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ORIGINAL RESEARCH

Comparative Evaluation of the Shear Bond Strength of a Total Etch Adhesive with a Self-Etching Primer on an Endodontically Treated Teeth

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ABSTRACT

The present *in vitro* investigation evaluated the shear bond strength of endodontically treated teeth restored with composite resin in conjunction with a total etch adhesive excite and a self-etching primer, Prompt-L-Pop.

The aim of this study was to evaluate and compare the bond strength of two generation bonding systems when used on endodontically treated teeth.

Twenty-four freshly extracted noncarious intact human maxillary and mandibular teeth were selected for this study. They were divided into 2 groups of 12 teeth each. The occlusal surface of the teeth was ground to prepare flat dentin surface. In group I, 5th generation dentin bonding system excite was used and in group 2, Prompt-L-pop, a self-etching primer was used. Both the dentin bonding agents were placed on the flat dentinal surfaces according to the manufacturer's instructions. Cylinders of composite resin were built on the prepared surface using Teflon mold. The prepared specimen were then embedded on an acrylic jig of suitable dimension and transferred to Instron machine for shear bond strength analysis. Shear bond strengths were measured at a cross head speed of 0.03 mm/sec.

Keywords: Total etch adhesive, Self-etching primer, Shear bond, Pulpal dentin.

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INTRODUCTION

Present day dentistry is unimaginable without adhesives. Composite resins is widely used and accepted for the treatment in almost all situations. Several clinicians in general practice prefer to use composite resins for all sort of clinical situations including postendodontic restoration. The concept of bonding a restorative material to dentinal surface is by no means a new idea. Even at the time of Buonocore using phosphoric acid to bond enamel, the idea of bonding to dentin was considered.[1] The dentin bonding systems have been developed over the years and have become of particular interest to the success of tooth colored restorative materials that include ceramics, composites and compomers. With the introduction of newer generation bonding agents, the problem of technique sensitivity has reduced.[2]

A resin composite restoration enables nonvital teeth to be restored by replacing only the lost tooth structure because the dentin bonding system can reinforce the remaining tooth structure.[3] The successful use of dental adhesive materials relies on their proper selection and on understanding their properties, in particular their curing mechanism and application technique.

Enamel adhesion by means of acid etching has become an accepted technique in restorative dentistry. Adhesion to dentin, however is still under investigation. At this time, two distinct adhesive techniques are prominent in the attempt to establish a strong bond to dentin: Total etch and self-etching primers.[4]

Isolated studies have indicated that chemical irrigants do adversely affect the bond strength of resin composite to dentin stored after endodontic treatment.[5] Limited information exists covering dentin bonding to nonvital teeth in general and pulpal dentin in particular. Research on bond strength values against endodontically treated teeth is scarce. The aim of this study was to evaluate the effect of endodontic treatment on performance of bonding to pulpal dentin using two different dentin bonding systems.

MATERIALS AND METHODS

Twenty-four freshly extracted noncarious intact human maxillary and mandibular teeth were selected for this study. The occlusal surface of the teeth were ground on a water cooled trimming wheel to prepare flat dentin surface. Pulpal dentin is the dentin obtained after removal of the roof of the pulp chamber. They were divided into 2 groups of 12 teeth each. Group 1 was bonded using 5th generation total etch adhesive namely Excite. Group II was bonded using 1 step self-etching primer namely Prompt -L-Pop.

In group I, where excite was used, the prepared flat dentinal surface was etched using 35% phosphoric acid for 15 seconds. It was then cleansed and dried using oil free water spray. Dentin bonding agent was then applied and cured according to the manufacturers instruction. This was followed by packing of composite resin over the prepared dentinal surface using Teflon mold measuring 3×3 mm and cured layer by layer.

In group II, one step self-etching primer Prompt-L-Pop was used. Here the liquid from the red blister was transferred into the yellow blister which was then transferred into the green blister which has the applicator tip. Using this applicator tip, the bonding agent was applied to the prepared dentinal surface with moderate finger pressure stream of air was used to evenly disperse the material into thin film. The material was then cured for 20 seconds. Composite resin was packed over this prepared surface using Teflon mold and cured layer by layer.

The prepared specimens were mounted on the acrylic jig of specific dimension and was transferred to the instron machine individually and subjected to shear bond strength analysis at a cross head speed of 0.3 mm/sec.

RESULTS

The present *in vitro* investigation evaluated the shear bond strength of Excite, a total etch adhesive in comparison with Prompt -L- Pop, a single step self-etching primer when used on pulpal floor dentin restored with single composite resin Z 100.

According to this present study, Excite required the highest mean shear load to fracture [14.7 MPa] when compared to Prompt-L-Pop [13.55 MPa].

Group comparison was done using Boneferonni t-test. Highly significant results were observed when Boneferonni t-test was applied to the results.

DISCUSSION

In the present investigation, we have made an attempt to evaluate a globally accepted total etch adhesive, Excite, in comparison with more recently introduced self-etching primer Prompt-L-Pop.

Conventional three step dentin bonding system have been shown to provide reliable bonding. But the elaborate three steps required gives rise to possible problems through contamination of the bonded surface prior to the placement of resin composite restorative material. The problem of this technique sensitivity seems to have been reduced with the new generation dentin bonding systems.[2]

Conventional endodontic therapy begins with access cavity preparation and ends with obturation. The access cavity when conserved with minimum involvement, the usual choice as access restorative material is composite resins. The utilization of resins as access restorative material is almost routine in clinical practice.

Variation in dentin depth and permeability can significantly influence the bond strengths of direct resin-based restorative systems.[6] Regional structural differences, such as caries affected dentin; sclerotic dentin and root dentin are important factors that can affect bond strengths to dentin.[7] However, there is little information about the bonding performance of bonding systems to floor of pulp chamber dentin. Few studies have been conducted to evaluate the sealing capabilities of resins against enamel and coronal dentin while little research has been done on adhesion of resins to the floor of the pulp chamber dentin.

If one considers characteristics of the endodontically treated tooth, one should accept that the endodontic treatment performed, changes the actual composition of the remaining tooth structure. The tooth structure that remains after endodontic treatment is undermined and weakened by caries, fracture, tooth preparation and restoration. Endodontic access into the pulp chamber destroys the structural integrity provided by the coronal dentin of the pulpal roof and allows for greater flexing of the tooth under function.[8]

Nikaido et al[9] discussing bonding to nonvital teeth are of the opinion that the decreased strength seen in endodontically treated teeth is primarily due to loss of coronal tooth structure and is not a direct result of endodontic treatment.

Akagawa H et al[10] observed that the different region of superficial, deep and pulp chamber dentin demonstrated different morphological characteristics. The ratio of dentin tubules to inter tubular dentin in deep dentin was more than that of superficial or pulpal floor dentin, where as diameter of tubules in pulpal floor dentin was smaller than that of coronal dentin. These morphological differences according to Akagawa et al will have an effect on the conductance of fluid within dentin and thereby on the bond strength. However, the bond to radicular and pulp chamber dentin does seem to vary quite a lot depending on the dentin bonding agent used.[11] Hence, it is essential to give importance to the selection of dentin bonding agent used for these regions of the tooth.

When it comes to dentin bonding systems, it is important to follow the manufacturer's instructions carefully. Over etching can create a region of poorly or uninfiltrated dentin. This zone may be susceptible to acid or enzyme attack from oral bacteria, hence leading to bond failure.[12]

In the present investigation, comparatively lower bond strength values were recorded in comparison to previous studies with both the bonding systems tested. Reason for this lower value may be because most of the teeth used for the study were from older age group, periodontal involved and subjected to various masticatory loading during the life of the tooth. Further to this, dentin as a bonding substrate is heterogeneous. The surface wetness, dentin permeability are all nonuniform on the flat surface of dentin. There is high tubule density in the pulp chamber level and hence

little intertubular dentin between tubules to permit hybrid layer formation.[13]

Seema Belli et al[14] in their study on regional strengths to adhesive resin to pulp chamber dentin suggested that clinicians should choose an adhesive system that is simple, easily retrievable and technique insensitive.

With the introduction of self-etching primers and newer adhesive resin system and bonding techniques it is hoped that in future these can be adapted for use within pulp chamber to provide second layer of defense against micro-leakage and at the same time have sufficient bond strength values to pulpal dentin, so that there is no scope of debonding of access restoratives.

CONCLUSION

This investigation concluded that the total etch adhesive Excite (Group I) fractured at the highest mean shear load while Prompt -L-Pop, a 1 step self-etching primer (Group II) fractured at the lowest value when used on endodontically treated teeth. Highly significant results were observed when Boneferonni t-test was applied to the results.

The purpose of this study was to evaluate the dentin shear bond strength of two adhesive systems on an endodontically treated teeth. It may be concluded that the shear bond strength of dentin is dependent on material (adhesive system), substrate depth and adhesive/depth interaction.

Major developments in adhesive materials, especially dentin bonding systems are seen in the past years. Further improvements in the reliability and ease of use of DBA can make restoration of endodontically treated teeth easier and stronger.

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