

## DENTIN HYPERSENSITIVITY ASSOCIATED WITH NON-CARIOUS CERVICAL LESIONS: A LITERATURE REVIEW

### HIPERSENSIBILIDADE DENTINÁRIA ASSOCIADA A LESÕES CERVICAIS NÃO CARIOSAS: REVISÃO DE LITERATURA

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#### Resumo

O objetivo deste trabalho foi apresentar uma revisão de literatura sobre a etiologia, diagnóstico e tratamento da hipersensibilidade dentinária. A hipersensibilidade dentinária é caracterizada por dor curta e aguda, que surge da dentina exposta em resposta a estímulos, tipicamente térmicos, evaporativos, táteis, osmóticos ou químicos e que não podem ser atribuídos a qualquer outro defeito ou patologia dentária. O termo "Hipersensibilidade radicular" é usado para descrever a hipersensibilidade da dentina associada normalmente às recessões gengivais, abrasões, erosões e abfrações. A etiologia é multifatorial e a escolha do tratamento ideal é dependente de diagnóstico correto. Outras entidades relacionadas à hipersensibilidade são as lesões cervicais não cariosas (LCNC) que são condições comuns numa sociedade mais longínqua e com novos hábitos. Todos os tratamentos apresentados, como uso de agentes bloqueadores associados ao creme dental dessensibilizante, procedimentos restauradores, uso de lasers e procedimentos cirúrgicos são eficazes em reduzir a hipersensibilidade dentinária. Uma avaliação do perfil periodontal também torna-se importante principalmente quando objetivam-se estabilidade marginal e prevenção de possíveis LCNC futuras. Com isso, pode-se concluir que a hipersensibilidade dentinária e as lesões cervicais não cariosas são condições que exigem o conhecimento do cirurgião-dentista em relação à sua etiologia, formas de tratamento e manutenção a longo prazo.

**Palavras-chave:** Desgaste dentário. Gengiva. Sensibilidade da dentina. Recessão gengival

#### Abstract

The aim of this study was to present a literature review on the etiology, diagnosis and treatment of dentin hypersensitivity. Dentin hypersensitivity is characterized by short and acute pain, which arises from exposed dentin in response to stimuli, typically thermal, evaporative, tactile, osmotic or chemical and which cannot be attributed to any other dental defect or pathology. The term "Root Hypersensitivity" is used to describe the dentin hypersensitivity normally associated with gingival recessions, abrasions, erosions and abfractions. The etiology is multifactorial and the choice of the ideal treatment depends on a correct diagnosis. Other entities related to hypersensitivity are non-carious cervical lesions (NCCL), which are common conditions in a more distant society with new habits. All treatments presented, such as the use of blocking agents associated with desensitizing toothpaste, restorative procedures, the use of lasers and surgical procedures are effective in reducing dentinal hypersensitivity. An evaluation of the periodontal profile is also important especially when aiming at marginal stability and prevention of possible future NCCL. Thus, it can be concluded that dentin hypersensitivity and non-carious cervical lesions are conditions that require the dentist's knowledge in relation to their etiology, forms of treatment and long-term maintenance.

**Keywords:** Tooth wear. Gingiva. Dentin Sensitivity. Gingival recession

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## INTRODUCTION

A pleasant smile is influenced by the quality of dental elements and supporting tissues, the relationships between teeth, jaw and lips during the act of smiling and their harmonic integration in facial composition (1). Non-carious cervical lesions (NCCL) are characterized by loss of dental structure in the cemento-enamel junction that is not associated with caries (2) and that may interfere with the aesthetic parameters of the smile, involving changes in the shape of the gingival margin, color and texture of the gums and color of the lesions themselves. They may generate visual discomfort to the patient and are associated with functional damage, such as dentin hypersensitivity (3).

Dentin hypersensitivity is characterized by short and acute pain, which arises from exposed dentin in response to stimuli – typically thermal, evaporative, tactile, osmotic or chemical – that cannot be attributed to any other dental defect or pathology (3). Two processes are necessary for dentin hypersensitivity to occur: the dentin must be exposed, and the dentin tubule system must be open and connected to the pulp. The mechanism of action still accepted is the Hydrodynamic Theory (Figure 1, A and B), which is based

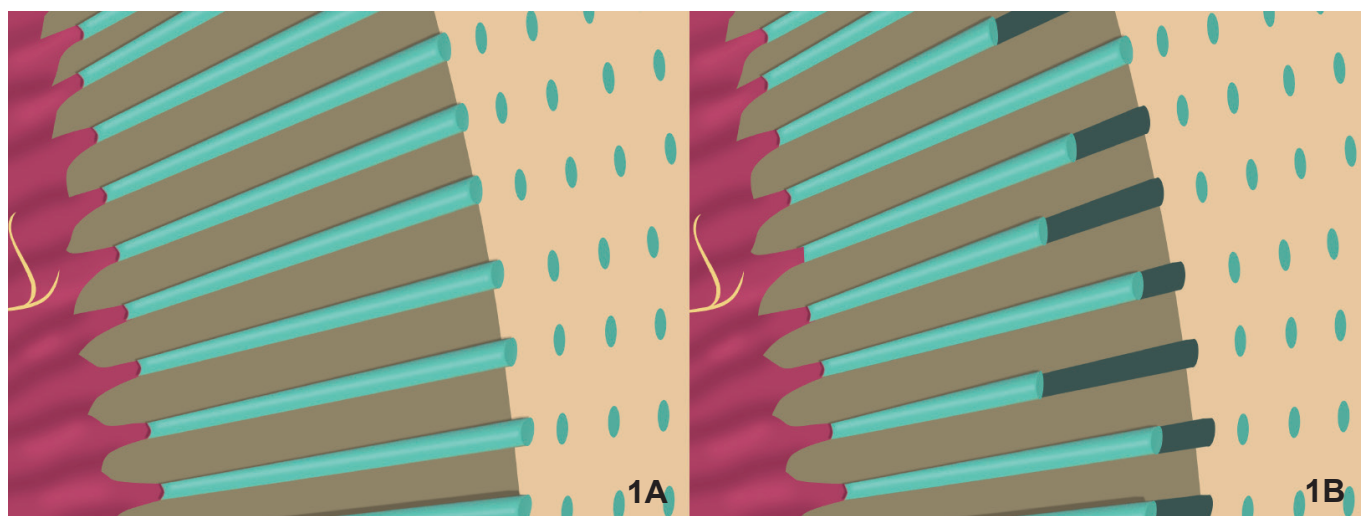
on the principle that stimuli on the area of dentin exposure cause the dentin fluid in the tubules to move. Pressure is thus exerted on the nerve endings of the dentin-pulp complex, with a consequent rapid and painful response, through the delta A fibers of the pulp (4).

The term “root hypersensitivity” is used to describe hypersensitivity in the dentin associated with gingival retraction, abrasion, bio-corrosion, abfraction (5).

Besides generating aesthetic and functional damage, hypersensitivity is a highly prevalent entity in the population, frequently occurring in patients aged between 30 and 40 years in a rate of 3 to 98% (6). In young patients, the prevalence is approximately 19% (7).

The correct diagnosis of the condition and etiology by the dentist are crucial, as the treatment is often multidisciplinary, involving the home use of desensitizing toothpastes or blocking agents of the openings of the dentinal tubules; restorations in composite resin or glass ionomer; use of sealants or varnishes; laser therapy, root covering, and, in the most severe cases, endodontic treatment (5,8,9).

The aim of this study was to conduct a literature review, based on a bibliographic survey on etiology, different forms of diagnosis and treatment of dentinal hypersensitivity.



**Figure 1** - (A) and (B) Scheme of Hydrodynamic Theory described by Brännström (1986). Due to stimuli on the area of exposure, the dentin fluid in the tubules moves, exerting pressure on the nerve endings of the dentin-pulp complex, with a consequent rapid and painful response, through the delta A fibers of the pulp. Source: schematic drawing by professors Luis Paulo Barreto and Marcela Melo dos Santos.

## LITERATURE REVIEW

The search strategies for selection in this study were electronic databases, such as Pubmed, Lilacs and Medline and conceptual books, via the following terms: dentin hypersensitivity, gingival recession, non-carious cervical lesions, root covering.

### Etiology, Prevalence, Diagnosis and Mechanisms

Clinical management of dentin hypersensitivity requires at first the correct diagnosis. The greatest challenge of treatment is the subjectivity of personal perception of pain, thus making the diagnosis of the degree of hypersensitivity rebuttable. Many clinical studies use the Visual Analog Scale (VAS) and Verbal Response (VR) in order to measure the patient's response to pain through stimuli to touch with the explorer tube in contact with the cervical region of the dental element; or thermal stimulus, with the use of triple syringe air jet for a few seconds on the assessed tooth (7,10-12).

The wear of the enamel or cement structure in the cemento-enamel junction without association with caries can be classified as non-carious cervical lesion (NCCL) (2). This type of injury occurs due to biocorrosion, abrasion and/or abfraction processes and this exposed dentin surface may generate some degree of sensitivity (3,5). NCCL can occur from a combination of factors: age, presence of premature contact and alcohol consumption (13-15).

Dental biocorrosion (Figure 2, A and B) is characterized by the progressive loss of hard tooth tissue caused by the direct action of chemical substances on the dental surface exposed to the oral cavity (16). Biocorrosion is not a new phenomenon but has received great attention due to its increase in prevalence due to changes in the habits of populations and the increase in tooth longevity in the oral cavity (16-18). The ingestion of acid foods and beverages and the use of medicines explain the external etiology of biocorrosion. The main mechanism of this condition is the deficient performance of the buffer effect of saliva in the critical pH (5.5), leading to the demineralization of the dental structure and impairing the remineralization process of dental



**Figure 2 - (A) and (B) biocorrosion in lower left and right premolars and 1st molars. Patient reported. Patient reported ingesting high amount of citrus juice during the day. Source: Images granted by Professor Luis Paulo Barreto and Professor Marcela Melo.**

elements, which start to present concave depressions on the palatine and occlusal surfaces of the upper teeth and in the vestibular and occlusal faces of the posterior inferiors (Figure 3, A and B). The most frequent biocorrosion lesion is located on the vestibular face of the anterior teeth in the cervical third. This region is often more affected because self-cleaning occurs less intensely, leading to longer contact between acid and tooth (16).

Abrasion (Figure 4) is a process of demineralization or pathological loss of the dental structure or restoration, free of plaque, that occurs slowly, progressively and gradually due to harmful habits (19). It is associated with mechanical stress, mostly attributed to the prolonged action of traumatic brushing in the horizontal direction and the applied force. Hard bristle brushes have a greater capacity to generate abrasions compared to soft bristle brushes (7, 20).





**Figure 3 - (A) and (B) Biocorrosion.** Wear on the occlusal of lower molars  
 Source: Images granted by Professor Luis Paulo Barreto and Professor Marcela Melo



**Figure 4 - Abrasion.** Related to excessive brushing habits and high acidic food intake.  
 Source: Images granted by Professor Luis Paulo Barreto and Professor Marcela Melo.

Abfraction (Figures 5 and 6) is the loss of dental structure resulting from occlusal stress, which by repeated forces cause defects in enamel and dentin in the gingival line (19). The main cause can be attributed to occlusal overload, which most often causes tooth flexion at the amelocementary limit (21). Patients with bruxism are approximately six times more likely to present abfraction lesions when compared to those who did not face this condition (22).

NCCL involving the root part of the dental element is commonly associated with gingival recession (Figures 7 and 8), a condition in which there is an apical displacement of the gingival margin in relation to the cemento-enamel junction, which may trigger hypersensitivity. NCCL, hypersensitivity and gingival recessions have a similar distribution with increasing age (9,12).



**Figure 5 - abfraction in upper left premolars and tooth 14.**  
 Source: Images granted by Professor Luis Paulo Barreto and Professor Marcela Melo.



**Figure 6 - in the upper right canine and 2nd premolar, due to occlusal trauma.**  
 Source: Images granted by Professor Luis Paulo Barreto and Professor Marcela Melo



**Figure 7** -Presence of multiple recessions and abfraction in several teeth, possibly associated with the use of orthodontic apparatus and occlusal traumas.

Source: Images granted by Professor Luis Paulo Barreto and Professor Marcela Melo.



**Figure 8** - Presence of gingival recessions in recessions in teeth 8 and 9, whose etiology, whose etiology is the habit of "scratching" the gums. Source: Images granted by Professor Luis Paulo Barreto and Professor Marcela Melo.

## Treatment

The treatment of hypersensitivity associated with NCCL is based on the removal of the etiological factor, so that any proposed treatment modality may have a chance of success. In cases of biocorrosion it is recommended to avoid brushing immediately after consumption of acidic foods and reevaluation of the patient's diet. In the case of abrasion, the harmful habit in question should be stopped (8). In cases of abfractions, treatment depends critically on occlusion, and lateral forces in affected teeth should

be eliminated, either through restorations that reestablish the previous guide or orthodontic treatment (21). In the case of teeth-grinding, use of medications, interocclusal appliances and the patient's own awareness (22).

Initial treatment often takes place with plaque control to develop smooth, hard and insensitive root surfaces. In severe cases, the use of blocking agents associated with desensitizing toothpaste is the first choice of noninvasive treatment (5, 8).

Some compounds are being used with astringent or coagulant effects on the content of dentinal tubules, namely: arginine, strontium chloride, calcium monofluorophosphate, sodium fluoride, calcium hypophosphate, calcium hydroxide, potassium nitrate, potassium oxalate, glutaraldehyde, ferric oxalate, tin fluoride, bioactive glasses. These compounds are used either in toothpastes or in dentist's office applications, but no therapy has proven to be universally definitive. Most agents cause superficial blockage, dissolved over time (5,8,23).

Restorative procedures are alternatives that aim to interrupt the progression of NCCL, strengthening the dental remnant, preventing plaque accumulation and the development of caries and periodontal disease. The commonly used restorative materials are composite resin, flow resin and resin-modified glass ionomer (12,24,26,27). Composite resin was more efficient in relation to hypersensitivity treatment when compared to resin-modified glass ionomer, especially among young patients. In older patients, both materials had the same efficacy (12,24-27).

Low- and high-intensity lasers are also used as noninvasive therapy methods in the treatment of dentinal hypersensitivity. The low-power laser stimulates normal cellular functions, bringing analgesic benefits, obliterating the dentinal tubules by the photobiomodulation effect on the dental pulp (28). The high-power laser, in turn, acts on the transmission of heat resulting in fusion and solidification of the dentin, with a sealing effect and reduction of the diameter



of the dentinal tubules (29). Both types of laser therapy are considered effective (30,31).

NCCL may be associated with gingival recession, leading to a combined defect that requires different types of treatment. A classification of dental surfaces in the areas of these combined defects was proposed by Pini-Prato et al. (2010) to facilitate treatment planning. This was based on either the presence or absence of cemento-enamel junction (CEJ) and tooth surface wear, thus determined: Class A-, gingival recession with visible CEJ and intact root surface. Class A+, gingival recession with surface wear and visible CEJ; Class B-, gingival recession associated with the loss of CEJ without surface wear; Class B+, gingival recession associated with the loss of CEJ with surface wear (32). Thus, the treatment for each situation, despite Miller's classification (33) (1985), regarding predictability in cases of surgical coverage, are: Class A- is a gingival recession with intact root surface and can be treated by a root covering surgical procedure. Class A+ is a gingival recession associated with NCCL that affects only the area of the root surface. In this situation, a connective tissue graft, associated with the coronally positioned flap, can be placed to fill the defect in the root. Class B- is a gingival recession associated with a shallow NCCL that affects the root and surface of the crown. This class may require a procedure only for root cover. Finally, Class B+ is a gingival recession associated with NCCL that affects the root and crown of the tooth with wear. This condition often requires a surgical-restorative approach (32).

A study carried out in 2019 by Agudio et al. (34), with monitoring from 25 to 30 years, sought to evaluate the effect of the gingival augmentation procedure (free gingival graft) in reducing the risk of non-carious cervical lesions. Fifty-two patients participated, with the test group being composed of patients who presented gingival recessions with absence of keratinized tissue. Patients were treated with free gingival graft and evaluated at the beginning of treatment (T0), 12 months after (T1), after 15

- 20 years (T2) and finally, 25 to 30 years (T3). In total, 49 patients were evaluated, among 130 assessed sites. The presence of cervical lesions was associated with sites with keratinized tissue smaller than 2 mm, concluding that the modification of the periodontal phenotype may prevent the development/progression of NCCL.

## DISCUSSION

In general, the choice of the best treatment for dentinal hypersensitivity should be based on accurate diagnosis and control of etiological factors (5,8,11).

Regarding the diagnosis, the use of thermal testing with air jets and/or tactile testing with probes in the cervical area of teeth affected by NCCL are the best techniques to verify painful response (7,10-12).

Another interesting tool in the diagnosis and planning of the treatment of NCCL is the use of the classification of Pini-Prato et al. (32) in 2010, which previously defines a form of treatment of recessions according to the presence or not of the cemento-enamel junction and NCCL.

In a clinical study, Figueiredo et al. (18) observed that the frequency of soft drink consumption was positively associated with the occurrence of NCCL in patients with occlusal disorders, corroborating the findings of Sobral et al (16), who analyzed the effects of acid iced beverages such as juices and soft drinks on the development of dental biocorrosion and consequent sensitivity. In clinical studies by Alvarez-Arenal et al (14), in 2018, and Yoshizaki et al (13), in 2016, it was also found the relationship between consumption of salads seasoned with acid sauces and alcoholic beverages such as wine with NCCL and hypersensitivity, respectively. On the other hand, Silva et al (7) did not observe an association between acid food consumption and hypersensitivity in a sample with Brazilian adolescents.

Regarding the etiology of abrasion lesions, Lindhe et al (8) associated it with horizontal brushing, corresponding to the findings of Silva et al (7), in which this harmful habit was considered a risk indicator for dentinal hypersensitivity. Brush configuration has an impact on the development of NCCL, therefore, the use of

brushes with soft bristle decreases the chance of NCCL occurring, regardless of the applied force (20).

Teixeira et al (15), in 2018, observed a growing relationship between the increased incidence of NCCL, hypersensitivity and gingival recession with age, especially from 50 years onwards. However, Silva et al (7) highlighted a worrying prevalence of this condition in Brazilian adolescents.

The main cause of abfraction injuries can be attributed to occlusal overload and this phenomenon can be aggravated by abrasion and/or erosion (21,22).

In a noninvasive treatment approach, authors mostly agreed with the use of desensitizing toothpastes or treatment in the office with blocking substances of the dentinal tubules, despite the temporary results (5,8,23). Arrais et al. (23) they did not find statistically significant differences in the obliterating capacity of three market-recognized substances.

Low-power lasers as well as high intensity lasers offer the same effective result in the treatment of hypersensitivity (30). Treatment exclusively with laser therapy can reduce sensitivity for up to six months, while there are authors who have observed that the association of laser and application of desensitizing agent extended the result by 18 months (30,31)

The resin-modified glass ionomer has biocompatible properties to periodontal tissues and allows satisfactory restoration of NCCL, especially in the subgingival region (24). According to Carvalho et al (2018), there was no statistically significant difference between teeth restored with composite resin or resin-modified glass ionomer regarding the response of adjacent periodontal tissues (26). Santamaria et al.(12), in 2016, found that the resin-modified ionomer led to color change after two years, compromising the aesthetics; thus, it was concluded that the composite resin responded satisfactorily to this item after one year of follow-up. Corroborating this finding, a clinical study showed that the resin-modified glass ionomer presents greater susceptibility to degradation in relation to composite resin (25). Regarding the effectiveness in blocking hypersensitivity, the composite resin was shown to be superior in young patients (26).

The cases of NCCL associated with gingival recession that were treated with coronal repositioning mucogingival surgery combined with connective tissue grafting and restorative procedure resulted in improvement of hypersensitivity and periodontal and aesthetic conditions (12,24). In addition, gingival thickness smaller than 2 mm may be a factor associated with NCCL, and the free gingival graft is one of the possibilities to increase gingival thickness in these cases (34). Thus, the great challenge of treating dentin hypersensitivity, especially when associated with NCCL, is to find a therapy method that permanently eliminates the pain.

## CONCLUSION

Dentin hypersensitivity associated with non-carious cervical lesions is a common condition in a long-living society with new habits, and due to its multifactorial characteristics, accurate diagnosis becomes fundamental in the conduction of treatment. All treatments presented are effective in reducing dentin hypersensitivity. An evaluation of the periodontal profile also becomes important with regard to marginal stability and prevention of possible future NCCLs. Therefore, knowing the etiology and treatment of non-carious cervical lesions associated with dentinal hypersensitivity becomes necessary for a safe and effective clinical conduct by the dentist.

The authors declare no conflict of interest.

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