Esthetic Noncarious Class V Restorations: A Case Report

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ABSTRACT

When restoring anterior and posterior teeth affected by noncarious cervical lesions, many clinicians overlook the etiologic factors responsible for the lesions' development, resulting in frequent restorative failures. The treatment approach for noncarious cervical lesions must not be based only on restorative procedures since a variety of causative and aggravating factors are related to their formation. This article discusses a treatment protocol and techniques for the restoration of noncarious Class V lesions and presents a clinical case in which esthetic restorations are achieved.

CLINICAL SIGNIFICANCE

Treatment options for noncarious Class V lesions can range from simply eliminating the causative factors of the lesions and regularly monitoring their progression to specific restorative procedures. Resin composites are the best materials for restoring cervical defects owing to their bonding ability, physical properties, and esthetic potential. A straightforward technique for the successful restoration of noncarious Class V lesions is presented.

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As the prevalence of carious lesions follows a trend toward diminishing in several populations,[1,2] noncarious cervical lesions have been advancing in the opposite direction, becoming more common candidates for restorative procedures.[3]

In 1991 Grippo introduced the term *abfraction* as a fourth classification of dental hard tissue lesions not related to the carious process.[4] However, it was in 1984 that the first theory was proposed concerning their etiologic process; at that time, noncarious cervical lesions were divided into abrasion and erosion.[5] In a recent review by Grippo and colleagues,[6] the authors recommend the term *erosion* be supplanted by the term *corrosion* as an appropriate denotation of chemical dissolution of teeth.

Corrosion is the chronic result of interaction of intrinsic or extrinsic acids, without bacterial involvement, to the mineral surfaces of the teeth.[7] Abrasion is the loss of tooth substance through mechanical means such as toothbrushing.[8] Abfraction, however, is a stress-induced lesion that results from eccentric loads applied to the occlusal surfaces of teeth and can be further exacerbated by erosion-corrosion and abrasion.[5,9]

Different types of noncarious cervical lesions present various etiologies and morphologic characteristics that allow us to differentiate them;

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however, the actions of acids, abrasion, and occlusal stresses can act separately or interact,[6,10] and it is the responsibility of the dentist to diagnose the multifactorial pathogenesis of these lesions. Local factors tend to modify the tooth's original shape, whereas abfraction lesions generally are wedge-shaped defects with a sharp cavosurface angle at the occlusal margin, and acid corrosions show structure loss over a wide area with no sharp line angles. Abrasion lesions usually tend to occur in more than one element, with a cavosurface angle not as sharp as those in abfractive lesions. The exposure of dentin in the cervical third to the oral environment provokes the stimulation of the mechanoreceptors at the pulp-dentin interface through the dentinal tubules, resulting in dentin hypersensitivity, a common sequela of this type of lesion.[9]

Several studies have found a high correlation between patients with excessive functional or eccentric loading and periods of active bruxism and the development of abfractive lesions.[9–14] They concluded that a causal association appears to exist among wedge-shaped lesions, occlusal disharmony, parafunction, and severe psychological stress of the patients. Bruxism can be centric, when the teeth are pressed together without lateroprotrusive movements of the mandible, or eccentric, when the teeth are ground owing to small and/or large movements of the mandible.[15] Eccentric bruxism seems to be the most harmful since lateral movement loading forces produce a flexure that is 10 to 20 times greater than that from vertical loading forces.[12] The prevalence of abfractive lesions is higher for posterior teeth, which absorb most of the stresses generated by the masticatory forces.[9] However, the presence of these lesions in anterior teeth is well documented, both in maxillary and mandibular teeth.[9]

Treatment of noncarious cervical lesions may be limited to palliative, nonrestorative therapy if the causative factors have been eliminated and the clinician is able to monitor the lesion on a regular basis.[16,17] However, some clinical evidence suggests that restoration of these lesions may be necessary to prevent their enlargement.[18] The early treatment of angular lesions must involve the reduction of flexion and compression through occlusal adjustment to interrupt the pathogenesis of expansive, flexural, and compressive abfractions.[12,19] Nevertheless, it is our opinion that the noncarious cervical lesions must be restored in the following situations:

- The lesion is active and no success has been obtained to stop its progression.
- The integrity of the tooth structure is jeopardized.
- A pulpal exposure becomes imminent.
- The hypersensitivity does not subside with nonrestorative treatments.
- The lesion location compromises the planning of a removable prosthesis.
- A carious lesion is associated.
- The defect becomes esthetically unacceptable.

Although the restorative procedure for this type of lesion appears to be challenging, the predictability of this treatment modality has been significantly improved by the introduction of adhesive protocols toward the reduction of stress concentration and inhibiting the effect of corrosion in abfracted areas.

CASE REPORT

A 51-year-old male presented for esthetic restorative treatment at the Clinic of Operative Dentistry, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil, with multiple noncarious cervical lesions in both arches (Figure 1). Clinical examination and directed anamnesis were performed to determine any potential etiologic factors, focusing on the multifactorial character usually associated with the formation and progression of this type of lesion. During the anamnesis, the patient reported habits of grinding and clenching, exaggerated toothbrushing, and excessive consumption of acidic drinks, key etiologic factors for lesion formation and progression (Figures 2–4). The mandible position and move-

Figure 1. Multiple noncarious cervical lesions affecting both arches.

Figure 2. Cervical lesions affecting both anterior and posterior segments.

ments were examined to detect potential occlusal interferences. The patient exhibited a difference between the centric relation and the habitual maximum intercuspation owing to the early contact between the maxillary third molars and the second mandibular molars. The maxillary third molars were extracted, and occlusal adjustments were performed.

The first stage of treatment was based on counseling. The patient was advised on the role of parafunctional habits, excessive ingestion of acidic drinks, and exaggerated toothbrushing in the etiology of noncarious cervical lesions. The patient was advised of the need for habit control and an occlusal splint for dental protection, and was asked to reduce the ingestion of acidic substances and the intensity of toothbrushing.

The operative procedures were initiated with the cleansing of the teeth using an oil-free prophylactic paste applied with rubber cups at slow speed, with extreme caution to prevent gingival bleeding, which would compromise the field isolation. The shade selection was realized with a detailed observation of the optic properties of the dental structures and their superficial appearance under indirect natural light with the assistance of a shade guide (VITA, Vident, Brea, CA, USA). Abrasion, erosive acid action, and age can alter some characteristics of the enamel, making it smoother and more translucent.[20] The reproduction of the dental polychromaticism and internal aspects such as cracks and pigmentation provide a desirable harmonious esthetic result for restorations located in the cervical region of the teeth. For each tooth defect, one or more try-ins were accomplished for the determination of the individual shades since chroma and value of the cervical area are not the same for

Figure 3. Closer view allowing the visualization of the lesion morphology. Note the wedge-shaped defects with a sharp angle in the occlusal margin.

Figure 4. Preoperative facial view of noncarious lesions in the cervical region of lower premolars.

all teeth. Whenever possible, accomplishment of a restorative try-in will allow the clinician to use the same composites and shades to be used for the final restoration without incorporating adhesive protocols.[21]

No cavity preparation was performed because no carious lesions were associated with the defects, and there were no failed previous restorations (Figure 5). For better access to the cervical edge, a rubber dam was placed with a modified no. 212 clamp stabilized with a low fusion compound (see Figure 5).

After isolation, a 35.7% phosphoric acid gel was applied for 15 seconds on the enamel, limited to 2 mm beyond the occlusal edge, and then extended to the dentin for an additional 15 seconds (Figures 6 and 7). Air-water spray was used to remove the etchant, and the surfaces were dried with a gentle air stream; care was taken to leave the dentin slightly wet (Figure 8). The adhesive system (Single Bond, 3M ESPE, St. Paul, MN, USA) was applied according to the manufacturer's instructions (Figure 9). A microfilled resin composite (Durafill Vs, Heraeus-Kulzer, Armonk, NY, USA) was selected for the restoration procedure.

The first composite increment was placed on the cervical region of the defect, in order not to touch the enamel edge, and polymerized for 60 seconds through the tooth, followed by a 20-second polymerization directly over the increment (Figure 10). The second increment was placed to complete the restoration's contours (Figure 11). This placement technique aims to reduce composite shrinkage effects, preventing the contraction of the composite material toward the incisal margin, which could result in gaps at the cervical margins.[22,23] The second increment was polymerized for 60 seconds through the tooth and 20 seconds directly on the increment. A third increment was used to cover all surfaces of the restoration and was followed by a final polymerization of 60 seconds (Figure 12).

Figure 5. Following isolation of the operative field, it is possible to visualize that no bevel was performed on the enamel edge.

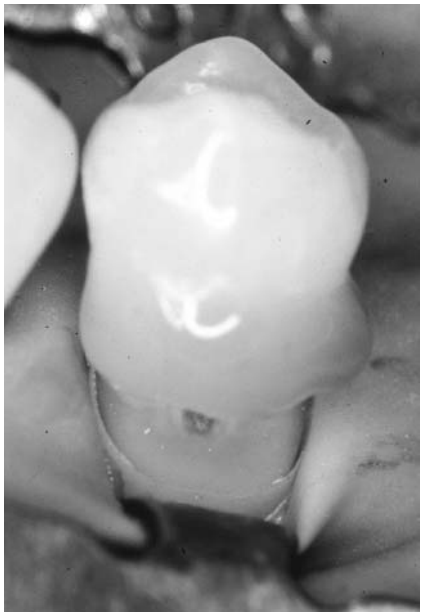

Figure 6. A 35.7% phosphoric acid gel was applied for 15 seconds in enamel, limited to 2 mm beyond the occlusal edge.

Figure 7. Acid gel extended to the dentin performing the total-etch technique.

Figure 8. The dentin was left slightly wet to enhance the bonding procedure.

Figure 9. A single-component adhesive material was applied with a brush.

During the final polymerization, an antioxidizing gel (KY, Johnson & Johnson, S.J. Campos, SP, Brazil) was placed on the surface of the restoration. The antioxidizing gel on the external surface during the final polymerization isolates the superficial layer of composite, allowing its complete polymerization and conferring a vitrified aspect to its surface (Figure 13) until finishing and polishing can be completed in the next session (Figure 14).[17] The same restorative protocol was applied to the other sites (Figures 15–21).

The composites used in this case were Charisma (Heraeus-Kulzer), a microhybrid resin composite,

Figure 10. The first increment is placed in order not to touch the enamel edge.

Figure 11. The second increment is placed to completely fill the cavity.

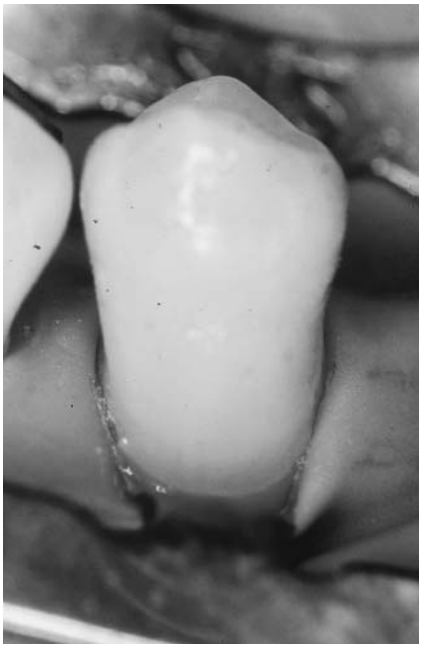

Figure 12. The third increment is gently placed to cover the restoration's surface, producing a slight resin extension over the enamel margin to minimize the line effect from the occlusal edge.

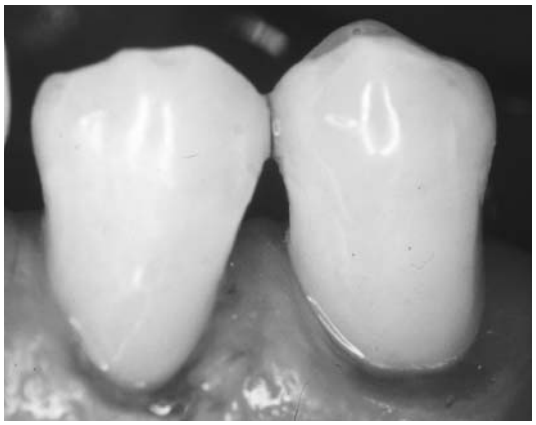

Figure 13. Immediate postoperative appearance of the definitive restorations.

Figure 14. Aspect after polishing in the subsequent session.

Figure 15. Lesions affecting other segments.

Figure 16. Lesions affecting the anterior segment, resulting in esthetic restorative challenges.

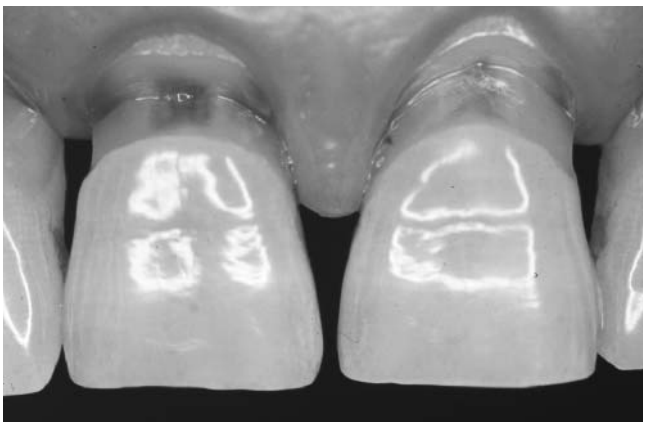

Figure 17. Lesions affecting the central incisors. Note the complexity of details regarding color and texture.

Figure 18. Postoperative aspect in the posterior segment.

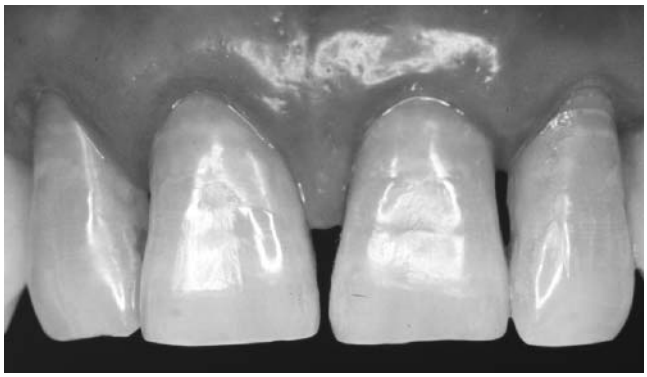

Figure 19. Postoperative aspect in the anterior segment.

and Herculite (Kerr, Orange, CA, USA)when a opaque dentin buildup was required; and Durafill (Heraeus-Kulzer), a microfilled resin composite, and Vitalescence (Ultradent, South Jordan, UT, USA) for the reproduction of the enamel. For the reproduction of pigmentation and specific features of the enamel, saturated pigments (Color Plus, Kerr) were used.

The finishing and polishing steps were performed in the next session. For these procedures, Sof-Lex (3M ESPE) abrasive disks were applied to a dry surface. A polishing paste (Enamelize, Cosmedent, Chicago, IL, USA) was used with flexible felt disks to produce a high luster on the restoration. The esthetic excellence obtained can be observed in Figures 18 through 21.

DISCUSSION

Currently esthetics has acquired an extreme value for both patients and clinicians, becoming a preponderant factor for any successful procedure involving anterior and posterior teeth. The anterior segment of the dentition requires extra efforts for esthetic results since a slight anatomic or shade defect may readily be denoted by any smile or lip movement.

Noncarious cervical lesions are usually associated with older patients, who have a greater number of defects per person; however, there is also a high prevalence of lesions affecting young patients.[9] Nevertheless, both patient groups can demand esthetic restorations, and, occasionally, older teeth may represent more challenging situations than do young teeth.

Aw and colleagues, investigating 171 noncarious cervical lesions, reported that 65% of the lesions were maxillary and 30% were in the anterior segment.[24] Another study, conducted by Coleman and

Figure 20. Closer view demonstrates the harmonious integration, despite the absence of any bevel on the enamel.

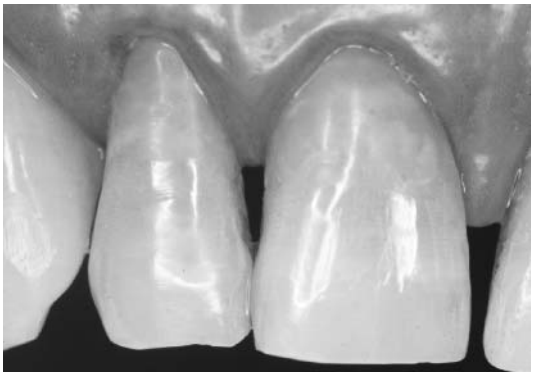

Figure 21. Lateral and central incisors. Note the harmony between the tooth and the restoration.

colleagues, found rates of 21% of abfractive lesions in anterior teeth.[9] Although these indexes seem to be low compared with the prevalence in the posterior teeth, it is pertinent to consider that the teeth shown during an enthusiastic smile are not restricted to only incisors and canine teeth. Therefore, the premolars also require efforts for esthetic restoration since they can present lesions in a prevalence of 42 to 46%.[11,25]

Although the etiology of abfraction lesions is well clarified and the classification is well established, these lesions are frequently confused with abrasive and erosive lesions. Therefore, clarification of the mechanism of formation of abfraction lesions becomes important for the determination of an accurate diagnosis. The masticatory system during function places three types of stresses on teeth: compressive, tensile, and shearing. The masticatory forces are directed primarily along the long axis of the teeth when the occlusion is balanced and there is no abnormal stress tensor happening on the teeth. Consequently, the forces are dissipated and transmitted to the root and indirectly to the periodontal complex, resulting in less stress concentration at the cervix and minimal distortion of the dentinal and enamel hydroxyapatite crystals.[5,26]

When occlusion is not balanced, the compressive stresses are located on the side toward which the tooth is being bent, inducing tensile forces on the opposite side, leading to the disruption of enamel from dentin[5,26]; this area seems to present a weaker mechanical bond between enamel and dentin owing to the lack of a scalloping pattern of the dentin-enamel junction.[26,27] When the bonds are broken between crystals, additional spaces are created where small molecules, such as water and organic material, penetrate,[4,10] preventing the reestablishment of chemical bonds between crystalline structures and allowing the propagation of cracks as soon as subsequent stresses are induced on the teeth. The tooth location of the stress tensor dictates the shape of the lesion. Eccentrically located stresses can cause asymmetric lesions, and centrally loaded teeth exhibit symmetric lesions.[10]

A study on the deformation of teeth subjected to simulated occlusal loading have shown that removal of tooth structure causes increased cuspal flexure.[28] The restoration of tooth structure using an adhesive acid-etch technique has been shown in strain-gauge studies to restore tooth stiffness significantly.[29] Grippo has suggested that when a noncarious cervical lesion is restored, the flexure of the restored tooth under load is reduced, thereby strengthening the affected teeth and preventing the lesion enlargement.[18] However, this strengthening was not noted when the effects of restored and unrestored noncarious cervical lesions on the fracture resistance of previously restored maxillary premolar teeth were evaluated,[16] suggesting that the presence of an occlusal restoration may have a deleterious effect on the retention of a Class V restoration.[16,30]

In attempt to achieve esthetic success in Class V restorations, single factors must be emphasized during the procedure to ensure mechanic, biologic, and state-of-the-art standards. The selection of the composite, the margin access, and the performance of a try-in are fundamental clinical tasks that help lead the restorative procedure to successful results.

The choice of using a microfilled composite was based both on mechanical principles and esthetic properties. Besides the potential of microfilled composites to reproduce the surface detail, brightness, and translucency of enamel, the low elastic modulus of the microfilled composite make this material the best choice for Class V restorations. This is due to the fact that a great part of the tension exerted on the teeth is absorbed by the restoration instead of being transferred to the resin-dentin interface, allowing higher bond durability.[31]

The gingival margins of the wedge-shaped defects can be located supragingivally or subgingivally. The development of a subgingival lesion suggests that the main factor that initiates this type of defect is unstable occlusal forces.[10] The

location of the cervical limits may imply more difficulty in the placement of the rubber dam and maintenance of gingival health, ultimately compromising marginal integrity and bonding durability.[32,33] Another method for the access of the cervical margin, when a relative isolation is preferred, is the use of retraction cords, making possible the retraction of the gingival margin and hindering the flow of crevicular fluids.[17]

During the try-in preparation, it is mandatory to keep the tooth and composite wet during observation to prevent incorrect color evaluation that can be caused by dehydration.[21]

The configuration at the enamel cavosurface margin is still controversial when non-retentive cervical defects are to be restored. The choice of whether to bevel the enamel prior to bonding steps on the butt-joint (90°) margins may involve many variables, such as retention rates, microleakage, marginal discoloration, secondary caries, and esthetics, which serve as parameters to assess the clinical performance of Class V restorations.[34] It has been established in the literature that beveling the enamel produces higher bond strength than does non-beveling.[35,36] However, the retention rates of restorations placed in noncarious lesions without an enamel bevel were showed to be similar when compared with beveled margins in a 3-year clinical performance evaluation,[37] and after 12, 24, and 36 months in another study.[34] Studies evaluating microleakage showed no statistical differences between Class V noncarious restorations with or without cavosurface preparation.[38,39] The choice of maintaining the sharp occlusal edge relies on the fact that, beyond the aforementioned factors and the possibility of obtaining satisfactory esthetics without performing any bevel, a substantial enamel structure can be preserved when no additional preparation is undertaken, preventing further structure loss if the restoration needs to be replaced.

The restorative procedure itself, within the whole noncarious cervical lesion treatment protocol, integrates a relatively simple and easy part that is generally overestimated by the clinician: often the importance of an interventional approach, which has causative factors as the primary focus, is neglected.[12,19,33] When occlusal disharmony, parafunctional habits, and active bruxism are correlated with the presence of noncarious cervical defects, reduction of flexion and compression through occlusal adjustment must be adopted as standard procedures to prevent lesion enlargement and potential bonding failure.[19,31,40] Corrosion and abrasion usually interact with existing abfractive areas, speeding up the progression and loss of structure since the exposed dentin is less calcified and wear resistant than the enamel. This situation requires patient counseling on the necessity of controlling the aggravating factors.

Thus, when a treatment plan for a noncarious cervical lesion is adopted, if the proper attention is given to the causative factors and principles of occlusion are applied, a better prognosis is possible and durable restorations can be achieved.

CONCLUSIONS

The treatment of noncarious Class V lesions can be limited to the elimination of the causative factors and regular monitoring, or it may involve restorative procedures. Resin composites are the best option for restoring cervical defects owing to their bonding ability, physical properties, and esthetic potential.

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