AlloDerm, a biomaterial for the treatment of carious and previously restored cervical lesions associated with Miller Class I and Class II recession defects

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Abstract: Non-carious cervical lesions are defined as the loss of hard dental tissue (enamel, cementum and dentin) near the CEJ on the buccal surfaces of the teeth from reasons other than caries. Cervical lesions (carious and non-carious) are commonly treated using a restorative approach. Despite improvements in dentin bonding, the longevity and the esthetics of a class V restoration bonded to dentin remains problematic. The use of biological materials such as AlloDerm in the treatment of gingival recession has been proven to be a viable option with respect to esthetics and longevity. The aim of this case series is to describe the application of the tunnel technique utilizing AlloDerm to treat carious and previously restored cervical lesions associated with Miller Class I and Class II recession defects. Clinicians should consider all the options, surgical and restorative, for the treatment of cervical lesions.

Background

Gingival recession is a pathologic migration of the gingival margin apically from the CEJ which exposes the root surface[1]. It occurs frequently in adults and has a tendency to increase with age. A recent survey by Kassab and Cohen[2] revealed that 50% of the population between the ages of 18 and 64 are a victim of one or more gingival recession sites, while 88% of patients older than 65 have at least one recession site, with the number of recessed teeth increasing with age. Although gingival recession seldom leads to tooth loss, the clinical implications of recession includes esthetic complaints, dentin hypersensitivity, and a tendency for root caries. Various root coverage procedures with different degrees of success have been recommended in the past. These procedures include but are not limited to the coronally positioned flap[3], the double papilla flap[4], the subepithelial connective tissue graft[5], and the semilunar coronally positioned graft[6], to name a few. Among these techniques, the subepithelial connective tissue based procedures provide the best outcomes in terms of root coverage and increased keratinized tissue (KT)[7]. However, the connective tissue graft (CTG) has some disadvantages, such as there being a limit in the amount of graft that can be harvested, and that it requires a secondary surgical site, increasing the morbidity of the procedure. For patients with generalized recession, one or more donor sites may be required to acquire sufficient graft, involving multiple surgeries. To overcome these disadvantages, AlloDerm (LifeCell) has been used for gingival augmentation procedures. AlloDerm (ADM), widely used in both medical and dental surgery over the past 10 years, is an acellular dermal matrix. It is derived from donated human skin tissue supplied by

Fig. 1a: Pre-operative view. Failing class V restorations on teeth 21 and 23, and a lost filling/carious lesion on tooth 22

Fig. 1b: AlloDerm inserted into the pouch

tissue banks in the United States that are all within American Association of Tissue Banks standards and following of FDA guidelines. ADM is a viable biologic substitute for palatal donor tissue. Compared to the CTG, ADM offers several advantages: no donor site, unlimited supply, and similar clinical outcomes in the treatment of multiple recessions. In a recent systematic review, Chambrone et al[7] recommend that ADM with a coronally advanced flap (CAF) may be used as an alternative to the CTG. Gaspky et al[8] reported that there is no statistically significant difference between ADM and a CTG with respect to root coverage, gain of KT or probing depth reduction.

Non-carious cervical lesions are defined as the loss of hard tissue structure near the CEJ, usually on the buccal surfaces of the teeth. They are very prevalent in teenagers and adults, and the overall prevalence increases with age[9]. The exact aetiology of the non-carious cervical lesion (NCCL) is unknown but is generally accepted that its cause is multifactorial[10]. Many treatment modalities have been proposed for the treatment of the NCCL. Unfortunately, although NCCL restorations are very common in a clinical setting, they harbour restorations that have retention issues, frequent marginal excess, and secondary caries[11]. The failure of the restorative treatment of carious and non-carious cervical lesions is due to moisture[12], contamination, improper access to sub-gingival margins[13] and the presence of sclerotic dentin which has less micro-tensile bond strength than normal dentin[14]. It has been documented that even after the NCCL is treated, its progression is not arrested[15]. In addition to dentinal bonding problems (leakage), cervical restorations may compromise periodontal health. Poalantino et al[16] reported that the placement of cervical composite results in increased sub-gingival plaque, increased total gram-negative anaerobic bacterial count and decreased total gram-positive aerobic bacteria. Recently it has been shown that gingival recession associated with the NCCL can be successfully treated with a glass ionomer[17,18] /composite resin[19,20] restorative material, or by a coronally advanced flap. The use of ADM for the treatment gingival recession associated with NCCLs has been previously reported by Winter and Allen[21]. Little is known about the outcome of mucogingival surgery with the addition of a graft (autograft, such as CTG or allograft, such as ADM) directly onto carious or restored roots.

Root coverage after caries removal was first reported by Matter in 1979[22]. After this, Fourel et al[23] and Miller et al[24] reported root coverage and the regaining of clinical attachment on roots affected by root caries. The use of a connective tissue graft for root coverage after caries or restoration removal was first reported by Bruno et al[25], and then later by Urbani et al[26]. To our knowledge, this is the first article that reports the use of ADM in the treatment of carious and previously restored cervical lesions associated Miller class I and II recession defects. I will now outline the details of our tunnel technique with ADM for the treatment of carious and previously restored failing cervical lesions associated with Miller class I and II recession defects.

Case 1

A 45-year-old non-smoking female presented to the clinic seeking treatment for her multiple failing Class V restorations and Miller Class I recession defects on the buccal surfaces of her maxillary anterior teeth. The patient expressed concern about the frequent replacement of her restorations (three replacements in the past two years), about the color of her restored root surfaces, and about the gingival inflammation associated with her restorations. Her previous restorative dentists recommended the removal of the filling material and replacement with either a new restorative material or porcelain veneers.

The patient was not happy with the treatment options presented by her previous dentist and asked us what the treatment alternatives were. The clinical oral examination

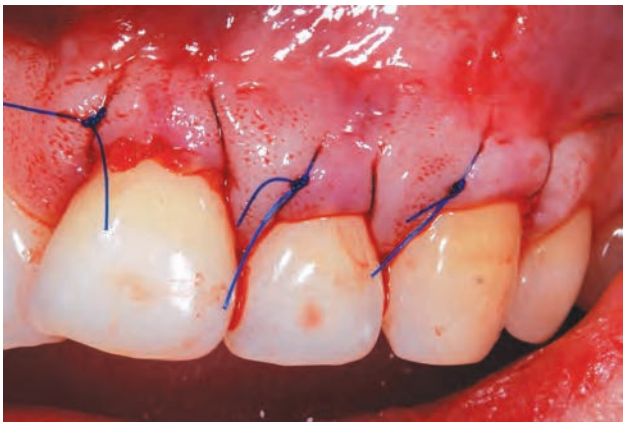

Fig. 1c: Double sling sutures around every tooth (5.0 polypropylene sutures)

Fig. 1d: Post-operative view at three months

revealed the presence of cervical restorations on the root surfaces of teeth 21 and 23 and a carious lesion associated with Miller class I recession on tooth 22. Probing depths were in the range of 1-2 mm, and the patient had a wide band of attached gingiva. The treatment recommended was the removal of the unaesthetic resin restorations and then grafting the area with an allograft (ADM) via a supra-periosteal modified tunnel technique. The patient accepted the treatment plan. In all of the following cases, after obtaining profound anaesthesia, the restorations and/or the cervical carious lesions were removed using surgical loupes, a handpiece (a Neumeyer bur used) and hand instruments (a Younger-Goog Curette used).

Fig. 1e: Post-operative view at the 4-year point

The surgical loupes enhanced the visibility to ensure that the entire composite or carious lesion was removed. After thorough debridement and smoothing of all the root surfaces, the exposed root surface was treated with 17% EDTA (ethylene-diaminetetraacetic acid) for 1 minute with a cotton tip applicator to remove the smear layer and to expose the dentinal collagen fibers (tubules) in order to encourage fibroblast migration to the root surface.

The modified tunnel, supra-periosteal, approach was adapted from Allen[27]. The site preparation was started with an intra-sulcular incision made with an end-cutting intrasulcular knife. This was followed by a supra-periosteal blunt dissection to the mucogingival junction using an Allen Periosteal Elevator. Then, a partial thickness dissection with a Modified Orban Knife was continued apically, approximately 10 mm from the gingival margin to allow for passive advancement of the pouch. The palatal tissue was then elevated about 3 mm and the papillae were lifted from the alveolar crest. This palatal elevation of the flap, a modification from the original supra-periosteal protocol described by Allen, was completed in order to facilitate the flap advancement. The pouch was extended laterally to include the papillae of the adjacent teeth. The allograft (ADM, BioHorizons) was rehydrated according to the instructions for a minimum of ten minutes. The ADM was trimmed lengthwise to the site's adjacent line angles, and vertically, to a dimension of 8 mm. The graft was placed in the pouch and aligned with the gingival margin. The connective tissue side of the ADM was placed against the tooth surface, as recommended by the manufacturer. The tension free pouch was coronally positioned to cover the ADM, not extending beyond CEJ of the teeth. Single interrupted double sling sutures using 5.0 polypropylene were used around each tooth to secure the graft in place and to coronally position the graft and the pouch simultaneously. Analgesics were prescribed to control postoperative discomfort (Ibuprofen 800 mg four times daily for a week, Tylenol 3 every 6 hours as needed). Azithromycin (500 mg) was prescribed for three days, two tablets on the day of surgery, followed by one tablet per day for 3 days. To control the swelling, Dexamethasone (8mg 2 hours before surgery, 6 mg the next day, 4 mg the following day and 2 mg the next day) was prescribed. As instructed, the patient didn't brush or floss the surgical site for 3 weeks. Chlorhexidine gluconate (0.12%) was prescribed and rinsed with twice daily for three weeks after

Fig. 2a: Pre-operative view. Carious lesions on teeth 22 and 23. Failing restorations on teeth 24 and 25

Fig. 2b: One-year post-operative result

the surgery to control plaque buildup. The patient was seen postoperatively at the three week point when the sutures were removed. Oral hygiene instructions were given and professional cleanings were performed at each of the follow up visits as required (i.e. visible plaque present). Follow-up appointments were booked over the next 3 months to monitor the surgical healing.

Case 2

A 48-year-old male presented to our clinic with a history of multiple class V restorations and/or carious lesions in the 2nd quadrant. Both the referring dentist and the patient were concerned about the recession areas as well as the previous restorative treatment. Oral examination also revealed Miller Class I recession on teeth 21 and 22 and Miller Class II recession defects on teeth 23, 24, and 25. There was root surface caries present on 21, 22, and 23, while 24 and 25 had buccal restorations that were failing. The procedure that was performed was identical to the procedure described in Case 1.

Case 3

A 54-year-old non-smoking woman was referred to our practice for the treatment of recession associated with her teeth in the maxillary arch. Clinical examination revealed multiple recession defects associated with carious and non-carious cervical lesions associated with teeth number 13, 22, and 23. The carious lesions were removed and an allograft was placed as described previously to provide root coverage.

Discussion

The goal of these case outlines was to describe the use of a biomaterial, ADM, and its use with a supra-periosteal tunnel surgical technique for the treatment of carious and previously restored failing cervical lesions. The treatment of carious and non-carious cervical lesions has traditionally been exclusive to conservative restorative therapy. However, restorative treatment should not be considered the primary option when the cervical lesions involve only the root surface. The clinical challenge with the restorative treatment of carious/non-carious cervical lesions and previously restored root surfaces is the difficulty in the adhesion process. The bonding of the dental material (usually resin) to the root surface creates an unaesthetic, long clinical crown with a questionable long term prognosis. The treatment of cervical lesions with a restorative material should be avoided whenever there is a presence of pathologic dentin[15], moisture[7], and the accumulation of sub-gingival gram-negative pathogenic bacteria[10]. After the caries or restorative material is removed, the resultant exposed root surface presents a similar challenge as the non-carious root surface. From an anatomical and esthetic point of view, the root surfaces should be covered by gingival tissue using a minimally invasive surgical tunnel procedure, and unlike the restorative material, replaces the lost gingival anatomy. Therefore, the soft tissue root coverage graft procedure which re-creates the gingiva back up to the CEJ should be considered the primary treatment option in order to isolate the root surfaces from thermal changes, create ideal esthetics, and create a new attachment which is a combination of connective tissue and long junctional epithelium attachment to the previously diseased root surface, resulting in stable and shallow probing depths after healing. Recent studies showed very predictable aesthetic results when non-carious cervical lesions were treated with a CTG and a CAF[28], or a combination of CTG/modified glass ionomer restoration[18] or resin restoration[19] with a CAF. The treatment of the previously carious root surfaces with a CTG is a very predictable procedure and the results are very similar to the pre-recession situation[29,30]. Studies have also shown that ADM provides a suitable alternative for the CTG with well documented esthetic and clinical results[31]. The use of the tunnel technique with ADM for the treatment of recession, carious root surfaces and previously restored cervical lesions has many advantages. ADM comes in an unlimited supply in our office, therefore generalized recession cases can be treated in one appointment. Placing the 0.9-1.6mm uniform thickness ADM in the tunnel increases the gingival thickness, changing the tissue biotype. The thick and dense

Fig. 3a: Pre-operative view. Extensive recession associated with carious lesions

Fig. 3b: Post-operative result

connective tissue that results creates a stable marginal tissue zone, preventing the further recession[32]. The tunnel technique with ADM enhances the esthetic result by protecting the interdental papillae and by avoiding the keloid tissue formation associated with the vertical incisions of the CAF[33]. ADM acts as a biological substitute for the restorative material, such as resin reinforced glass ionomer that is placed in abfractions or on the concavity created by rotary instruments. As well, ADM provides stability for the flap and restores the emergence profile of the teeth. By choosing the tunnel technique with AlloDerm for our cases, the gingival thickness was increased to the thickness of adjacent non-recessed areas, as would have occurred with the connective tissue graft.

The Case Studies revealed that:

1. Complete root coverage with a modified tunnel technique and AlloDerm is a predictable procedure for the treatment of carious and previously restored defects
2. The tunnel technique with AlloDerm, which replaces missing tissue with gingival tissue, should be the primary treatment option for carious and previously restored cervical lesions (without enamel involvement) associated with Miller class I and Class II recession defects
3. AlloDerm acts as a biological filler preventing the collapse of the flap
4. AlloDerm increases gingival thickness and stabilizes the gingival margin thereby preventing further attachment loss

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