The influence of different root canal medicaments on the tensile bond strength of composite resin to coronal dentin.

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ABSTRACT

Background: Intra canal medicaments are routinely used during endodontic procedure and may influence the bond strength of resin materials to the dentin. The purpose of this in vitro study was to assess the adherence of composite resin to dentin conditioned with different intracanal medicaments by using the 7th generation bonding agent.

Materials and Methods: Superficial dentin of 60 human premolars was used as substrate. The following irrigants solutions were applied to dentin surface for 60 seconds- Distilled water, 2% NaOCl, 2% CHX and 17% EDTA with 2% NaOCl. The FC and CMCP were maintained in contact with the dentin for 3 days. Gluma-BOND was applied to the conditioned dentin and the test specimens were built with composite resin (Cavex). After storage in distilled water at 37ºC for 24 hours the specimens were thermocycled for 500 cycle, then tested to failure for tensile bond strength (MPa) in an Instron machine and examined the mode of failure under the stereomicroscope.

Results: The TBS did not differ significantly among those conditioned with DDW, FC and CMCP. The mean scores were significantly higher after conditioning with CHX group and 17% EDTA with 2% NaOCl group, while the mean scores were significantly lower after conditioning with 2% NaOCl group.

Conclusion: The intracanal medicaments differently influence the adhesion of composite resin to coronal dentin bonded with Gluma-BOND and on the mode of failure.

Keywords: Intracanal medicament, tensile bond, 7th generation bonding agent.

INTRODUCTION

Endodontically treated teeth are structurally weakened not only from access and instrumentation but also because of extensive carious lesions and large restorations (1). In recent years, the choice of materials used in the restoration of endodontically treated teeth has changed from the exclusive use of very rigid materials to materials which have mechanical characteristics that more closely resemble dentin (2). The development of new dentin bonding systems has brought great improvements in the treatment modality of endodontically treated teeth. These resin-based materials have become widely accepted as a restorative material for these teeth. These materials offer many advantages over the use of traditional one, like transmission of functional stresses across the bonded interface to the periodontium, with potential to reinforce the weakened tooth structure (3).

However, some irrigants routinely used during endodontic procedure may influence the bond strength of resin materials to the dentin. The major elements, which contributed to bond strength, are increased surface area of the resin/tooth interface, increased mechanical retention and tubular resin tag promotion (4).

When tag bond well to the tubule wall, resin infiltration into demineralized tubular dentin and lateral branches of the tubules occur.

After the use of chemical irrigants and medicaments in the root canal, the residual irrigants and their products are likely to diffuse along dentinal tubules and may contaminate the dentin surface, which may affect the penetration of resin onto the dentin structure or the polymerization of the monomer in the demineralized dentin (5). Therefore, this study was designed to evaluate the effect of root canal medicaments and irrigants on tensile bond strength of composite to the coronal dentin surface using 7th generation bonding agent (G-BOND).

MATERIALS AND METHODS

Sixty caries-free human maxillary first premolars, recently extracted were used. The teeth were embedded in acrylic resin; the occlusal surface of each tooth was ground with a mechanical grinder machine to create a flat superficial dentinal surface. The teeth were randomly divided in 6 groups (n=10) and the dentin surface was treated with one of the follows:

Group 1: deionized distilled water for 60s.
Group 2: 2% sodium hypochlorite for 60s.
Group 3: 2% chlorhexidine for 60s.
Group 4: Tricresol Formalin solution for 3 days.
Group 5: Camphorated paramonochlorophenol solution for 3 days.
Group 6: 0.02 ml of CMCP or FC solution was applied by using a micropipette and placed it on three sponge pellets to cover the exposed dentin.

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surface surrounded by the copper ring, and then the upper surface of the ring was covered with glass slide and kept in an incubator at 37 ºC. Group6: the dentin was treated with 17% Ethylene diamino tetra acetic acid for 60 seconds followed by 2% sodium hypochlorite for 60 seconds then the surface was washed with air/water spray. After the treatment with root canal medicaments, the dentin bonding agent (Gluma-BOND) was applied on all specimens, following manufacturer's instructions. First, a circular hole of 3 mm in diameter was punched by a mandrel of multi-hole punch in an adhesive tape, positioned on the ground dentin surface to demarcate the bonding region (6). By a disposable brush, ample amount of bonding agent was applied to the bonding area and left undisturbed for 10 seconds, then drying thoroughly under maximum air pressure for 5 seconds. Finally light cured for 10 seconds using visible light curing unit (Conventional type, Astralis-5).

The test specimens were built with composite resin (Cavex, Germany), using a cylinder of 5 mm in height of clear transparent standardized plastic straw. The composite resin was applied in three increments; each one being light cured for 60 seconds. First loaded by 2 mm layer of composite then a prefabricated stainless steel dental post (4L, Anthogyr, France) was placed over the cured composite resin 2 mm layer and held in a vertical position with the help of electrical dental surveyor. A new 2 mm layer of composite resin was added around the post. Finally 1 mm layer of composite added and light cured as shown in figure1.

![Figure 1: Spacemen preparation.](image)

After 24 hours in distilled water at 37ºC, the specimens were thermocycled for 500 cycled between water bath held at 5 and 55, with dwell time in each bath of 30 seconds, and transfer time of 5 seconds. After thermocycling, the tensile bond strength was measured with an Instron universal testing machine with crosshead speed of 0.5 mm/min was used to load the specimens until fracture. After testing, the fracture modes were examined in a stereo microscope with 40 x magnification power. The data were subjected to one-way ANOVA and least significant difference (LSD) test, using the SPSS version 10.0 for windows (SPSS, Chicago, IL) software package.

RESULTS
Mean and standard deviations of tensile bond strength for each group are shown in Table1.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group1</td>
<td>10.92</td>
<td>7.47</td>
<td>14.5</td>
<td>±1.977</td>
</tr>
<tr>
<td>Group2</td>
<td>6.713</td>
<td>4.8</td>
<td>8.92</td>
<td>±1.427</td>
</tr>
<tr>
<td>Group3</td>
<td>16.83</td>
<td>13.39</td>
<td>19.36</td>
<td>±1.969</td>
</tr>
<tr>
<td>Group4</td>
<td>12.267</td>
<td>7.89</td>
<td>15.45</td>
<td>±2.95</td>
</tr>
<tr>
<td>Group5</td>
<td>9.933</td>
<td>7.65</td>
<td>13.5</td>
<td>±2.059</td>
</tr>
<tr>
<td>Group6</td>
<td>15.604</td>
<td>9.4</td>
<td>19.8</td>
<td>±2.928</td>
</tr>
</tbody>
</table>

One-way ANOVA revealed highly significant differences (P<0.0001) in TBS between all groups. The LSD showed that the bond strengths of group 3 (chlorhexidine treatment) were significantly higher than those of group 1 (control), while the TBS was significantly decreased (p<0.0001) after treatment of dentin with NaOCl in comparison with the control group. There is no significant difference in the mean TBS values after treatment of dentin with FC or CMCP for three days compared with DDW (control) group.

DISCUSSION
Consistent dentin bonding is essential to the clinical success of restorative dentistry, and it is important to examine if the intracanal medicament prior to the bonding procedure would have an effect on TBS of the composite to the coronal dentin surface of endodontically treated teeth with the using of the new generation of the adhesive agent.

The mean TBS value for the control groups in the present study (10.92 MPa) was consistent with values found in previous study (6,7). The mean TBS for the group 2 (2% NaOCl) specimens was the lowest among all groups. The use of 2% NaOCl for 60 seconds may change the morphological appearance of the hybrid layer and lost its fibrillar arrangement. NaOCl has...
been used on dentin as a deproteinizing agent; NaOCl is a well-known nonspecific proteolytic agent capable of removing organic material as well as magnesium and carbonate ions, resulted in a decrease in bond strengths in spite of a deeper penetration of the adhesive (8).

The bond strength of the self-etching, all in one G-BOND was significantly increased (P<0.05) when the dentine was conditioned with 17% EDTA followed by 2 % NaOCl (15.6 MPa). This conditioning protocol is known to remove the smear layer, whereas 2% NaOCl alone leave the smear layer intact (9). The effect of NaOCl alone on dentin is different when compared with the use of NaOCl with EDTA. This may be due to EDTA's chelating activity at neutral pH with the capacity to neutralize the acidity of the NaOCl and terminating its action (10).

The mean TBS for the group 3 (2% chlorhexidine) specimens was the highest among all groups. This may because chlorhexidine possessing 2 positive charged which enables it to adsorb onto the dentin surface very well and to the adhesive agent (11). This effect is known as substantivity and its perpetuation depends on the exposure time of the dentin to chlorhexidine. When used as an irrigants, chlorhexidine produces a residual effect of 72 hours. In the case of its use as an auxiliary before the application of the bonding agent, the effect reached by irradiation would be sufficient because bonding procedures and prosthetic restoration might close the dentin surface (12).

High bond strength reported with the use of FC has been attributed to the cross-bonding structures formed by formaldehyde, which can fix the proteins and stabilize the collagens in dentin (13). This enables the resin monomer to encapsulate more stabilized collagen fiber leading to increasing in bond strength (14).

Slightly decreasing in the bond strength when CMCP was applied before the bonding procedure may be explained because of the inhibitory effects of phenol compound which presents in CMCP on the polymerization of methyl methacrylate (MMA) which is part of the bonding system (14).

Dentin pretreated with CHX or EDTA with NaOCl showed the highest TBS among other groups (16.83 and 15.6 MPa) and the mode of failure was mixed type in higher percentage, while the rest four groups (DDW, NaOCl, CMCP and FC) the TBS significantly decreased and adhesive failure appeared on the fractured surface. Miyasaka Nakabayashi (15) found that when TBS value increase the mode of failure between composite and dentin will be high rate in mixed type while adhesive mode failure will be when the TBS decreased.

REFERENCES