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Management of Non-Carious Cervical Lesions: Case Report

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Abstract:

Introduction: NCCLs are non-cavity lesions found near the gum line, often extending towards the tooth root due to weaker enamel and various factors like abrasion and erosion. They worsen over time, causing pain, tooth weakening, and gum issues. Tooth sensitivity decreases after age 50 due to pulp changes. NCCLs increase with age and are influenced by weak gums.

Case report: Through a clinical case we'll show how to properly identifying the cause of NCCLs and establishing an appropriate treatment plan.

Discussion: Non-carious cervical lesions are considered a contemporary pathology, with the primary cause being the modern lifestyle and dietary habits of the population. Their multiple etiologies and variety of morphological aspects can confound etiological diagnosis, highlighting the importance of thorough patient history to address etiological factors and ensure treatment longevity while preventing recurrence. Direct composite restorations are currently the restoration treatment of choice when functional or aesthetic issues are involved due to their minimally invasive nature and satisfactory long-term clinical performance. However, other alternatives exist, particularly when lesions are associated with gingival recession, including the use of mucogingival surgery techniques or combining both periodontal and restorative treatment approaches

Introduction:

Non carious cervical lesions (NCCL)" can be described as an irreversible loss of mineralized tissue in the absence of carious pathology. Generally, NCCLs are located in the cervical third of the tooth at the amelocemental junction and tend to extend towards the root of the tooth. This is explained by a thinner enamel thickness at this level, and consequently, a much weaker enamel-dentine bond. These lesions can also have various configurations and evolve unfavorably over time, leading to pulpal suffering, weakening of the tooth, and involvement of surrounding periodontal tissues. Dentin sensitivity is also correlated with them but decreases after fifty years; which is quite logically explained by a more atrophied pulp, therefore less close to the surface in this age group. (9)

The prevalence of NCCLs varies according to studies, but all converge towards a significant increase in these lesions at an older age. (1) Kolak et al. found that in a group of patients over 55 years old, 94.7% of them had NCCLs, and a third of them had more than three lesions. (2) The increasing prevalence of these lesions shows that they certainly progress slowly over time.

NCCLs have a multifactorial etiology and are the result of several phenomena which can also occur simultaneously. Causes of NCCLs include abrasion (mechanical wear of the tooth), abfraction (wear via occlusal forces), and erosion (chemical and electrochemical degradation). These physical and/or chemical factors implemented on an insufficiently resistant gingival phenotype will lead to the appearance of NCCLs. As well as the opening of dentinal tubules will be responsible for increasing tooth hypersensitivity at the NCCL level. (3) Correct identification of the cause of NCCLs will establish the most appropriate treatment plan, reduce the progression of already formed lesions and put the patient on a prevention plan. (3)

Clinical case:

A 65-years-old man with general Parkinson's disease, complained of an aesthetic dental problem. The dental examination reveals gingival inflammation with slight generalized tooth mobility (2). The patient has occlusal overload, with moderately deep cervical lesions with blunt edges on the following maxillary teeth: 14,13,12,11,24 and mandibular ones: 43,42,41,31,32 at. The severity of the condition is significant, especially concerning the right maxillary premolar and canine (the patient is left-handed). (fig 1) Panoramic radiography also shows moderate generalized bone loss. (fig2) In this case, the diagnosis was abrasion associated to abfraction in chronic periodontitis.

Figure 1: Clinical photos taken during the initial consultation, showing the severity of the lesions associated to the gingival inflammation

Figure 2 : Panoramic radiograph of the patient

A multidisciplinary collaboration is necessary for comprehensive care. The treatment involves a periodontal phase for the treatment and stabilization of chronic periodontitis, which lasted a total of 12 months. (fig3) An aesthetic phase (after 12 months) entails the creation of aesthetic cervical restorations

using direct composite technique. Then, a final occlusal phase is carried out to perform occlusal equilibration and ensure stabilization of the results. (fig4)

Figure 3 : Photographs after periodontal management showing :

- **Stabilized chronic periodontitis**
- **Preservation of non-mobile teeth**
- **Absence of gingival inflammation**
- **Good oral hygiene**

Figure 4 : [1*] Attempting composite on a tooth /[2*] Restoration of maxillary teeth visible when smiling (14-23) / [3*] Restoration of anterior mandibular teeth (33-43) / [4] Composite finishing

Two types of composites were used to manage this clinical case: PALFIQUE LX5 (Tokuyama Dental) in shade A2 for covering coronal substance losses, and Micro Esthetic Gingiva (Bisico) fluid composite in "dark pink" shade for root coverage with a gum simulation effect. This particular fluid composite, due to its pink shade, is micro-filled and also exhibits good flexural strength (>148 MPa), compression strength (>394 MPa), hardness (>770 MPa), and Young's modulus (>13485 MPa).

DISCUSSION

I. Etiological Diagnosis of NCCLs:

I.1. Dental Erosion:

Dental erosion involves the dissolution of mineralized tooth tissue due to a chemical process without

bacterial action. Factors affecting the severity of erosion include the quantity and temperature of the acidic substance and the timing of acid contact with the hard tissue of the tooth. (3)

These lesions on the enamel surface are described as smooth and concave. Microscopic examination will reveal a porous surface corresponding to the exposure of enamel prisms after dissolution of the interprismatic matrix.

The location of erosion lesions varies depending on the origin of the acidic substance. Endogenous erosion occurs when the acidic substance comes from within the body, such as chronic gastroesophageal reflux or repeated vomiting encountered in eating disorders. These will cause lesions on the palatal surfaces of the maxillary anterior teeth. (3,4,6) Exogenous erosion, on the other hand, involves acidic substances from external sources, such as acidic drinks or foods, primarily responsible for erosion of the buccal surfaces of the teeth. Constant contact of the acidic substance with the tooth surface leads to progressive softening of hard tooth tissue with subsequent dissolution and total loss, observed on the buccal surfaces of the maxillary anterior teeth. (3,5,6,10,13)

I.2. Dental Abrasion:

Dental abrasion is the abnormal loss of tooth substance due to an exogenous mechanical process in the absence of bacterial action. These lesions are characterized by striated surfaces resulting from constant contact with external abrasive substances. Patients who develop such lesions often have good oral hygiene combined with vigorous brushing technique, hard-bristled toothbrushes, or excessive use of abrasive toothpaste. (3,7,10) These lesions are more noticeable in the quadrant where brushing begins, primarily affecting premolars and canines.

I.3. Dental Abfraction:

Abfraction is the pathological loss of hard tooth tissue due to occlusal forces causing dental flexure and deformation, resulting in microfractures in the enamel and cervical dentin, considered a stress concentration zone, thus weakening the tooth structure. This is explained by the application of horizontal occlusal forces encountered during chewing or parafunctional activities, concentrated at the cervical level of the teeth and inadequately supported by dental tissues. These tensile forces lead to a rupture of hydroxyapatite crystal bonds, exposing the underlying dentin. Abfraction lesions typically present as wedge or V-shaped with sharp angles. Secondary factors such as erosion or abrasion may exacerbate the loss of tooth substance and alter the initial appearance of lesions, resulting in more blunt enamel edges due to mechanical brushing action. (3,8,10,13)

II. Management of NCCLs:

The severity level of NCCLs leads to various signs and symptoms, including a progressive increase in tooth hypersensitivity, alteration in dental aesthetics (manifested by visible dentin color or gingival recession), subsequent accumulation of dental plaque at the concave lesion area, or gingival inflammation causing bleeding and discomfort during brushing. (3,10)

The loss of mineralized tissue resulting from NCCL formation leads to the formation of tertiary or reparative dentin, which occludes dentinal tubules. (11,12) The deposition of such reactive dentin can hinder the adhesion of the restorative material to the tooth surface. (11) There are many other factors that can compromise the durability of the restoration, including lesion depth, cavity shape, and the restoration performed. In addition, the location of NCCLs, if too cervical, will create a difficult-to-isolate moist environment. (10,11) For these reasons, it has been shown that the treatment and prediction of NCCLs can be challenging. The ability of the chosen material to adhere to the tooth and resist occlusal forces

determines the success of the restoration performed. Additionally, the activity of NCCLs must be evaluated and taken into account in the treatment planning process. It is known that the progression of these lesions is generally slow but with significant variations among patients. (3,13) Therefore, individual follow-up should be established, assessing the severity of current lesions, age, as well as existing etiological and risk factors. For patients exposed to intrinsic acids or exhibiting rapid progression, for example, the lesion activity assessment procedure should be repeated every 6 months with strict hygiene. For most other cases, annual evaluation is acceptable. (13) Approaches to determining lesion activity include the use of standardized intraoral photographs, study models, and measurement of lesion dimensions (width/length). With the recent introduction of digital dentistry, computer-aided design and manufacturing systems can be useful for diagnosing and monitoring NCCL activity. (13)

The decision to monitor NCCLs rather than intervene should be based on lesion progression and how they compromise the vitality, function, and aesthetics of the teeth. Restorative treatment of NCCLs should be considered when one or more of the following conditions are present:

A. Active and cavitated carious lesions associated with NCCLs.
B. The boundary of one or more lesion(s) is subgingival and prevents plaque control.
C. Significant loss of tooth structure compromising tooth integrity, near pulp exposure, or exposed pulp.
D. Persistent tooth hypersensitivity, for which non-invasive therapeutic options have failed.
E. A tooth serving as a prosthetic abutment for a removable prosthesis.
F. Aesthetic requirements at the patient's request. (13)

If restoration is necessary, NCCLs should be restored in the least invasive manner possible. Among the available restoration techniques, an adhesive system combined with composite resin is the preferred choice for restoring this type of lesion due to its good aesthetic and mechanical properties. Although the use of glass ionomers, resin-modified glass ionomers has been advocated for NCCL restorations, these materials will be reserved for clinical situations where bonding is impossible to achieve. (13) The operator also plays a crucial role in the success and longevity of restorations. They must ensure that a rigorous clinical protocol is followed: isolation, tooth preparation, application of adhesive system and composite, finishing, polishing, and finally, restoration maintenance. If these parameters are respected, the restorations will be successful. (13)

1. Preventive Treatment :

Preventive therapy aims to slow the progression of existing lesions or prevent the development of new ones. This preventive approach involves changing certain patient habits based on the etiology of the lesions: abrasion, erosion, abfraction. (20) It is important to assess hygiene and dietary habits as well as evaluate salivary factors and their protective role. This is to raise awareness in the patient that their habits may have potentially harmful characteristics that need to be addressed. (20)

2. Therapeutic Treatment :

2.1. Choice of Composite :

The absence of macromechanical retention with a relatively low C factor (ranging from 2 to 5 depending on the depth of the cavity) in most of these class V cavities minimizes the effect of material characteristics such as polymerization shrinkage. (22,24) The success of the restoration primarily depends on the actual bonding capacity of the material. Indeed, the retention of NCCL restorations is closely related to the adhesive capacity and the modulus of elasticity (Young's modulus) characterizing the stiffness of the

restorative material. (3) Mechanical properties such as wear resistance are relatively unimportant due to the absence of direct stresses, unlike the performance of the adhesive used. (23,24) However, it is important to choose a material with a low modulus of elasticity. (15,16) This is because any occlusal flexion forces tend to dislodge the restoration; a low modulus of elasticity allows the material to adapt by absorbing excessive stress. The most suitable composite resin families for NCCL restoration are fluid composites, micro-hybrid composites, and micro-filled composites. (15,16,24,25) However, no definitive conclusion can be drawn from the literature regarding the difference between success/failure rates of composites with different stiffness used for NCCL restoration. (15,16)

2.2. Choice of Adhesive:

In a systematic review of clinical studies on non-carious cervical lesions, the performance of 78 adhesives was tested in 87 clinical trials, with the key parameter evaluated being the number of restorations lost per year. The adhesives were classified into seven categories (‘’ER adhesives for *etch and rinse adhesive systems ; there are ER2 and ER3 according to the number of steps in the procedure /* SE adhesives for *self-etch adhesive systems*): ER3, ER2, SE 2, SE 2 s, SE 2 m, SE 1 m, SE 1 s (*m for « mid » , s for « strong »).*

According to initial findings, the adhesive protocol is a determining factor in the effectiveness of bonding for non-carious cervical lesions. The most performing categories are S Self-etch 2 m, ER 3, and SE1 m. ER 2 systems and SE s are reported to have the lowest bonding efficacy. (19,20)

However, these results are contradicted in a meta-analysis including 29 studies, where it was found that the use of a self-etch or etch-and-rinse adhesive system protocol had no influence on the restoration retention rate with composite or post-operative sensitivities. However, there was a reduction in marginal discoloration with etch-and-rinse adhesives systems. Besides the choice of adhesive system, the operator plays a decisive role in implementing clinical procedures. (20,21)

In another meta-analysis comparing studies evaluating the marginal adaptation of several universal adhesive systems with different compositions, various studies showed good clinical performance in terms of marginal adaptation quality and better results when enamel margins were etched with phosphoric acid, while maintaining the self-etch effect of the adhesive only for dentin. (17)

However, the use of a universal adhesive system in its self-etch mode is preferable to facilitate its application and also reduce the risk of double etching of dentin when applying phosphoric acid and the acidic monomer of the adhesive itself. Given the operational difficulty of applying phosphoric acid without exceeding the enamel margin and its diffusion into the dentin, no study has evaluated universal adhesives for their potential simultaneous adhesion to enamel and dentin margins in the same cavity. (17)

2.3 Role of Glass Ionomer Cements (GICs) in NCCL Restoration :

The retention of GICs is superior to that of composites in NCCLs, ranging between 90 and 100% at 3 years. (23) They are also characterized by very good pulpal and periodontal biocompatibility, despite a surface state that is rarely smooth. They are also bioactive due to their ability to release fluoride ions even after setting, giving them antibacterial properties and tissue remineralization capacity. The thermal expansion coefficient is close to that of the tooth, and the setting shrinkage ranges between 3 and 5%, but it induces very little stress. The material's setting is extremely slow, providing good dimensional stability and therefore good marginal integrity. Due to this delayed setting, it is advisable to defer polishing GIC restorations for at least 24 hours. (23,24) However, GICs also have drawbacks, such as their weak aesthetic and mechanical properties (compression resistance, abrasion resistance, and wear resistance), which are much lower than those of composite resins. Although resin-modified glass ionomers (RMGICs) address

some of the shortcomings of conventional GICs, aesthetics remain a significant issue, and long-term surface stability is less favorable than with composite resins. Surface porosity does not allow for good color stability. To address the shortcomings of RMGICs, it is possible to perform the restoration using the "Sandwich" technique. This approach preserves the advantages of each material. Replacing dentin and enamel with GIC and then composite resin reduces the composite's setting shrinkage and improves surface condition, mechanical properties, and optical properties of GICs. (23,24,25)

Treatment of NCCL Hypersensitivity:

It is important to recognize that hypersensitivity is not systematic in all patients. Indeed, if NCCLs develop in elderly individuals, dentinal permeability is already reduced along with dentin volume, significantly decreasing hypersensitivity rates in these patients. Lasers have been introduced as an innovative, conservative, and eco-friendly alternative for treating cervical dentinal hypersensitivity when conventional techniques yield no results. They allow for the obliteration and reduction of the number of dentinal tubules by melting and then resolidifying the dentin surface. According to other authors, they obliterate dentinal tubules by coagulating proteins present in dentinal fluids.(18,20)

A study on the use of diode lasers before restoring teeth with NCCLs confirmed that it had no effect on the restoration retention rate, could reduce hypersensitivity, and might affect the restoration's success. This in vivo study revealed that groups receiving diode laser treatment before restoration had lower sensitivity than those that did not. However, evidence remains weak and requires further confirmation. (18)

D. Management of Occlusal Disorders and Parafunctions :

Lee et al. (26) hypothesized that horizontal occlusal forces from mastication, bruxism, and parafunctional activity create a stress concentration point at the cervical region of the tooth, leading to a weakening of the thin crystalline enamel structure and tissue loss at this level. (26,27) The study's results align with Soares et al.'s conclusions, stating that oblique forces on the tooth would promote stress in the cervical region, consequently initiating and progressing NCCLs. Romeed et al.'s (26,29) study findings also support these conclusions, reporting that the maximum stress concentration at the amelocemental junction was generated by lateral occlusal forces. Occlusal trauma and group function during lateral movement have been recognized as significant factors in the development of NCCLs. (26) Therefore, managing NCCLs should include restoring lost tissues in addition to controlling all other etiological factors and possibly correcting occlusal forces when associated with them. (26)

CONCLUSION:

Non-carious cervical lesions are considered a contemporary pathology, with the primary cause being the modern lifestyle and dietary habits of the population, and their prevalence increases with age. Their multiple etiologies and variety of morphological aspects can confound etiological diagnosis, highlighting the importance of thorough patient history to address etiological factors and ensure treatment longevity while preventing recurrence. Direct composite restorations are currently the restoration treatment of choice when functional or aesthetic issues are involved due to their minimally invasive nature and satisfactory long-term clinical performance. However, other alternatives exist, particularly when lesions are associated with gingival recession, including the use of mucogingival surgery techniques or combining both periodontal and restorative treatment approaches.

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