Abfraction: Concepts Revisited
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Abstract:
Abfractions are angular, wedge shaped defects present at cervical part of teeth. These are caused by mechanical overloading initiated by cuspal flexure. Clinically, present as notches in the tooth structure near or even under gum line usually on the cheek side of tooth. Up until now, research into the causes of abfractions seems to be divided into two camps; some researchers argue for tooth brushes and other artifical forces as the cause while some also point out the internal physiological sources as the culprit. The latter argument, though not providing a complete explanation, does offer a significant clue to the real cause of this troubling phenomenon. This article therefore deals with current facts and myths about abfraction.

Keywords: Abfraction; Force; Flexure; Microcracks; Hypersensitivity; Tooth Brush Trauma.

Introduction
Abfraction means ‘to break away’.¹ It was Grippo, who originated the term ‘abfraction’, in 1991 to depict the pathologic loss of tooth enamel and dentin caused by biomechanical loading of forces.² Other terms have also been suggested for this phenomenon, including noncarious cervical lesions and stress corrosion.³ Abfraction solely represent loss of tooth structure at the cementoenamel junction.⁴

Abfraction, a biomechanics based theory, is one of the most discussed and controversial of these alternative theories. Recent reviews in this field lack details, hence it is essential that clinicians understand where abfraction stands in current clinical practice. The aim of this article is to critically review the literature to explore the validity of abfraction.⁵

Etiopathogenesis
Through the years the dental profession has held a variety of theories about the causes of abfractions, including chemical wasting of the teeth, the effects of tooth brushing, and lateral forces.⁶ The forces could be static, such as those produced by swallowing and clenching; or cyclic, as in those generated during chewing action. The abrasive lesions are caused by flexure and ultimate material fatigue of susceptible teeth at locations away from the point of loading. The breakdown is reliant on the enormity, duration, direction, frequency, and location of the forces.⁵ Lee and Eakle proposed a multifactorial etiology, with a combination of occlusal stress, abrasion, and erosion. Spranger in a review of the literature supported the multifactorial nature of the cervical area.⁸ Further studies⁹-¹⁰ have indicated that acid penetration in the micro cracks and undermining of the tooth surfaces lead to mechanical deformation. The abfractions caused by flexure, ultimately lead to material fatigue of susceptible teeth at locations away from the point of loading. This breakdown is dependent on the magnitude, duration, frequency and location of the forces.³

Typically, abfraction is said to result from forces associated with mastication, swallowing and malocclusion. However, Gibb’s et al found that occlusal forces during swallowing and mastication are only approximately 40 percent of maximal bite force. Suit et al. reported that tooth contact occurs on average for only 194 milliseconds during mastication and for 683 milliseconds during swallowing. Considering that duration and magnitude of forces during bruxism are much greater than those during functional activity, it is more likely that Para function would result in such a process rather than function. Interestingly, logic suggests the non axial forces that result from tooth grinding, would actually cause compression on the buccal cervical surfaces of the teeth involved.⁵

Of importance is the fact that the small amount of experimental evidence published for abfraction has limitations. What has been
confirmed is that cervical tooth structure may be more vulnerable to stress induced breakdown. Although the loss of enamel was addressed, no explanation was given about how dentine could be lost during this process. As dentine has a different structure from enamel and can withstand tensile stress better, than enamel, this omission represents a major flaw in the concept of abfraction. Also, cervical 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. The 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.

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. 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 smoother concave lesion has developed, which suggests that toothpaste abrasion had a more prominent role in etiology. Thus, 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.

Clinical Appearance
Abfraction is a wedge shaped cervical lesion. Clinically the lesion is localized to cervical margin and patient complains of hypersensitivity of tooth. The tooth can flex causing tensile and compressive forces at the necks of teeth resulting in cracks in the enamel. An abfraction lesion should be located at or near the fulcrum in the region of greatest tensile stress concentration, be typically wedge-shaped and display a size proportional to the magnitude and frequency of tensile force application. Interestingly, Lee and Eakle proposed that the direction of lateral forces acting on a tooth would determine the location of the lesion. There has been strong association between occlusal wear facets and and non carious cervical lesions. Since occlusal wear facets are indicative of past tooth grinding it has been proposed that this is evidence for abfraction.

Diagnosis
When possible, abfraction lesions are not causing clinical consequences and/or they are only shallow in depth (less than 1 mm), one may elect to simply monitor them at regular intervals. Standardized intra oral photographs, study models and measuring lesion dimensions are all potential approaches. A novel method of determining the activity of abfraction lesions over time is to undertake a scratch test. A number 12 scalpel blade is used to superficially scratch the tooth surface. Visual observation of the scratch will give an indication of the rate of tooth structure loss. Loss of scratch definition or loss of scratch altogether signifies active tooth structure loss.

Treatment
It is imperative to distinguish the potential role of occlusal loading in the loss of cervical tooth tissue so that management of the occlusion can be included into a treatment plan for a patient with abfraction lesions. A dentist who restores an abfraction lesion to relieve hypersensitivity of the patient’s tooth should be aware that to prevent this restoration from falling out, one needs to treat the cause of the abfraction before restoring it. Various authors advocate, in order to productively treating so called “abfractive lesion”, a blend of Adhesion Restorative Dentistry and Occlusal Adjustment Therapy are considered necessary.

It is critical to eliminate the lateral interferences that craft the cyclic compressions of the crown onto the cementoenamel junction so that the micro fractures of the enamel and cementum are eliminated. This is the way to assure that the bonded restorative material stays in place in the lesion, and the abfractive formative process is arrested. Flowable composite’s relative low modulus of elasticity (i.e. 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.\textsuperscript{11}

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