periodontal probe and reported its readings on the sides of the defects starting from the tips of the papillae. Oblique submarginal incisions were made in the interdental areas, continued with intrasulcular incisions at the recession defects. Surgical papillae were dislocated from the anatomic papillae by the oblique submarginal incisions (Figure 2b, 3b). The flap was then raised with a split-full-split technique. The root surfaces were mechanically treated with the use of curets. A subepithelial connective tissue graft was harvested from the palate and fixed to the recipient bed (Figure 2c, 3c). The flap was coronally advanced covering both the connective tissue and the recessions and fixed with sling sutures (Figure 2d, 3d). Nine months later, a coronally advanced flap with a SCTG was performed to treat the mandibular recessions (Figure 4).

Figure 2: Surgical technique. a: baseline ;multiple recessions affecting teeth #12 through #15. b: flap design; oblique sub marginal incisions in the interdental areas continued with the intrasulcular incision at the recession's defects. c: flap elevation (split-full-split technique), fixation of a SC TG to the prior deepithelialized papillae. d: coronally advanced flap and sutures.

Figure 3: Surgical technique. a: baseline ;multiple recessions affecting teeth #22 through #25. b: flap design; oblique submarginal incisions in the interdental areas continued with the intrasulcular incision at the recession's defects. c: flap elevation (split-full-split

technique), fixation of a SCTG to the prior deepithelialized papillae. d: coronally advanced flap and sutures.

Post-Surgical Instruction

The patient was instructed not to brush her teeth in the treated area but to rinse her mouth with a chlorhexidine solution (0.12%) daily. Sutures were removed after 14 days. The patient was recalled for prophylaxis once every three months after suture removal.

Results

All the treated recessions were covered. The tissues were of the same color and texture of the neighboring sites hence an optimal aesthetic integration was obtained.

Discussion

Clinical Results of Connective Tissue Graft Based root coverage procedures

The coronally advanced flap (CAF) as a stand-alone procedure was compared to the Subepithelial Connective Tissue Graft (SCTG) in several Randomized Clinical Trials (RCT). Kuis et al.

Figure 4: a: baseline ;multiple recessions affecting teeth #42 through #32. b: flap design: triangular submarginal incisions in the interdental areas continued with the intrasulcular incision at the recession's defects. c: flap elevation and mobilization with a dissection into the lining mucosa. d: fixation of a SCTG to the recipient bed after papillae DE epithelialization. e: sutures

in 2013 has conducted a RCT in a split mouth-design in order to evaluate the effectiveness of CAF alone versus CAF with CTG. The Split mouth-design, instead of parallel group, was used to ensure more objective evaluation, since both procedures were performed in each mouth by the same operator (Figure 5, 6). In such a manner, patient influence on post-surgical wound healing (mainly oral hygiene habits) was equal for both procedures. Both surgical procedures resulted in reduction of recession, which was greater in the CAF with CTG group. This difference was not statistically significant after 6 months [2].

Figure 5: One-year follow-up: complete coverage has been achieved in all treated recessions. Note the increase of keratinazed tissue especially at tooth #13.

Figure 6: Three months follow-up: complete coverage of the treated

As a conclusion, the CTG with a CAF provide a better long-term clinical outcome than CAF alone. However, the evaluation of the effectiveness of SCTG in surgical treatment of Miller Class II showed that the CAF with CTG procedure provides significantly better results only for Keratinized Tissue values, the same could not be applied to the reduction of recession and Complete Root Coverage (CRC) values in all observed follow up periods [2]. The author concluded that opposed to class I, long-term stability of the gingival margin is less predictable for miller class II. Which confirms the finding of Pini Prato et al. that baseline KT width is a predictor for GR reduction in the CAF technique [3]. Concerning the Class III (and IV) of GR, according to Miller CRC cannot be obtained in sites with inter dental bone loss. Hence, Cairo et al. has conducted a RCT with the aim to evaluate the efficacy of the adjunction of CTG under a CAF for the treatment of single GR with loss of inter-dental clinical attachment (RT2). He found, that in opposition to Miller, CRC can be achieved in RT2 GR. The additional use of a CTG results in a greater number of sites with CRC; up to >80% of the sites (when the baseline amount of inter-dental CAL is ≤ 3 mm) while sites treated with CAF experience soft tissue contraction in the early healing phase. Thus, supporting the role of CTG in limiting the post-operative apical shift of the gingival margin following the CAF technique [4]. Those conclusions have been confirmed lately after three-year extension of this study [5]. In regards to multiple GR, Pini Prato et al. has conducted a CCT with a split mouth design and f ive year follow-up period, to evaluate effectiveness of CTG in the treatment of class I, II and III multiple GR. As a result, he observed a coronal displacement of the gingival margin of the CAF with CTG treated sites due to a creeping attachment effect over time and may be facilitated by the thick gingival tissue obtained after positioning of a CTG. While the CAF treated sites showed an apical relapse of the gingival margin between the six month and five-year follow-up [6]. Zucchelli et al. provided additional evidence to answer whether or not, a graft was needed in the treatment of multiple GR defects. The study demonstrated that there were no statistically significant differences in gingival recession reduction and CRC between both groups at the six month and one-year time point. However, after five years, the group treated with a CAF with SCTG displayed significantly greater recession reduction, greater stability of obtained CRC, greater buccal Keratinized Tissue Width (KTW), and better soft tissue contour than the group treated with CAF alone. Thus, the authors concluded that a graft is recommended to maintain long-term root coverage stability. According to them, the CTG provide greater soft tissue thickness and width that facilitate the long-term patient maintenance and thus the stability of root coverage [7]. Other RCTs has compared the SCTG to Free Gingival Graft (FGG) in coverage of GR. Besides the closer blend of the graft with adjacent tissue and improved esthetics with SCTG avoiding the patchy healing seen with the FGG, the adjunction of the CTG provide a greater percentage of root coverage. On the other hand, both techniques significantly increased the width of KT [8, 9].

Clinical Results of Guided Tissue Regeneration (GTR) with Barrier Membrane Root Coverage Procedures

GTR based root coverage procedures were introduced to promote new attachment, new bone and new periodontal ligament formation. Since 1995, RCTs have been developed to assess its effect on root coverage, KTW and CAL. However, limited data exist on aesthetic condition change related to patient opinion [10]. GTR, as an emerging new technique had been compared to conventional muco-gingival surgery. RCTs comparing GTR with pedicle flaps (CAF) shows that it appears ineffective in improving the clinical outcomes [11]. The use of demineralized xenograft ovoid the collapse of membrane against the root surface and aids to maintain a sufficient space in order to allow cells to colonize the area and form new periodontal tissue which particularly should be an advantage when the defect morphology itself does not create a space, as in the situation of GR in contrary of intrabony defect [12-14]. Other factors may influence the outcome of GTR based root coverage procedures such as the type of membranes. In this way, authors concluded that non-absorbable and absorbable membranes provide similar outcomes [15]. However, the need for a second surgical procedure to remove the membrane (non-absorbable) which causes stress to the patient, additional time for the surgeon and causes trauma to the immature newly regenerative periodontal tissues limited the indication of such membranes in favor of bio absorbable matrix [12, 13]. Conflicting clinical outcomes were also reported when GTR-based root coverage procedures were compared to the CTG. The effectiveness of GTR in obtaining stable results was also demonstrated in other comparative studies. Despite the procedure adopted for SCTG, the CTG based root coverage techniques led to better outcomes in term of KTW increase, gingival thickening and root coverage (Mean Root Coverage MRC and CRC) [14, 15]. Other studies have reported less favorable outcomes in GTR technique comparing with SCTG. The fact that root coverage after GTR therapies is less stable than CTG may be due to less KTW at GTR treated sites [16]. This discrepancy of results can be related, in addition to factors described above (adjunction of bone substitute, type of membranes…), to the exposure of membranes during the healing phase which leads to contamination [17]. Hence, bacterial colonization of membranes has been negatively correlated with CAL gain and positively correlated with GR [18]. Another factor that could interfere with the amount of RC is the initial recession depth. In fact, deep recession defect (≥5mm) had greater RC after GTR treatment. Another shortcoming of the GTR-based root coverage technique is that it is not suitable for the management of multiple recession defect at the same time [15] Taken together, GTR-based root coverage has various limitations, and so its routine use cannot be recommended at present.

Clinical Results of Guided Tissue Regeneration with Enamel Matrix Derivative (EMD) Root Coverage Procedures

The use of EMD has been proposed as another approach to substitute the CTG in root coverage procedures and to promote periodontal regeneration on the previously exposed root surface. Mcguire et al. demonstrated the presence of a new cementum, organizing fibers of periodontal ligament and islands of condensing bone when EMD is associated to CAF (9 months after surgery). Despite the limit of its study (fenestration of the flap), he concluded that EMD may possess potential for enhancing periodontal regeneration of CAF over denuded root surfaces [19]. This result has been confirmed later in 2016 by Micheal K, McGuire et al. They concluded that "EMD+CAF continues to show histologic evidence of periodontal regeneration via human histology". However, the use of EMD appears to be less effective than the CTG in increasing the width and thickness of KT. Many histological studies have been performed on the use of

EMD in association with CTG in recession coverage, however, at present there is not enough evidence to support this combination [20]. Clinical Results of Platelet Rich Fibrin (PRF) Root Coverage Procedures Since 2005, the effectiveness of PRF (or Platelet Rich Plasma) has been evaluated in ten RCTs, with short follow-up (six/twelve months) and only in class I and II GR defects. When comparing PRF based root coverage procedures to CAF with SCTG, Eren et al. demonstrated that CAF + PRF results earlier vessel formation and tissue maturation compared to CTG. Thus, suggest that "PRF might enhance angiogenesis and neovascularization through the release of pro-angiogenetic factors in the early phases of wound healing. However, there is very poor information's about the healing of PRF based root coverage procedures. To summarize, since earlier studies showed discrepancy in clinical outcomes, more long-term RCT are necessary to adequately confirm if PRF can be considered as a suitable alternative of CTG in root coverage procedures [21].

Clinical Results of Acellular Dermal Matrix Allograft (ADM) Root Coverage Procedures

The use of ADM in periodontal plastic surgery has been proposed as a substitute for palatal donor tissue in order to eliminate the disadvantages associated with autogenous grafts. When tested clinically, several RCT has compared ADM to CTG in root coverage procedures, and obtained comparable clinical outcomes. When compared with CAF alone, the adjunction of ADM improved root coverage outcomes. The adjunction of ADM provided only greater tissue thickness [22]. Variations among studies may be due to different factors such as surgical procedures as we described above, surgical experience and skill of operators, tissue thickness, design of the studies and recall interval of patients [16]. Despites these discrepancies, the use of ADM in root coverage procedures can be considered a safe and patient-friendly alternative to autogenous donor tissue [23, 24].

Clinical Results of Xenogeneic Collagen Matrix (XCM) Root Coverage Procedures

Recently, XCM materials have been introduced as an alternative to ADM and autogenous tissue in root coverage procedures. When used in a clinical setting, the XCM is intended to act as a temporary 3D scaffold to support host cell infiltration and tissue ingrowth without eliciting a foreign body or immunogenic response. Several RCT demonstrated that the use of XCM in the treatment of recession defect significantly improved clinical outcomes in terms of root coverage, GT and KTW when compared with CAF alone [25,26]. It could be concluded that XCM provides a viable and long-term alternative for the CTG, when balanced with patient-reported outcomes for esthetics and compared with historical root coverage results reported by other investigators [27,28]. A possible approach to further improve the clinical outcomes of XCM is the combination with EMD. However, a recent study failed to demonstrate enhanced clinical outcomes of XCM + EMD + CAF compared to XCM + CAF [25, 26].

Summary and Critical Remarks

CTG-based procedures lead to the best outcomes for clinical practice (i.e. superior percentages of MRC and CRC and significant increase of KT) when compared to most of the other surgical techniques [29]. The base of evidence on CTG-based procedures is very vast and dense. The short- and long-term outcomes (≥24 months) presented in the literature indicate that CTG-based procedures may provide superior and more stable outcomes than CAF alone, CAF + biomaterials, laterally positioned flap and FGG. Evidence suggests that CTG promotes better stability of the gingival margin and some degree of creeping attachment over time compared to other surgical approaches. Regarding the different alternatives, EMD and soft tissue substitutes (mainly ADM) can significantly improve recession depth, CAL, and the KTW (MRC and CRC are comparable to ones reported by CTG). XCM may be used as well but with inferior outcomes [23,24,29]. The available information on the use of PRF associated to CAF is very scarce and it precludes formal accurate comparisons with CAF alone or CAF + CTG or another biomaterial [23]. For the increase of the width and volume of keratinized tissue, ADM and XCM performed worse than CTG or FGG [30]. In case where both root coverage and gain in the KTW are expected, the available evidence base suggests that the use of CTG seems to be more adequate. The base of evidence on ADM based procedures is somewhat long and solid. In statistical terms, there is no significant differences between ADMA and CTG procedures in terms of MRC and CRC (but CTG showed a trend of better outcomes), ADM may provide 15 % more MRC than CAF alone (at six months). For XCM, it led to 9 % less MRC than CTG [23, 24].

Conclusion

Various biomaterials have been proposed as a substitute for autogenous grafts in root coverage procedures. Current evidence, as we already discussed, suggests that enamel matrix derivatives, acellular dermal matrix grafts, and xenogeneic collagen matrices combined with pedicle flaps especially coronally advanced flaps can be considered a safe and effective treatment procedures for obtaining aesthetic root coverage. Moreover, the use of these soft tissue substitutes as an alternative to autogenous donor tissue offers certain advantages such as increased surgical efficiency, decreased chair time and reduced patient morbidity. This approach also appears to be particularly useful in patients with limited donor tissue availability or patients who wish to avoid a second site surgery. Despite this potential benefit, the use of soft tissue substitutes are still associated with inferior clinical results when compared with those of the connective tissue graft procedures. Other drawbacks can be related to their cost, ethical concerns regarding the origin, humans' cadavers for acellular dermal matrix and porcine for both xenogeneic collagen matrix and enamel matrix derivative. There is also only limited data available focusing on long-term outcomes following treatment with these biomaterials. Moreover, their use has been shown to be more technique-sensitive and less forgiving when compared to autogenous grafts. In conclusion, the clinician's decision to use soft tissue substitutes as an alternative to autogenous donor tissue should be based upon consideration of the clinical situation, availability of palatal donor tissue, and patient preferences.

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