# A Biomaterial Alternative (Alloderm) For The Treatment Of NCCL Associated With Gingival Recession Defects

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## Abstract

Non Carious Cervical Lesions (NCCL) are defined as the loss of hard dental tissue (enamel, cementum and dentin) near the CEJ on the buccal surfaces of the teeth. The cervical lesions (carious and non-carious) are commonly treated using a restorative approach. Despite the improvements in bonding to dentin, the longevity and the aesthetics of class V restoration on 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 aesthetics and longevity. The aim of this case series is to describe the application of a modified tunnel technique with addition of Alloderm to treat NCCL associated with recession defects. Clinician should consider all the options, surgical and restorative, for the treatment of cervical lesions.

## Background Information

Gingival recession is a pathologic migration of the gingival margin with exposure of the root surface to the oral cavity.[1] It is found in population with good oral hygiene[2,3] and it is most commonly located on the buccal surfaces[4]. It occurs frequently in adults and has a tendency to increase with age[5]. Recent survey by Kassab et al[6] revealed that 50 % of the population between the ages 18 and 64 have one or more sites with gingival recession , while 88% of the patients older than 65 have at least one recession and the number recession defects increases with age.[7]

There are many classifications of the gingival recessions. (Sullivan and Atkins, Miller, Smith , Cairo.) However, all these classifications have some limitations in the diagnosis of gingival recession and the associated root condition. The newly proposed classification by Cortelinni and Bissada[8] tries to overcome the deficiencies associated with the previous classifications. This classification includes not only the classification of the gingival recession, but also the classification of the gingival biotype. According to the authors is a treatment oriented classification based on the interdental CL (Cairo score, RT) and complemented with the qualifiers of recession depth, gingival thickness keratinized tissue width and also the root surface condition such as the presence/absence of the NCCL and the presence absence of the CEJ . Furthermore it also includes aesthetic concern of the patient and the presence of dentin hypersensitivity.

There are many clinical implications of recession: esthetics concerns to the patients, dentin hypersensitivity, non-carious cervical lesions such as abrasion and erosion and also root caries. Various root coverage procedures with different degrees of success have been recommended in the past for the treatment of gingival recession. These procedures include but are not limited to coronally positioned flap double papilla flap[10], semilunar coronally positioned flap[11], subepithelial connective tissue graft[12] etc. Among these techniques the subepithelial CT based procedures provides the best outcomes in terms of root coverage and increase in the KT[13]. However, the CTG has some disadvantages. There is a limit in the amount of the graft that can be harvested and it requires a secondary surgical site, increasing the morbidity of the procedures. For patients with generalized recession additional site may be required or the patient may be subject to multiple surgeries to acquire sufficient graft required.

To overcome these disadvantages ADM has been used for gingival augmentation procedures. AlloDerm (LifeCell), 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 tissue banks in the United States utilizing American Association of Tissue Banks standards and FDA guidelines. AlloDerm provides a viable biologic substitute for palatal donor tissue. Compared to the CTG ADM offers several advantages; no donor site, unlimited supply, similar clinical outcomes in the treatment of multiple recessions. In a recent systematic review Chambrone et al[14] recommended that Alloderm and Coronally advanced flap may be used as an alternative to autogenous connective tissue graft. Gaspky et al[15] reported that there is no statistically differences between the ADM and CTG in recession coverage, gain of KT and probing depth reduction. AlloDerm (LifeCell), 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 tissue banks in the United States utilizing American Association of Tissue Banks standards and FDA guidelines. Alloderm (ADM) is an allograft, chemically processed to remove all epidermal and dermal cells but preserve the remaining bioactive dermal matrix. AlloDerm provides a viable biologic substitute for palatal donor tissue. ADM works like an autogenous graft by providing a bioactive matrix consisting of collagen, elastin, blood vessel channels and bioactive proteins that support the revascularization, cell repopulation and tissue remodeling. Alloderm is considered a safe alternative to the autogenous grafts. In over 10 years of use and over 900,000 graft completed the were zero cases of viral transmission.[16] Compared to the CTG, ADM offers several advantages; no donor site, unlimited supply, similar clinical outcomes in the treatment of multiple recession.

Non-carious cervical lesions are defined as the loss of hard tissue structure near the CEJ usually on the buccal surfaces of the teeth, in the absence of caries.[17] They develop as a result of normal and abnormal or pathological wear and cause abfraction, abrasion, and erosion or chemical degradation of dental tissues.[18] Their clinical appearance can vary depending upon the type and the severity of the etiological factors involved.[19] Despite many efforts to demonstrate that occlusal forces are the main cause of abfraction, its etiology remains poorly understood and controversial.[20] Instead, current evidence suggests that the etiology of NCCL is multifactorial.[21] The purpose of this article is to provide treatment guidelines for the teeth which exhibit gingival recession associated with NCCL are relatively common clinical conditions, their prevalent in teenagers and adults ranging from 5% to 90% and their prevalence increases with age.[22,23,24] The prevalence of these recession defects associated with NCCL is very high. In a report by Pinti Prato et al[25] more than 50 % of the 1010 gingival recession evaluated were associated with NCCL. When the gingival recession is associated with a NCCL forming a combined defect , they require special treatment. A new classification of the combined defects based on the location on the tooth surface condition has been developed by Pinti prato et al. Pinti Prato et al classified the presence/absence of CEJ as Class A (detectable CEJ) or Class B (undetectable CEJ), and the presence/absence of cervical concavities (step) on the root surface as Class + (presence of a cervical step >0.5 mm) or Class – (absence of cervical step). Therefore, a classification includes four different scenarios of tooth-related conditions associated with gingival recessions . According to the authors the classification which included four classes relies on the presence or absence of the visible CEJ and or the absence of a surface discrepancy. A class A - is a gingival recession with intact root surface , visible CEJ and no surface discrepancy . this class is the most common , (Class A-, 46%); This class is treated with a mucogingival surgery alone . Class A+ is a gingival recession is associated with a NCCL that affects only the root surface , has a visible CEJ and also has a step apical to the CEJ , a surface discrepancy . This class can also be treated with a mucogingival surgery alone , however the addition of a CTG or Alloderm to act a biological filler for the root surface defect and as space maintainer for the flap . Class B- is a recession defect that lack a visible CEJ but without any surface discrepancy. Therefore this type of defect involves both the crown and root and a gingival recession . This class is treated by a combination treatment involving a root coverage surgery combined with a restorative treatment ( dentin hypersensitivity or restorative treatment) . Class B+ is a gingival recession associated with NCCL that affects both the root and the crown of the tooth, lacks visible CEJ and presence with a step, surface discrepancy. This is the most challenging combined defect class and requires a combined periodontal and restorative approach.

Based on these concerns Zuchelli et al reported a partial restoration limited to the crown portion of the NCCL might be performed in association with a CTG +CAF to treat class B+ class of combined defects ( no visible CEJ and a surface discrepancy). The authors recommended that the coronal portion of the NCCL to be restored with a resin composite restoration with the apical margin extending up to a line representing the maximum root coverage, previously determined using the method described authors.

The NCCL can involve only the crown of the tooth (enamel and/ or coronal dentin) or only the root surface (cementum and /or dentin) or it can occupy both the crown and the exposed root. When the NCCL involves only the root of the tooth is associated with gingival recession. Winter and Allen[26] proposed a classification and guidelines for the treatment of recession with NCCLs based

| Classifications | Miller Class I or II | Miller Class III or IV |
|---|---|---|
| **Class I** | Root coverage | Root coverage<br>Possibly restore CEJ |
| **Class II** | Bevel enamel, contour root<br>Root coverage | Contour root, root coverage procedure<br>Possibly restore CEJ |
| **Class III** | Restore CEJ, contour root<br>Root coverage to CRM | Contour root, root coverage procedure<br>Restore tooth to new FGM |
| **Class IV** | Restore deep portion lesion, restore CEJ<br>Root coverage to CRM | Restore CEJ 3mm apical to papilla<br>Root coverage to CRM |

CEJ - Cemento Enamel Junction CRM - Cemento Restorative Margin FGM - Free Gingival Margin

on the depth/location of NCCLs, gingival dimensions, and recession depth/ classification. Regarding NCCL depth, it can be categorized in four classes: I) shallow: <0.5 mm; II) moderate: 0.5 to 2.0 mm in depth but without enamel involvement; III) moderate: 0.5 to 2.0 mm in depth but with enamel involvement; and IV) deep: >2.0 mm with enamel involvement.[16]

Therefore, the treatment planning should be based on the type/ extension of the NCCL, recession location, and the desired gingival level.

When the radicular NCCL associated with Miller Class 1 and Miller class 2 gingival recession, the treatment is strictly periodontal. The intact root surfaces can be treated very successfully and predictability with various muco-gingival surgeries[27] during which the root surface was treated mechanically using hand or rotary instruments to obtain a hard smooth concave surface eliminating all the sharp angles. After the mechanical instrumentation the application of the EDTA 24% for two minutes was applied to eliminate the smear layer. In these two cases a bilaminar technique is recommended (ie alloderm /CTG and CAF). The alloderm was positioned inside the root concavity. The graft thickness (roughly 1.6 mm thick) filled the NCCL and actually prevents the collapse of the covering flap inside the concave area of the abrasion. The Alloderm can act as a biological filler, a space maintainer inside the concave abrasion area providing stability of the covering flap which was coronally advanced to the CEJ.

However, complete root coverage of the gingival recession associated with NCCL is not predictably achieved.[28] Recently it has been shown that gingival recession associated with deep NCCL located only on the root surface can be successfully treated with glass ionomer[29,30] or a composite resin restoration and a coronally advanced flap[31]. Zuchelli et al[32] described in a case series a treatment protocol involving a restorative and mucogingival surgery with CTG +CAF.

When the NCCL involves the enamel and the root of the crown the treatment is more complex requiring a combination of restorative and mucogingival surgical treatment. The coronal treatment is recommended to be performed before the mucogingival surgery due to several advantages : isolation of the restorative field with a rubber dam without any interference firn the soft tissue, and the root coverage surgery can be facilitated by the reconstruction of the clinical crown only. The coronal treatment of the lesion involves the restoration of the anatomical CEJ with composite restoration extended up to the maximum root coverage ( MRC) that was established beforehand. The method to determine the location of the missing CEJ in theses cases and the maximum root coverage, based on the calculation of the ideal height of the anatomical interdental papillae was demonstrated in detail by Zuchelli et al.[33]

The enamel was beveled to create a long bevel that improves the adhesion of the restorative material. The radicular treatment is performed during the mucogingival surgery and involves odontoplasty in order to reduce the depth of the lesion and to increase the height of the NCCL. The radicular odontoplasty was accomplished with rotary and hand instruments. The reconstruction of the crown emergence profile will provide a stable and convex substrate for the surgical flap. In class 4 type of NCCL lesions , the deep portion of the lesion can be covered with a resin-modified glass ionomer cement. Studies by Alkan et al[34] and Drago et al showed that periodontal health was maintained when a resin-modified glass ionomer ionomer was used for subgingival and transgingival restorations. Therefore the selection of the resin-modified glass ionomer to be used in the deep portions of the root NCCL was based on the results of the previous studies which demonstrated the biocompatibility of these materials when placed in subgingival environment.

The value of restorative dentistry to treat NCCL remains questionable in restorative dentistry.[36] The restoration of the NCCL (carious or non carious is a major challenge

in restorative dentistry. The restorative treatment of cervical lesions, carious and non-carious with composite restorations in the cervical area is compromised by moisture, contamination, improper access to subgingival margins[37,38] and due to the presence of sclerotic dentin which has less bonding tensile strength than the normal dentin. After the root of the tooth is etched the sclerotic dentin obliterate the dentinal tubules resulting in minimal or no tag formation . when compared to normal cervical resin it was found that sclerotic dentin has 20%-45% lower tensile bonding strength due to the absence of the resin tags and the incomplete hybridization of the sclerotic dentin. This is attributed to the occlusion of the dentinal tubules with sclerotic casts that prevent the optimal resin infiltration and a hypermineralized surface that is more resistant to the acid etch procedure.[39] Occlusal loads, quality of dental substrates[40,41,42], and mechanical properties of the restorative materials[43] have been considered an important factor affecting the retention and clinical performance of the NCCL restorations. There are no generally accepted specific guidelines in the literature stating when or how these abfraction lesions should be restored. While several management options have been proposed to treat NCCL, treatment planning of these lesions remains an area of great variability among general dentists.[44] It has been documented that even though the NCCL are treated their progression is not arrested[45] and the initial bond of resin to dentin degrades over time.[46] A recent meta-analysis of clinical trials of cervical restorations revealed retention loss rates ranging from 0 to 50% and marginal discoloration rates of 0 to 74%.[47] In addition to the inherent problems of retention and leakage, poorly adapted or contoured cervical restorations may also compromise periodontal health. The restorative materials themselves can affect the bacterial flora. Poalantino et al[48] reviewed the clinical and microbiological effects of different restorative materials on periodontal tissues adjacent to Class 5 restorations. They concluded that composite resin restorations can have negative effects on the quantity and quality of subgingival plaque, increasing total bacterial counts with a decrease of gram-positive aerobic bacteria and a significant increase of gram-negative anaerobic bacteria.

The primary aim of this case series is to describe and clinically evaluate the application of a modified tunnel technique with alloderm for the treatment of recession defects with deep non-carious cervical lesions.

## Case 1

A 39 old nonsmoking womAn in good general conditions presented to the clinic for alternative treatment options regarding her generalised gingival recession associated with the presence of NCCL . The clinical oral examination revealed the followings : In the maxillary right area presence NCCL involving only the root surface on teeth 12, 13, 14, and NCCL involving the coronal aspect and the radicular part of the tooth number 14. All the teeth mentioned had a Miller class 1 gingival recession. A deep step > 0.5 mm was present on teeth number 13,14,15.

In the maxillary left area 22 and NCCL involving only the root and involing both the root and the enamel on teeth number 23,24,25, . In the mandibular right area teeth number 43,44,and 45 had a MIller class I recession defect associated with the presence of the NCCL, without CEJ involvement , tooth number 43 and with CEJ involvement Teeth number 44 and 45. A step > 0.,5 mm was present on all theese teeth. The treatment recommended was restorative first , restoring the anatomical CEJ followed by periodontal surgery.

***Initial Therapy :***

After the complete periodontal examination, all the patients received a session of prophylaxis and oral hygiene instructions. The surgical treatment was not scheduled until the patients demonstrated an adequate standard of OH and Surgical protocol.

Figure 1a: Pre operative view showing deep NCCL lesions (radicular and combination radicular/coronal) associated with gingival recession

Fig 1b: Post operative healing

Fig 1c: Maxillary right area pre-operative view; recession associated with NCCL

Fig 1d: Maxillary right area post-operative view

Fig 1e: Mandibular right area preoperative view

Fig 1f: Mandibular right area postoperative view

The tunnel, (supra-periostal,) approach was adapted from Allen.[49] After profound anesthesia was obtained through buccal and palatal infiltration the site preparation was started with an intra-sulcular incision made with an end-cutting intrasulcular knife around each tooth, on all the surfaces. (B,LM,D) The surgical area was extended M and D to include one tooth adjacent to the defect. This was followed by a supra-periosteal blunt dissection to the mucogingival junction using a Allen Periosteal elevator. Then, a partial thickness dissection with modified Orban knife was continued apically, approximately 10 mm from the gingival margin to allow for a passive advancement of the pouch . The palatal tissue was then elevated about 3 mm and the papillae was 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 facilitate the flap advancement . The pouch was extended laterally to include the papillae of the adjacent teeth. The root surface was prepared with Younger –Good curette and/or Neumeyer bur to obtain smooth concave surface. The exposed root surface was then treated with 17% EDTA (ethylene-diaminetetraacetic acid) for 1 minute with a cotton tip applicator to remove the smear layer and to open up the dentinal tubules to encourage fibroblast migration to the root surface. The allograft (Alloderm, BioHorizons) was rehydrated according to the manufacturer instructions for a minimum ten minutes. The Alloderm graft 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 site of the Alloderm was placed against the tooth surface, as recommended by the manufacturer. The tension free pouch was coronally positioned to completely cover the ADM. After that the pouch, the CAF, and the ADM were posinited at the CEJ of the teeth. Single interrupted double sling suture using 5.0 polypropylene was 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 the postoperative discomfort (Ibuprofen 800 mg four times daily for a week, Tylenol 3 every 6 hours as needed. Azytromocycin (500 mg) was prescribed for three days, two tablets in 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. No brushing or flossing at the surgical site was performed for 3 weeks. Chlorhexidine gluconate (0.12%) mouth rinse twice daily was prescribed for three weeks after the surgery to control plaque buildup. The patient was seen postoperatively, at three weeks when the sutures were removed. Oral hygiene instructions were given and professional cleanings were performed at each of the follow up visits if indicated (i.e. visible plaque present).

The patient was followed for 5 years with minimal probing depth and no recession relapse (Fig 1b).

## Case 2

A 55 old male, non smoker and in good health was referred to our dental clinic for the treatment of gingival recession associated with NCCL in the maxillary left quadrant. Clinical evaluation revealed NCCL associated gingival recession on the maxillary left sextant. A further analysis revealed that the NCCL can be sub-divided into radicular NCCL (with intact CEJ and a step) tooth number 22, 23, radicular NCCL with no anatomical CEJ and a step (teeth number 24,25). The treatment recommended and performed was similar to the case described above. For the NCCL lesions associated with a step and intact CEJ a Alloderm graft was performed using a modified tunnel technique. The teeth presenting with a step and lacking CEJ, the reconstruction of the anatomical CEJ was completed first, using composite resin restoration, and after that a tunnel technique with alloderm was performed to readapt the coronally positioned gingiva to the new CEJ or the maximum root coverage.

Fig 2a: Preoperative view showing recession defects associated with NCCL in the maxillary right quadrant .

Fig 2: Postoperative view (5 year post surgery)

## Case 3

A 50 year old non smoking woman presented to our periodontal practice for the treatment of gingival recession associated with the root NCCL's. Clinical examination revealed Miller class I gingival recession on teeth number 13,14,15,16. Furthermore all the teeth involved had an intact CEJ and a step > 0.5 mm on the root was detected. The gingival recession associated with the presence of NCCL were treated only by a periodontal surgery, a modified, supra-periosteal tunnel technique with Alloderm as a graft.

Fig 3a: Preoperative view , NCCL associated with Miller class I recession on teeth number 134,14,15,16,

Fig3b: Postoperative view of the right site treated with modified minimally invasive tunnel technique with Alloderm

## Case 4

A 45 year old woman , non smoking , presented to our clinic for the treatment of her recession in the maxillary left quadrant . Clinical examination revealed the presence of NCCL on teeth number 23 25 and 26 . Tooth number 22 has a Miller class 1 gingival recession . Teeth number 23 and 24 had a miller class 2 gingival recession , intact CEJ , but presented with a radicular step >0.5 mm. The treatment recommended was strictly periodontal. The surgery , a modified supraperisotal tunnel technique with Alloderm was performed in the same way as described above.

Fig 4a: Pre operative view of the maxillary left quadrant , Miller class 1 and 2 recession associated with NCCL lesion on the teeth number 22 23 24 25 26

Fig 4b: Post operative result

## Case 5

Fig 5a: Preoperative view

Fig 5b: Postoperative view ( NCCL treated with alloderm and tunnel technique)

## Case 6

Fig 6a: Preoperative view

Fig 6b: Postoperative view

## Case 7

Fig 7a: Preoperative view

Fig 7b: Postoperative view

## Discussion

The goal of these case series was to clinically describe the use of a biomaterial, Alloderm, in the treatment of NCCL associated with gingival recession and to determine applicability and ease of use of the new classification of the recession defects proposed by Cortelinni and Bissada. Furthermore, this treatment oriented classification used to help the clinical decision process.

The treatment of cervical lesions (carious or noncarious) with resin restorations has been considered the ideal situation for conservative restorative therapy. However this restorative treatment should not be considered the first option when the cervical lesions involve only the root surface. The clinical challenge with the restorative treatment of cervical lesion, carious, non carious and previously restored is the difficulty in the adhesion process. The bonding of the dental material (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 due to the presence of pathologic dentin, moisture, and the accumulation of subgingival gram negative pathogenic bacteria. After the caries or the restorative material are removed the exposed root surfaces presents a similar challenge as the non-carious root surface.

From an anatomical and esthetic point of view the root surface should be covered by gingival tissue, not restorative material. Therefore, the root coverage procedure should be considered the first treatment option. Furthermore the root coverage with different surgical procedures proved to be highly predictable and have good esthetic results. Recent studies by Zucchelli et al[50] showed a very good and predictable results in the treatment non-carious cervical lesions with CTG while Santamaria et al[45,46] reported on the combination of CTG and resin modified Glass ionomer restoration +CTG. Other authors Leybovich et al[48], reported on the treatment of NCCL with a restorative periodontal combined treatment with excellent clinical results.

The use of tunnel technique with alloderm for the treatment of multiple recession associated with carious and previously restored cervical lesions has many advantages over advantages. Alloderm comes in an unlimited supply therefore generalized recession cases can be treated in one appointment. It has a relative uniform thickness, between 0.9 – 1.6 mm . By placing it under the CAF of the tunnel it increases its thickness, changing the tissue biotype. The thick dense connective tissue that results creates a stable marginal tissue zone preventing the further recession.[51] Moussa and Bissada et al[52] showed that the tunnel technique enhances the esthetic result by protecting the interdental papillae and avoiding the keloid tissue formation associated with vertical incisions of the CAF. Alloderm can act as a biological substitute for the restorative material, such as the resin reinforced glass ionomer, when placed in the concavity created by the rotary instruments (or in the noncarious cervical lesions) preventing the collapse of the covering flap into the lesion. Therefore, alloderm can compensate for the missing tooth structure and provide stability of the flap. Furthermore alloderm can restore the emergence profile of the tooth. By choosing the tunnel technique with alloderm the gingival thickness was increased to a relative normal size that makes it indistinguishable from the adjacent teeth. By comparison, the CTG can excessively increases the tissue thickness affecting the esthetics of the area treated.

Within the limits of these case studies we can suggest that

1. Complete root coverage can be obtained on recession defects associated with NCCL
2. The described modified tunnel technique with alloderm should be the first choice of treatment for the recession defects associated with deep NCCL without enamel involvement
3. Alloderm can act as a biological preventing the collapse of the flap
4. Alloderm increases the tissue thickness and the stability of the gingival margin preventing further attachment loss. ■

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***Additional References available upon request***


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