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Esthetic and Predictable Treatment of Abfraction Lesions

This type of lesion is common in today's patient population, opening up a new avenue of restorative treatment.

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As our population experiences greater longevity, dental treatment that allows patients to maintain their natural dentition is more critical than ever. With increased longevity, the dentition is considerably more exposed to wear from decades of use. Abfraction lesions, also referred to as non-carious cervical lesions, on the facial and sometimes lingual surfaces of teeth are seen with greater frequency as our population ages. This article addresses how to treat the pattern of destruction in abfraction lesions.Treatment of abfraction lesions specifically using flowable composite preserves tooth structure in an esthetic, conservative, and predictable way.

By definition, abfraction[1] is a theory that is used to explain the loss of enamel and dentin from flexural occlusal forces, particularly at the cemento–enamel junction (CEJ). This theory postulates that occlusal forces cause the flexure of the crown of enamel, focusing load at the CEJ and, ultimately, causing a separation of the enamel rods. Frequently, clinicians will leave these lesions untreated until these lesions become carious. For many clinicians, the treatment of abfraction lesions has been problematic.[2] The most frequently cited failure has been the lack of retention of the composite restorative material (retentive failure). This failure can create a practice-management issue if patients are repeatedly returning for follow-up visits to replace failed restorations. This common failure adds to the reluctance of the practitioner to treat abfractions, and may promote the philosophy that abfractions are not worth treating. Because clinicians are naturally reluctant to perform more aggressive treatment such as full coverage, the lesion often goes untreated. Additionally, treatment options using periodontal regenerative therapy should be explored at the time of diagnosis. Note that restorative treatment of these lesions with composite does not eliminate the possibility of periodontal regenerative treatment in the future.

The etiology of the abfraction lesion appears to be multifactorial in nature,[3] and off-axis occlusal forces transmitted through the tooth can be a contributing factor.[4] This occlusal force may be intensified by hyperocclusion, clenching, and bruxism. As teeth bear the occlusal load, the shell of the enamel flexes under the strain. The compressive force of occlusion becomes focused as a sheering force in the region of the CEJ. This area of enamel is most vulnerable to delamination from the underlying supporting dentin because the enamel shell progresses to a thin "feather-edge" of enamel rods or prisms. That fact that many Class V restorations using conventional composite suffer retentive failure suggests that forces of occlusion do exert cervical flexural strain, which lends credence to the theory of abfraction. If this cervical enamel area has suffered additional exposure from gingival recession, as well as a reduction in thickness secondary to toothpaste abrasion, the development of an abfraction lesion may be accelerated.[6] To what extent toothpaste abrasion and gingival recession contribute to the genesis of the abfraction lesion is unclear, but they may act as abfraction initiators and/or enhancers, thus starting the process.[7] As these cervical enamel rods flake away, dentin is exposed and the dentin continues to receive the focused flexural stress creating the telltale V- or wedge-shaped pattern (Figure 1 and Figure 2). In some cases, formation of an extremely sharp line angle at the apex of the lesion occurs. This pattern is highly suggestive of a focusing of force, as in a bending moment. In other cases, a more smooth concave lesion has developed, which suggests that toothpaste abrasion had a more prominent role in etiology.

The fact that abfraction lesions develop predominantly on the facial or buccal surfaces of the tooth suggest that gingival recession and toothpaste abrasion be strong contributory factors

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FIG. 1


FIG. 2

LESION FORMATION (1. AND 2.) As enamel rods flake away, dentin is exposed and continues to receive the focused flexural stress, creating the V- or wedge-shaped pattern.


FIG. 3


FIG. 4

RESTORATION (3. AND 4.) The proximity of the curing light during placement of a Class V restoration should be close enough to ensure an adequate depth of cure.


FIG. 5


FIG. 6

LESION REMOVAL (5.) Exposed dentin from an abfraction lesion on teeth Nos. 27 and 28. **(6.)** Caries was removed with a slow-speed round bur and all sharp line angles were smoothed and beveled.

in the development of this lesion.[10] This author hypothesizes that gingival recession and toothbrush abrasion may serve as abfraction lesion "initiators" as well as "enhancers" that facilitate the development and rate of progression of these lesions, with occlusal load as the initiating factor and driving force behind the lesion.[9] In the author's opinion, flowable composite's relative low modulus of elasticity (ie, Young's modulus) makes it an ideal restorative material for treating abfraction lesions. Its more flexible nature, as compared to traditional composite or enamel itself, allows for the absorption or reduction of these occlusal flexural forces at the CEJ. It is this dissipation of the sheering force that allows the flowable composite Class V restoration to resist displacement. In fact, restoration of the lesion relieves concentrated stress at the apex of the lesion, preventing further abfraction.[2] Additionally, the use of new "low shrinkage stress" flowable composites, such as Venus® Diamond Flow (Heraeus, www.heraeus-dental-usa.com), enables the author to place this material in only two to three increments with improved marginal integrity. The low shrinkage stress of Venus Diamond Flow composite, combined with the lower C-factor of a Class V restoration,[15] may allow for bulk filling of this class of restoration. The close proximity of the curing light in a Class V restoration during placement should ensure an adequate depth of cure regardless of shade (Figure 3 and Figure 4).

Case Presentation

A 46-year-old man presented to the author's office for his routine dental hygiene visit, but had a chief complaint of cold sensitivity in the lower right quadrant. Physical and radiographic examination revealed that the source of sensitivity was the presence of exposed dentin from an abfraction lesion


FIG. 7


FIG. 8


FIG. 9


FIG. 10


FIG. 11


FIG. 12

RESTORATION AND FINAL RESULTS(7.) The facial surfaces of the teeth were mechanically etched. **(8.)** The teeth were then acid-etched for 15 seconds and rinsed thoroughly. **(9.)** The bonding agent was placed, thinned, and dried thoroughly. **(10.)** Using a periodontal probe as a placement instrument, the flowable composite in shade opaque medium was applied to the preparation. **(11.)** Two additional increments of flowable composite (shade A2) were placed in a similar fashion covering the cervical and middle thirds of the teeth. **(12.)** A thin layer of sealant was placed and light-cured for 20 seconds to serve as a final "clear coat" for the final restorations.

on teeth Nos. 27 and 28 (Figure 5). The patient was scheduled for operative treatment of these teeth. Venus Diamond Flow composite was selected as the restorative material.

Treatment

Whitening using Venus® White Pro 22% (Heraeus) was performed 1 month before the restorative treatment. At the whitening-tray delivery appointment, teeth Nos. 27 and 28 were treated with Gluma® Desensitizer PowerGel (Heraeus) to reduce the possibility of any sensitivity during the whitening process. The patient was instructed to complete the whitening process at least 2 weeks prior to the dental visit for the treatment of teeth Nos. 27 and 28 in order to allow the dentition to fully rehydrate.

At the operative visit, the newly whitened tooth shade was taken before anesthetizing the patient. Care was taken to evaluate the shade at the cervical third of the teeth, which is typically more yellow in hue. Local anesthetic was then administered on teeth Nos. 27 and 28, and treatment initiated. Caries was excavated with a slow-speed round bur and all sharp line angles were smoothed and beveled with a Brasseler 8856 fine-grit, round-end-taper, 30-µm bur (Brasseler USA, www.brasselerusa.com) (Figure 6). Removing these line angles as well as the V-shaped pattern of the cervical lesion relieved concentrated stress at the apical area of the lesion.[2]

The facial surfaces of the teeth were then mechanically etched with the MicroEtcher II (Danville, www.danvillematerials.com) (Figure 7) and acid-etched with Ultra-Etch® 35% phosphoric acid (Ultradent Products, www.ultradent.com) for 15 seconds and rinsed thoroughly (Figure 8). The use of mechanical etching is very effective in providing a meticulously clean surface before acid-etching and bonding. Also, because the dentin in an abfraction lesion is typically sclerosed, the ability of restorative materials to bond well may be compromised. By ending this restoration more occlusally, well into microetched enamel, additional bond strength could be obtained.[8]

When the acid-etching was complete, the bonding agent was placed using iBOND® Total Etch (Heraeus), which was thinned and dried thoroughly (Figure 9). Then, using a periodontal probe as a placement instrument, Venus Diamond Flow flowable composite shade OM (shade opaque medium) was applied to the preparation (Figure 10). It is important to re-create the dentin with a more opaque composite, because this is consistent with the anatomical nature of the cervical area of the tooth.[14] Two additional increments of Venus Diamond Flow (shade A2) were placed in a similar fashion covering the cervical and middle thirds of the teeth (Figure 11). Finishing at the gingival margin was performed with a Brasseler 8392 30-µm gingival finishing bur, as any excess composite at the gingival margin would promote gingival inflammation. Polishing was accomplished with both pink and green Venus® Supra polishing cups (Heraeus). A thin layer of Palaseal® (Heraeus) was placed and light-cured for 20 seconds to serve as a final "clear coat" sealant (Figure 12). Finally, the occlusion was evaluated with articulating paper and any excessive occlusal contact was reduced, paying attention to occlusal prematurities. An occlusal guard was fabricated for the patient to wear at night.

Conclusion

In the last 16 years, this author has treated thousands of abfraction lesions with flowable composite with minimal failure. The restorations have been observed and followed up during subsequent dental hygiene visits. These flowable composite restorations have not only resisted displacement but also have shown no sign of toothpaste abrasion. This success is attributed to the selection of composite material and careful operative technique, which included micro-etching and thorough light-curing. Currently, Venus Diamond Flow is an exceptional material for this application in the author's opinion because of its low shrinkage stress, thixotropic nature, lower modulus of elasticity, and excellent polishability. This author believes that the bulk filling of an abfraction lesion with new "low shrinkage stress" flowable composite may become routine in the near future.[5,11,12] Abfraction lesions are common in today's patient population, and the treatment of this type of lesion opens up a new avenue of restorative treatment in today's practice.

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