REVIEW

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The link between Noncarious Cervical Lesions (NCCL) and gingival recession. Etiology and treatment. A narrative review.

Luminița Lazăr[1], Zsigmond-Loránd Makkai[1], Timea Dakó[1], Mircea Suciu[1], Ana-Petra Lazăr[1]

[1] George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu-Mureș, Romania

Abstract

Noncarious cervical lesions (NCCL) have a multifactorial etiology. The terms abfraction, abrasion, and erosion are also used to describe the same lesion. NCCLs can lead to gum recession which is one of the most frequent gingival defects. NCCLs generally also involve loss of tooth structure. Therefore, treatments should be planned and performed in an interdisciplinary manner. When NCCL is minimal, the choise to use simple direct restorations is the main therapeutic option. If it is serious, microsurgical treatment or, more precisely, interdisciplinary treatment might be necessary. Root coverage by microsurgical methods is the most challenging esthetic procedure. There are many techniques available of which we must always choose the method that can ensure and control root coverage in the long term.

Keywords: noncarious cervical lesions, gingival recession, root coverage.

Introduction

Noncarious cervical lesions (NCCLs) involve the destruction of hard tissue in the cervical area of the tooth crown and the underlying root surface by pathologies other than tooth decay (without the involvement of microorganisms) [1,2].

It is currently incorrect to label a single mechanism as causing all types of NCCL. Thus, the current state in the field of study mentions a multifactorial etiology of NCCLs [1,3–8]. Once tooth decay is ruled out as the origin of this condition, other factors involved must be recognized. The multifactorial origin manifests with combinations of distinct processes, including stress (abfraction), mechanical wear (abrasion), and biocorrosion (erosion) [1,3,9-12]. Studies indicate that due to noncarious cervical lesions together with dental decay, restoration of permanent teeth is needed [13]. Different terminologies in the literature such as "cervical erosion", "cervical abrasion", and "abfraction" describe the same injury.

There are factors directly linked to the onset of NCCL, such as sex, age, occlusion, diet, saliva, and parafunctions [1,12].

The prevalence of noncarious cervical lesions ranges from 5% to 85% [1,14,15], and their prevalence and severity exhibit age dependency [15–17].

When performing a clinical examination, NCCLs appear as hollow or deep craters, round-shaped or cuneiform irregularity close to the enamel-cementum junction [9]. These lesions can affect the structural integrity of the tooth, facilitate the retention of bacterial plaque, contribute to tooth sensitivity, and influence the vitality and esthetics of the pulp [1,11,18]. These are frequently linked to gingival recession that causes architectural fragility indicated by a low crown-root ratio and esthetic problems [19].

The cervical part of the tooth differs morphologically and histologically from the coronal and root part of the teeth. The enamel gradually becomes thinner approaching the cemento-enamel junction and this is the reason why the cervical region becomes the most vulnerable place, where the dentin can be exposed to the action of irritating agents. The direction of the enamel prisms is flattened, in contrast to their undulating direction in the crown enamel region. The enamel in the cervical region of the tooth contains less minerals and is physically thinner than the rest of the prismatic enamel [20].

Clinical manifestations

Abrasion is the wearing of dental surfaces by interdental foreign substances or bodies. Generally, it is the consequence of friction between a tooth and an external agent [21]. Abrasion can develop because of excessive brushing, one-sided chewing or only on a limited number of teeth, inappropriate use of toothpicks, floss, or parafunctional oral habits. Often, abrasions appear as painless cavities with polished surfaces, but sometimes pain can also occur. Generally, when incorrect brushing is a causing factor, the enamel reacts otherwise compared the dentin that deteriorates in a path made by the toothbrush [11,22-27].

The term erosion or biocorrosion is used to explain the loss of dental hard tissues by electrochemical, biochemical or chemical process without microorganisms. Corrosion has two main causes: endogenous and exogenous factors. When the cause is endogenous (bulimia or gastroesophageal reflux), the enamel seems narrow and see-through. Also, there is loss of enamel on the occlusal surface of posterior teeth, and on the oral surfaces of anterior teeth. Furthermore, on the cervical surfaces of upper frontal teeth, sometimes depressions may occur. If the cause of corrosion is exogenous, the appearance is very much alike, but the location is related to the path of the corrosive item [9]. Studies found that food substances with a lower pH value than 5.5 could be corrosive and teeth demineralizers. When highly acidic foods and carbonated drinks are consumed, corrosion occurs. Mouthwashes that are highly acidic have a similar effect. Teenagers and young children consume a lot of carbonated soft drinks as a main element of their diet. This affection involves not only the cervical areas, but it is coactive with other factors [9]. The interaction of biological, chemical, and behavioral factors is essential and benefits the explanation of why some patients have more erosive lesions than others [11,24].

Dental abfraction defines a dental wear lesion, which occurs mostly at the cervical level, on the buccal surfaces of the frontal and lateral teeth. One of the abfraction theories claims that cervical lesions are caused by physical stress in the form of occlusal pressure, resulting in the breaking of the bonds between the hydroxyapatite crystals, resulting in microfractures in the tooth enamel. These microfractures will favor the loss of dental substance in the cervical region. There are studies that have shown that abfraction may be present with a higher prevalence in patients with bruxism compared to patients without bruxism [28-30].

Gingival recession or retraction (RG), one of the most common gingival defects, is described as the apical movement of free gingival margin towards the CEJ exposing the surface of the root to the oral cavity [31].

A modern recession classification based on the interdental CAL measurement was proposed by Cairo et al. and was incorporated into the new WWC2017 classification as follows [32]:

- Recession Type 1 (RT1): Gingival recession with no loss of interproximal attachment. Interproximal CEJ is clinically not detectable at both mesial and distal aspects of the tooth.
- Recession Type 2 (RT2): Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the depth of the interproximal sulcus/pocket) is less than or equal to the buccal attachment loss (measured from the buccal CEJ to the apical end of the buccal sulcus/pocket).
- Recession Type 3 (RT3): Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the apical end of the sulcus/pocket) is greater than the buccal attachment loss (measured from the buccal CEJ to the apical end of the buccal sulcus/pocket).

Methods of treatment

NCCLs involve loss of tooth structure and gingival recession. If we aim to accomplish a good esthetic result in the course of time, the evaluation and approach to the diagnosis, as well as the treatment must be performed from an interdisciplinary point of view. As treatment methods may alter depending on the form of gingival recession, the level of the free gingival margin and the degree of NCCL, the clinical characteristics of every lesion should be taken into account prior to treatment [33]. At the same time, awareness of a multifactorial etiology guides the practitioner to develop a suitable treatment plan for the patient.

Zucchelli et al. categorized NCCLs and proposed some guidelines to choose the best treatment option. The main indications for treating NCCL are:

1) esthetics, specifically when the lesion is pigmented or combined with gingival recession.
2) dentine hypersensitivity, which causes discomfort for the patient and pain, or dental plaque build-up.
3) carious lesions/demineralization accompanied or not by dentine hypersensitivity.
4) the accumulation of bacterial plaque caused by the aspect or depth of the lesion that not only hinders oral hygiene but even renders it impossible [34].

Topographically, an NCCL can interest only the crown of the tooth (enamel or crown dentin) or only the surface of the root (cementum or root dentin) or may affect both structures. In cases in which NCCL affects the surface of the root, gingival recession can also be observed. NCCLs that only interest the crown region of the tooth can be resolved with direct restorations, while NCCLs that involve the root of the tooth, should receive periodontal surgery. Since in most cases NCCL interests both the crown and root of teeth, it often destroys the cemento-enamel junction, which is the anatomical separation between the crown and the root [35]. After that, the primary criterion for choosing the therapeutic strategy is no longer valid. The clinical and anatomical definitions of the crown and root do not always line up, and the exposed entire surface of the root is covered in soft tissues (Miller classes III and IV) [32]. Furthermore, even in the absence of loss of interdental periodontal support, a tooth with gingival recession may have local circumstances that limit the amount of root covering (i.e., loss of papilla tip or papilla tips, tooth rotation, and tooth extrusion with or without occlusal wear) [35].

When NCCL is minimal, supervision accompanied by using direct restorations is the ideal treatment option. When symptoms are severe, restorative therapy and ongoing interdisciplinary treatment might be required. To be able to make an accurate diagnosis and develop a successful treatment plan, the physician must have access to the patient's complete social, medical, and dental histories as well as a thorough clinical examination that is backed by additional tests such as salivary flow and radiography. Before beginning any irreversible invasive treatment, long-term follow-up is required in some patients [36]. If the patient is troubled by the appearance of their teeth and the lesion is active and causing symptoms, therapeutic action should be taken. Prior to beginning treatment, these aspects must be addressed because they are extremely important. In addition, liaison with general practitioners is indispensable for identifying or developing therapeutic solutions for any general conditions [37].

The treatment of choice for corono-radicular NCCLs should be a combination between restorative and periodontal therapy and should vary depending on the severity, complexity, and cause of the disease [37]. Completion of restorative therapy prior to mucogingival surgery results in several clinical advantages for both strategies. Restorative therapy can be easily performed and completed without compromising the soft tissue, while root coverage treatment is eased by clinical crown reconstruction, which provides a smooth, round and solid substrate for the

periodontal flap [34]. The maximum root coverage (MRC) term is defined by the height at which the gingival margin persists to remain stable after healing from a surgical root coverage procedure [38].

Root coverage is the most demanding esthetic procedure. Azzi, Takei et al. [39,40] found that the prognostication for Miller classes I and II is good to exceptional, while for classes III and IV only limited recovery is expected by using existing techniques.

Numerous feasible techniques known nowadays, such as pedicled grafts, free gingival grafting, subepithelial connective tissue grafting, coronally positioned crescentic flap or guided tissue regeneration, have various degrees of success. Even now, despite numerous cutting-edge surgical techniques and the development of surgical options, a result with 100% root coverage is still impossible. Finding a surgical technique that can guarantee and maintain solid root coverage is thus always important. [41,42].

Pedicled flaps are classified according to the direction of their movement: 1) The rotated flap (rotated or displaced laterally) which includes: laterally positioned flap, transposition flap, double papillary flap. 2) Extended flap (without rotation or lateral displacement) comprising: coronally positioned flap [43].

Coronally positioned flap was used exclusively or combined with other procedures (guided tissue regeneration and subepithelial connective tissue graft). This technique is relatively simple with good esthetic results. It is a predictable procedure to achieve root coverage in Miller class I and II mucogingival defects. The most decisive component in accomplishing full root coverage is the initial gingival thickness. For this reason, this technique (as well as the other pedicled flap techniques) is advised when sufficient keratinized tissue near the gingival recession is present [44,45].

The laterally advanced flap is highly satisfying in the treatment of isolated gingival recessions [46,47]. By combining the esthetics and root coating highlights of the coronally positioned flap technique and the elevated gingival width and keratinized tissue provided by the laterally positioned flap, this technique is highly popular with clinicians. For an effective and predictable result, healthy gingival tissue must be present [48].

It is indicated when there are local anatomical conditions that prevent the formation of a coronally positioned flap, such as: 1. the absence of apical keratinized tissue; 2. the presence of the frenulum or muscle insertion near the gingival margin; 3. white fissures extending to the alveolar mucosa; 4. the presence of deep root abrasions, which require a greater thickness of soft tissues for the formation of a correct profile [49].

Incisions are made in the marginal gingiva and in the interdental papilla at the donor site. A vertical discharge incision is prepared in the apical direction from the gingival margin to the distal surface of the donor area in the sulcular position. A partial thick flap is raised leaving the periosteum intact, which will accelerate the healing of the donor area. The donor flap is rotated in place to cover the defect and is tightly adjusted by suture [45].

The development in gingival width and keratinized tissue height suggests an improvement in the outcome of progressive, isolated recessions and benefits the periodontal health and esthetics of the patient [46,50,51].

The free gingival graft includes both the epithelium and the underlying connective tissue, which is usually harvested from the hard palate and transplanted to the prepared site [45].

In gingival augmentation, free gingival grafting increases buccal depth more predictably than other techniques. Nonetheless, free gingival grafting has certain limitations, like an open wound localized at the donor site and the wound left behind the gingival graft at the recipient site, which may cause postoperative bleeding and pain [52]. The main disadvantage of the free gingival graft is the lack of predictability from an esthetic standpoint [53-55].

Previous studies have shown that the outcome of root covering therapy by using the free gingival graft will not be esthetically successful, as such, from this point of view the conjunctive graft offers better esthetics [52,56-60]. Currently, even if free gingival grafts have proven to be less effective than subepithelial connective grafts in terms of root coverage, they still retain an advantage: they are simple, several teeth can be treated simultaneously, they have easy tissue manipulation, and can be performed when the adjacent keratinized gingiva is insufficient [52]. This technique is optimal in cases with low buccal gingival depth or for teeth that need appropriate root coverage prior to a subgingival filling [60].

Conjunctival grafts are harvested mainly from the level of the palate or from the area of the retromolar trigone. This graft is carefully sutured using at the same time a coronally positioned flap and sutured over it [45]. These are divided into two categories: mucoperiosteal techniques (lamina propria and complete submucosa, periosteum included) [61,62], and mucosal techniques (lamina propria and a fragment of the submucosa) [63,64].

There is an agreement in the field of study that subepithelial connective grafts can improve the prognosis of long-term results [65]. The use of connective tissue for gingival augmentation is preferred when we have a thin mucosa and adequate vestibular depths. Conjunctival grafting can reproduce the appearance of keratinized epithelium, by putting a keratinized tissue under a non-keratinized mucosa changes the epithelium into keratinized tissue [60].

Conjunctival grafting has shown better esthetic and biological results than other techniques (free gingival grafting and guided tissue regeneration) [41,66-68], especially when combined with the modified tunneling technique [69]. But we can achieve equally good results in the reconstruction of the interdental papilla [70,71].

The most important task of the guided tissue regeneration (GTR) technique is to prevent the apical proliferation of the gingival epithelium, thus promoting the regeneration of the connective tissue [72]. It allows a particular restoration of the cementum by the cells of the periodontal ligament, which may form a different attachment from connective tissue in the space between the cementum and the cortical plate of the alveolus. This is done by placing a barrier (membrane) on the surface of the root [45].

Another basic principle in GTR is the formation and preservation of a slot between the cementum and the collagenous membrane [45]. Next to cell exclusion and space maintenance, the membranes used must act as a biomaterial and fulfill other conditions: biocompatibility, tissue acceptance, easy operation, physiological activeness [72].

The thickness of the tissue is the factor that can negatively influence the success of this technique, because if we want to obtain a favorable result, the thickness of the gingival tissue must be at least 1 mm [73].

Today GTR has lost its importance in the management of gum recession due to multiple complications [74].

Conclusions

Noncarious cervical lesions (NCCL) have a multifactorial etiology. Etiological factors and factors favoring the patient can lead to the initiation and progression of these lesions.

The fact that there is a clear link between NCCLs and gingival recession implies the possibility of microsurgical treatment of the lesions in most cases. Since the procedure is very delicate to technique, efficacious surgical intervention is tightly linked to the detection and reduction of causes, the careful choice of the surgical technique, and its appropriate implementation. There are many surgical procedures available to treat gingival recessions, each having benefits and drawbacks. The surgical technique must be carefully chosen for the best possible outcomes over the long term, keeping in mind a number of important considerations. The most effective method to date for treating gingival

recessions is a combination of a coronally advanced flap and a subepithelial connective tissue graft.

It is essential that we continue to understand the etiology, prognosis, and treatment of these lesions with further in vivo studies and meta-analyses.

Conflict of interest: None to declare.

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Corresponding author:
Timea Dakó
George Emil Palade University of Medicine, Pharmacy, Science and Technology of Târgu -Mureș, 38 Gheorghe Marinescu Street, Târgu -Mureș, 540139, Romania
Email: timea.dako@umfst.ro

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