Periodontal and Restorative Treatment of Gingival Recession Associated with Non-Carious Cervical Lesions: Case Study

Analice Giovani Pereira[1], Daniela Navarro Ribeiro Teixeira[1], Michelle Pereira Costa Mundim Soares[1], Ramon Corrêa de Queiroz Gonzaga[1], Alfredo Júlio Fernandes-Neto[2] and Paulo Vinícius Soares[3]

[1]NCCL Research Group; [2]Occlusion and Prosthodontics Department; School of Dentistry; [3]NCCL Research Group, Dentistry and Dental Materials Department, Federal University of Uberlandia, Brazil

Abstract

The association between the presence of gingival recession and non-carious cervical lesions is a common finding in dentistry. These diseases have multifactorial etiology and the treatment should be multidisciplinary. Although traditionally the majority of professionals treat non-carious cervical lesions only with conventional restorative procedures, in most cases a combination of periodontal and restorative treatments provides the best functional and esthetic results. Thus, the objective of this case report was to present a new option for treatment, which consists of a subepithelial connective tissue graft associated with a coronally advanced flap placed on dentin and non-carious cervical lesions restored with lithium disilicate partial veneers. A patient complaining about the esthetic aspects of her teeth and cervical dentin hypersensitivity was submitted to occlusal adjustments and daily diet analysis in order to manage etiologic factors. Experienced operators then performed restorative and surgical treatments. Periodontal clinical attachment level (probing depth + gingival margin), bleeding on probing, plaque index, and the integrity of the restorations were observed. During the monitoring period, the treatment was effective, with good functional and esthetic results. The hypersensitivity disappeared, and neither inflammatory characteristics in gingival tissue nor failures in restorations were noted. It might be concluded that treatment with a combination of techniques can be effective and predictable for patients with gingival recession and non-carious cervical lesions that may or may not require restorative procedures under controlled conditions.

Key words: Connective tissue graft, lithium disilicate, non-carious cervical lesions, root coverage, gingival recession

Introduction

Gingival recession has been defined as the displacement of the soft tissue margin apical to the cementoenamel junction (Glossary of Periodontology Terms, AAP, 2001). It is often observed at the buccal surface of teeth in patients with high standards of oral hygiene, and may affect smiling and the quality of the soft tissue, besides causing sensitivity (Bherwani *et al.*, 2014).

The exposure of root surfaces resulting from gingival recession may be due to several etiologic factors, including periodontal disease, mechanical forces such as improper tooth brushing, iatrogenic factors such as uncontrolled orthodontic movement and faulty restorations, viral infections of the gingiva, or anatomical factors such as tooth malposition and frenum pull (Pradeep and Sharma, 2006). Marginal tissue recession results in dental hypersensitivity, esthetic complaints, and a tendency toward root caries (Alkan *et al.*, 2006).

Many studies confirmed that Miller Class I and II gingival recessions without interproximal structure loss can be predictably treated and recovered with gingival tissue using surgical techniques such as coronal flaps, free gingival grafts and subepithelial connective tissue grafts.

Correspondence to: Paulo Vinícius Soares, DDS, MS, PhD, NCCL Research Group Advisor, Department of Operative Dentistry and Dental Materials, R: Republica do Piratini S/N - Campus Umuarama - Bloco 4L, Sala 4L42, Uberlândia - Minas Gerais. ZIP-CODE: 38400-902 – Brazil. E-mail: paulovsoares@yahoo.com.br

However, the connective tissue graft is considered the gold standard for its high predictability for root coverage (Cordioli *et al*., 2001; Bherwani *et al*., 2014).

The incidence of non-carious cervical lesions has shown a continuous increase over the years (Borcic *et al*., 2006). The progressive nature of these lesions requires early correction in order to prevent biological and biomechanical complications. The etiology is multi-factorial: a combination of stress (abfraction), friction (wear) and biocorrosion (chemical, biochemical and electrochemical degradation) (Grippo *et al*., 2012; Soares *et al*., 2013; 2014). Thus, a multidisciplinary approach to deal with this condition has been proposed in order to optimize the final esthetic outcome. Periodontal surgery is combined with restorative therapy to enhance esthetics (Oringer and Iacono, 1999). The outcome of the treatment consists of tooth tissue restoration, providing satisfactory biomechanical function (Machado *et al*., 2015) and gingival recession treatment with root coverage procedures that restores the esthetic appearance (Zucchelli *et al*., 2011). These procedures guarantee better margin stability because of the increased thickness of the tissue.

Non-carious cervical lesions and gingival recessions are closely related to each other, in terms of both etiologic factors and therapeutic procedures (Toffenetti *et al*., 1998). The two disorders occurring in the same tooth leads to a combined defect that may have a different prognosis regarding soft tissue coverage after periodontal surgery when compared to intact roots (Santamaria *et al*., 2007; 2009; 2013).

Despite the close relationship between these two phenomena, the literature reports different treatments for hard tissue reconstruction, without ample consideration for the presence of gingival recession or the final overall esthetic result. Gingivectomy has been performed to allow isolation of the non-carious cervical lesion and the restorative procedure (Chan *et al*., 2014). However, tissue excision procedures can alter the normal position of the gingival zenith, leading to esthetic damage. To obtain optimal functional and esthetic results may require the combined application of tissue grafts and restorative procedures (Terry *et al*., 2003).

In this case, the combined defect of gingival recession associated with non-carious cervical lesions was treated by connective tissue graft with coronally advanced flap and lithium disilicate ceramic partial veneers. The authors present a case report and discuss the chemical and biomechanical properties of ceramic and its relation with periodontal tissue.

Case description and results

A 47-year-old female patient, in good general medical condition, complained of poor esthetics and increasing teeth sensitivity. Buccal non-carious cervical lesions and gingival recession were found on left maxillary lateral incisive, canine and first premolar (*Figure 1A,B*). The non-carious cervical lesions were active, as they were exposed to the oral environment and ongoing etiological factors. At clinical examination, 1, 2 and 1.5 mm probing depths were observed, respectively, and there was 2 - 3 mm of healthy keratinized tissue and sound interdental papillae. The gingival recession dimensions were obtained using a periodontal probe and heights of 1, 2 and 2 mm were observed, respectively. Cone beam computer tomography indicated no bone loss of alveolar ridge except for the buccal aspect. After clinical evaluation, the patient was asked to complete a diet diary to report all types of food and beverages ingested for a week. The data were analyzed and the main contributing factors were determined. They were: thin gingival biotype, traumatic occlusion and consumption of acidic beverages, citrus fruits and juices. The patient was advised to reduce her consumption of acidic beverages and to improve her dental hygiene, thus contributing to the success of the treatment.

Full-mouth radiographs, periodontal charting, study casts and a careful medical and dental history were obtained. Also, a complete photographic documentation of the case was carried out. Treatment goals were the following: 1) etiologic factors management; 2) restorative treatment of the non-carious cervical lesions and consequent reduction of tooth hypersensitivity; and 3) surgical harmonization of gingival architecture and connective tissue graft placement.

The depth of the non-carious cervical lesions and extent of gingival recession on the canine can be seen from a profile view (*Figure 1C*). Gingival recession but no enamel and/or dentin structure loss can be observed on the lateral tooth; however, it is important to highlight that there is already minimal damage to enamel, dentin and cementum that could evolve to non-carious cervical lesions. Thus, ideal treatment would not involve restoration because of the minimal wear, but management of the etiological factors and surgical treatment is fundamental to prevent the increase of gingival recession and the formation of another non-carious cervical lesion. The first premolar presented with a composite resin restoration, which was removed and replaced.

Figure 1. Pre-operative phase. A. Buccal view of the initial aspect of patient's smile. B. Lateral view of gingival recession and non-carious cervical lesions in maxillary teeth (incisor, canine and premolar). C. Profile view of the depth of the non-carious cervical lesions in canine and premolar. D. Impression view of non-carious cervical lesions.

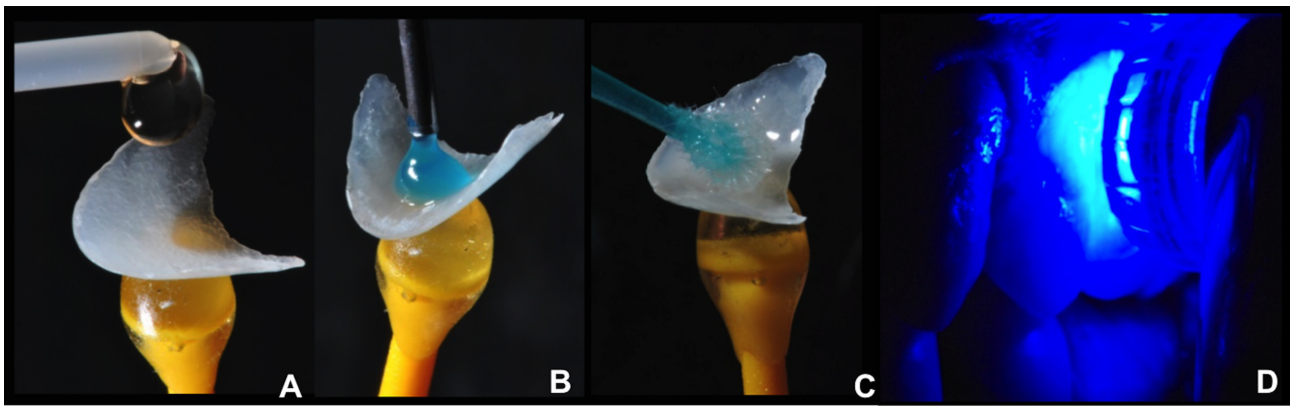

Figure 2. Restorative phase. A. Conditioning treatment of the veneer with 10% hydrofluoric acid for 20 seconds (Condicionador de Porcelanas, Dentsply, Brasil). B. Application of 37% phosphoric acid for 60 seconds for cleaning the veneer. (Total Etch, Ivoclar Vivadent). C. Silanization of the veneer with a silane coupling agent (Monobond Plus, Ivoclar Vivadent). D. Light-curing (40 seconds) of resin cement by high intensity LED.

Figure 3. Surgical phase. A. Lateral view of partial ceramic veneers cemented in cervical regions. B. Decontamination of restorations: canine and first premolar with 37% phosphoric acid for 60 seconds. C. Root treatment with tetracycline mixed with saline solution for three minutes. D. Graft in position, removed from left side of palate.

Occlusal interference and premature contacts were checked. Occlusion adjustment was performed using selective grinding with fine grit diamond burs (KG Sorensen, Brazil), providing harmonic occlusal contacts and preventing new areas of stress concentration (McHorris, 1985). The canine and first premolar were restored with lithium disilicate partial veneers (IPS e.max Press, Ivoclar Vivadent, Liechtenstein). Root coverage was also indicated because gingival recession resulted in esthetic problems. No signs of infectious or inflammatory periodontal tissues were found.

Polyvinyl siloxane impression material (President, Coltene, Switzerland) and retraction cord (Pro Retract #000, FGM, Brazil) were used to make subgingival impressions (*Figure 1D*). The ceramic restorations were prepared and the relationship between tooth structure and periodontal tissue was checked before cementation. The internal surfaces of veneers were etched with 10% hydrofluoric acid for 20 seconds (Condicionador de Porcelanas, Dentsply Brazil; *Figure 2A*). The surfaces were washed with water, dried and 37% phosphoric acid was applied for 60 seconds (Schotbond Echant, 3M ESPE, MN, USA; *Figure 2B*). The partial veneers were treated with a silane-coupling agent (Ceramic Primer, 3M ESPE, MN, USA; *Figure 2C*). The enamel was etched with 37% phosphoric acid for 30 seconds (Total Etch, 3M ESPE). The adhesive layer (Single Bond Universal, 3M ESPE) was applied to the enamel and dentin according to the manufacturer's protocols. Photo-cure resin cement was used (100%; (Rely X Veneer, 3M ESPE) to cement the veneers to provide the highest color fidelity. The surfaces were photo-activated for 60 seconds with a power LED 1200 mW/cm^2 (Radii Plus, SDI, AUS; *Figure 2D;* Soares *et al.*, 2014). Cervical finishing was done using ultrafine grit burs (#3070FF, KG Sorensen) and rubber points (8090D, KG Sorensen) with diamond paste (Diamond Gloss, KG Sorensen; *Figure 3A).*

Periodontal surgical correction of gingival recession was performed after polishing of restorations. A connective tissue graft combined with a coronally advanced flap technique has been reported to yield the most predictable results for root coverage (Cairo *et al.*, 2014). Under local anesthesia (Mepivacaine 2% with epinephrine 1:100,000 Nova DFL, Brazil), an intrasulcular incision was performed extending from the second premolar to the central incisor. The flap was then partially divided to give mobility to the tissue. The field was cleaned with saline and 37% phosphoric acid (Schotbond Echant, 3M ESPE) was applied for 60 seconds to decontaminate both restorations (*Figure 3B*). Tetracycline mixed with saline was applied for 3 minutes for root decontamination and chemical preparation (*Figure 3C*). The solution was removed and the roots were rinsed with saline. These procedures facilitate graft attachment and lessen the likelihood of necrosis.

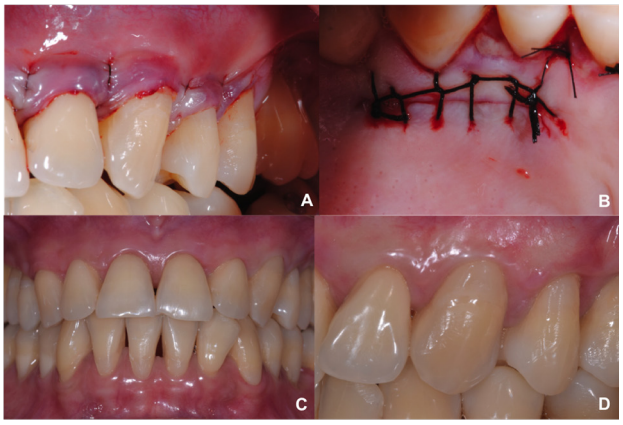

Figure 4. Surgical and postsurgical phase. A. Flap positioned coronally. B. Scalloped continuous suture of the palate. C. Clinical aspect of tissue and restorations one year after the surgery. No clinical signs of inflammation were observed. D. Lateral view of tissue and restorations one year after the surgery.

The donor site was the palate region of the left premolars. The graft was removed and put in position, overlying the incisor, canine and first premolar (*Figure 3D*). The ideal height of the papilla in a tooth with gingival recession was defined as the apical-coronal dimension of the interdental papilla capable of "supporting" complete root coverage. The ideal height of the papilla was measured as the distance between the mesial-distal line angle of the tooth and the contact point. The line angle is easily identifiable, even in a tooth with a buccal abrasion defect, by elevating the interdental soft tissues (with a probe or small spatula) and searching for the interdental cementoenamel junction. Once the ideal papilla was measured, this dimension was retraced apically starting from the tip of the mesial and distal papillae of the tooth with the recession defect. The horizontal projections on the recession margin of these measurements allowed for identification of two points that were connected by a scalloped line, representing the "line of root coverage" (Zucchelli *et al.*, 2006). The flap was displaced to the coronal position (*Figure 4A*) and the palate was closed with a scalloped continuous suture (*Figure 4B*). Postoperative instructions were given to the patient and anti-inflammatory medication was prescribed (ibuprofen 400 mg three times a day for 3 days). Rinsing with chlorhexidine 0.12% was prescribed twice a day for 7 days, until the sutures were removed and brushing could be resumed. Healing was uneventful.

One year later, the patient was evaluated (*Figures 4C,D*). The condition of gingival tissue was satisfactory. There was no hypersensitivity, no probing depth greater than 3 mm, no bleeding on probing, a low plaque index and no clinical inflammation evident on the gingival margin.

Discussion

The etiology of non-carious cervical lesions has been discussed extensively in the literature. The clinician should consider all etiologic and modifying factors before completing the diagnosis or initiating treatment. The first treatment step should be the elimination or control of all potential etiologic factors associated with the occurrence of gingival recession and non-carious cervical lesions. Detailed clinical examination is important for the identification of gingival inflammation, periodontal disease, traumatic toothbrushing, excessive consumption of acidic beverages, citrus fruits and juices, dietary disorders, parafunctional habits and signs of traumatic occlusion (Santamaria *et al.*, 2007; Grippo *et al.*, 2012).

The treatment of non-carious cervical lesions should start with control of the patient's diet, primarily decreasing the consumption of acidic foods. Then, occlusal stability should be checked and treated if it is not ideal, and only afterwards should any restorations be done. According to some reports, restorative treatment is necessary to prevent non-axial loading that could expose the pulp cavity or fracture the dental element. The restoration of non-carious cervical lesions is important to reduce stress concentration, decrease abfraction progression, strengthen the tooth, prevent pulpal involvement, eliminate biocorrosion of the enamel, prevent fractures, root caries and toothbrush abrasion, eliminate cervical sensitivity, provide esthetic improvement and comfort of the adjacent soft tissues, thereby restoring satisfactory health and periodontal integrity (Levicth *et al.*, 1994; Grippo *at al.*, 2012, Soares *et al.*, 2014).

A study using finite element analysis models to evaluate the effect of non-carious cervical lesions on the biomechanical behavior of maxillary premolars reported that load type and the presence of restorations were the major factors associated with the stress distribution patterns of the tooth. In non-restored models, the load produced a large accumulation of stress at some point of the non-carious cervical lesion. This mechanical stress may be a factor that contributes to horizontal progression of non-carious cervical lesions and gingival recession, resulting in an increase in depth of the lesions, demonstrating the importance of reconstruction of the lost tooth structures (Soares *et al.*, 2013; Soares *et al.*, 2014).

Localized gingival recession that occurs at the smile line may also be of great esthetic concern for the patient. There are many periodontal esthetic procedures used to treat this situation. Since 1985 the treatment of gingival recession has been influenced by the development of the subepithelial connective tissue graft technique, which has led to predictable and reproducible results (Allegri *et al.*, 2010). The success of root coverage varies depending on the width and height of recession, biotype of gingival tissue, type of surgical technique used, and smoking status (Bherwani *et al.*, 2014).

When just the non-carious cervical lesion is treated by a restorative procedure, the position of the gingival zenith is more apical because of the persistence of the gingival recession, which would lead to a longer tooth and consequently to a possible esthetic disharmony (Santamaria *et al.*, 2007; Chambrone and Chambrone 2006). Similarly, a surgical procedure alone would not be enough to rehabilitate the patient. The depth of the non-carious cervical lesions would not allow adequate root planing and would not resolve any biomechanical problems, which might influence the final results. Thus, the ideal treatment for the combination of non-carious cervical lesions and gingival recession should be a combined restorative-periodontal approach, as some authors have discussed (Deliberador *et al.*, 2012; Santamaria *et al.*, 2013).

The influence of restorations made of resin composite and resin-modified glass ionomer on subgingival biofilm was evaluated (McLaren, 1998). The results confirmed the hypothesis that connective tissue grafts provide stable outcomes after 2 years of follow-up, regardless of the presence or absence of glass ionomer restorations in the treatment of these combined lesions. During this period, the amount of soft tissue coverage was maintained and showed no signs of inflammation in either group (Santamaria *et al.*, 2007). Non-carious cervical lesion restoration with a composite resin combined with a connective tissue graft for the treatment of gingival recession produced little gingival inflammation, plaque accumulation, periodontal pockets, or bleeding on probing after 24 months of post-operative follow-up. One important factor to promote this result is satisfactory polishing and finishing (Santos *et al.*, 2007).

Besides other available restorative materials such as glass-ionomer, resin-modified glass-ionomer and flowable composite resin, that have been shown to be good alternatives for the restoration of non-carious cervical lesions, composite resin cores associated with glass ceramic laminates (for lesions deeper than 0.5 mm) or just glass ceramic laminates (for lesions less than 0.5 mm deep), are also suitable options (Machado *et al.*, 2015). The material used in this study was lithium disilicate veneer. The biocompatibility of these restorative materials favor the healing of connective tissue grafts because of their satisfactory smoothness and refined surface, resulting in tighter adherence of the junctional epithelium to the restoration when used subgingivally on root surfaces. All of these features avoid gingival inflammation and favor the healing of connective tissue grafts, which is one of the main goals of the treatment (Seghi and Sorensen, 1995). Besides, ceramic veneers ensure greater preservation of tooth structure, maintain tooth vitality, and produce predictable results, having failure rates of only 0% to 5% over 1 to 5 years (Peumans *et al.*, 2000).

Moreover, esthetic appearance is also improved when ceramic restorations are used. The glassy finishing of ceramics provides suitable surface smoothness and shine, making these restorations esthetically and biologically satisfactory (Peumans *et al.*, 2000). A better environment for root coverage and regularization of gingival architecture can be obtained when ceramic partial veneers are used for non-carious cervical lesion restoration. It is important that the clinicians analyze the financial viability of these procedures, as they involve more costs than composite and glass ionomer direct restorations. However, ceramic restorations can be successfully applied to non-carious cervical lesions, providing predictable and long-lasting functional and esthetic outcomes (Machado *et al.*, 2015), and also contribute to root coverage surgeries, which may present a favorable ratio of cost-effectiveness. The high prevalence of non-carious cervical lesions and gingival recession demands constant advancement of treatment protocols, and the use of lithium disilicate-reinforced glass ceramic restorations associated with a connective tissue graft and the coronally advanced flap technique is presented as a good alternative for esthetic and functional rehabilitation in these cases. Both patient and professionals involved in the treatment considered it worthwhile with regard to the restorative and surgical procedures performed and the results achieved.

It is important to clarify that restorative treatment of non-carious cervical lesions by itself does not solve the patient's esthetic problem caused by the excessive length of the tooth, in addition to not improving the width and length of keratinized tissue. So mucogingival therapy is recommended as additional periodontal treatment. The combination of restorative and surgical protocols is important for full rehabilitation of non-carious cervical lesions, particularly in the case of deep lesions, when the damage affects both teeth and periodontal structures (Zucchelli *et al.*, 2006).

The results of this clinical report were the same as found in previous reports. The presence of a restoration not only did not have any negative effect on the degree of root coverage, but also significantly improved the esthetic outcome of the therapy and the biomechanical behavior of the teeth. Despite the limited histological evidence on this combined therapy (Alkan *et al.*, 2006), it has been shown that long junctional epithelium and connective tissue attachment formation are directly related to the degree of finishing and the compatibility of the restoration material. The absence of any significant alteration of periodontal clinical parameters (probing depth, bleeding on probing, plaque index and clinical inflammation aspects) over time seems to be justified by the absence of any violation of the biological width (Bherwani *et al.*, 2014).

This protocol showed root coverage improvement without damage to periodontal tissues. The relation with ceramic restoration and gingival graft was positively supported by 1 year of clinical effectiveness. The results showed that the restorations did not interfere with an optimal healing process, improved the esthetic aspects and reduced the dentin hypersensitivity. It is relevant to evaluate whether these successful outcomes remain stable, because the true benefit for the patient is the stability of results over time. It is important to consider the patient's oral hygiene for the long-term predictability of the clinical outcomes achieved. Therefore, further studies are necessary for evaluation of the amount of root coverage achieved on previously restored roots and its long-term maintenance.

Conclusion

Within the limitations of this case report, it can be concluded that the use of lithium disilicate-reinforced glass ceramic associated with connective tissue graft and coronally advanced flap technique for rehabilitation of patients affected by non-carious cervical lesions and gingival recession may represent a predictable treatment option, as there were no signs of inflammation, bleeding, periodontal pocket formation, or restorative failure. However, a careful anamnesis and management of etiological factors should be done in order to confirm the indication for the combined protocol. Patients with acidic dietary habits, gastric dysfunction, occlusal problems, smokers, or those affected by periodontal or systemic uncontrolled disease should not undergo the treatment.

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