



**Research Article**

**EVALUATION OF EFFECT OF DIFFERENT DISINFECTING AGENTS ON BOND STRENGTH OF RESIN COMPOSITE: AN IN VITRO STUDY**

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**ABSTRACT**

Contemporary restorative techniques are on the basis of the adhesive properties of tooth-colored resin-based materials. Despite the significant improvements of adhesive systems, the bonded interface remains the weakest area of tooth colored restorations. Cavity preparation is a surgical procedure that attempts to remove all infected dentin. Bacteria left beneath the filling material is greatest threat to the pulp. To reduce the potential for residual caries development and sensitivity, an antibacterial solution with the ability to disinfect the prepared tooth surface would be of help.

Clinical significance: Cavity disinfectant applications did affect the dentin bond strength of a resin composite.

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**INTRODUCTION**

Restoring posterior teeth with resin-based composite materials continues to gain popularity and the demand for such aesthetic restorations is increasing. It is the most common aesthetic alternative to dental amalgam. studies have shown that the bond strength of resin-bonded dentin decreased over time due to collagen degradation within the hybrid layer. The adjunctive use of antibacterial solutions after cavity preparation may be considered a method to reduce the incidence of postoperative sensitivity by eliminating viable bacteria and their toxins from the restoration-tooth interface.<sup>1</sup> And also Conventional removal of carious tissue and cavity preparation procedures do not guarantee the complete elimination of oral cariogenic bacteria that might be entrapped within the dentin tubules or the smear layer, which may induce secondary caries or pulpal inflammation.<sup>2</sup>

Adhesion to dentin is still under investigation. New generation dentin adhesives have increased bond strength between composite resins and tooth, thereby resulting in decreased marginal leakage. Decreased marginal leakage avoids bacterial contamination, which in turn decreases the incidence of secondary caries. Secondary caries may also be result of action of bacteria left under restorations. Thus, after removal of carious dentin, it is important to eliminate any remaining bacteria that may be present on the prepared tooth surface, in the smear layer, at the enamel-dentin junction or in the dentinal tubules.

To reduce the potential for residual caries development and sensitivity, an antibacterial solution with the ability to disinfect the prepared tooth surface would be of great help.<sup>1</sup> Today, application of disinfectants like chlorhexidine, hypochlorite, EDTA and fluoride after tooth preparation and before restoration is gaining wider acceptance in order to eliminate the potential risk of secondary caries. The most commonly used antimicrobial agent till now has been NaOCl. Depending on the testing methodology and the adhesive system composition, the application of sodium hypochlorite may increase, decrease, or have no effect on bond strengths. In a study conducted by Taniguchi et al, 12 it was reported that NaOCl pretreatment for 30s significantly reduced the bond strengths of adhesive systems to sound dentin, while there were no significant differences in dentin bond strength values between normal dentin and NaOCl. A potential problem in the use of a disinfectant before dentin adhesives is the possibility of an adverse interaction on the bond strength of the resin composites. The objective of this study was to compare the effects of different disinfection agents; Iodine, NaOCl and EDTA on shear bond strength of a resin composite. The null hypothesis was different disinfectant agents do not affect the shear bond of a resin composite to dentin.<sup>3</sup>

**MATERIALS AND METHODOLOGY**

A total of 40 extracted premolars were collected. The samples were cleaned and scaled using ultrasonic scaling unit, and the crowns were stored in saline until further use. The samples were randomly divided into 4 groups, namely: Group I (control group), group II (Iodine), group III (sodium hypochlorite), group IV (EDTA).

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Teeth were embedded in acrylic blocks of same diameter, followed with reduction of occlusal enamel till 1 mm beyond DEJ was done.

The Exposed dentin was pretreated with 3 different disinfecting agents which are as follows:

- Group 1: control group (n=10)
- Group 2: 0.3% Iodine (n=10)
- Group 3: 5.25% sodium Hypochlorite
- Group 4: 17% EDTA

The samples in each group were pretreated for 20 secs and then rinsed with water. Dentin surface of each group were etched with 37% phosphoric acid for 25 secs and rinsed. Application of bonding agent was done and cured for 20 secs. Then followed with a composite build up with two increments of 1 mm and light cured for 20 secs each. The specimens were placed in the universal testing machine such that the blade of the machine lied perpendicular to the composite along the long axis of the tooth. Fracture resistance was calculated using the universal testing machine.

**Shear Bond Strength Analysis:** The specimens were placed in the universal testing machine such that the blade of the machine lied perpendicular to the composite cylinders along the long axis of the crowns. Force was then applied over the composite cylinders at a crosshead speed of 1 mm/minute unless the cylinders got detached from the dentin surface. The amount of weight needed to detach the composite cylinders was noted and the bond strength was calculated.

**RESULTS**

| control | iodine | sodium hypochlorite | EDTA |
|---------|--------|---------------------|------|
| 180     | 250    | 410                 | 530  |
| 210     | 270    | 380                 | 510  |
| 120     | 270    | 410                 | 480  |
| 180     | 250    | 450                 | 530  |
| 180     | 290    | 410                 | 510  |
| 210     | 290    | 330                 | 480  |
| 180     | 270    | 430                 | 510  |
| 210     | 360    | 380                 | 530  |
| 180     | 360    | 410                 | 510  |
| 180     | 270    | 430                 | 490  |

Mean values:

|                     |     |
|---------------------|-----|
| Control             | 183 |
| Iodine              | 288 |
| Sodium hypochlorite | 404 |
| EDTA                | 508 |

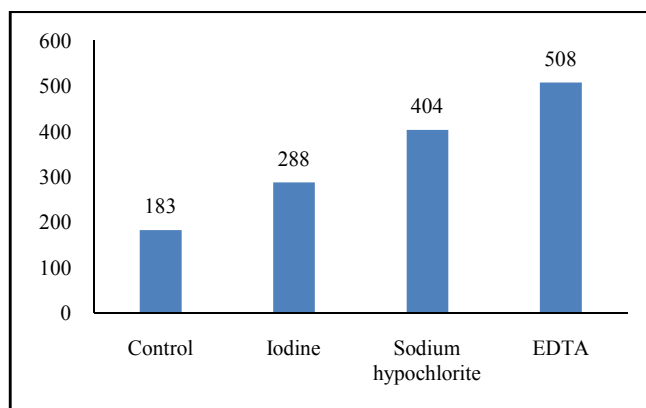
Data was analysed using one way Anova test.

| Anova: Single Factor |       |      |         |          |
|----------------------|-------|------|---------|----------|
| SUMMARY              |       |      |         |          |
| Groups               | Count | Sum  | Average | Variance |
| control              | 10    | 1830 | 183     | 690      |
| iodine               | 10    | 2880 | 288     | 1617.778 |
| sodium hypochlorite  | 10    | 4040 | 404     | 1137.778 |
| EDTA                 | 10    | 5080 | 508     | 373.3333 |

Mean SBS and the SD among test groups:

| ANOVA               |          |    |          |          |             |          |
|---------------------|----------|----|----------|----------|-------------|----------|
| Source of Variation | SS       | df | MS       | F        | P-value     | F crit   |
| Between Groups      | 595407.5 | 3  | 198469.2 | 207.8816 | 8.77627E-23 | 2.866266 |
| Within Groups       | 34370    | 36 | 954.7222 |          |             |          |
| Total               | 629777.5 | 39 |          |          |             |          |

Mean values of all groups are shown in the table above and in the graph. The highest mean shear bond strength was recorded for EDTA followed by sodium hypochlorite and then Iodine. while the lowest mean shear bond strength was recorded for control group.



**DISCUSSION**

Evaluation of Shear Bond Strength is important as the restoration is subjected to shear stress during mastication. Cavity prepared for restoration is never completely free from microorganisms/sterile, no matter whichever method of caries removal is followed, always a few microorganisms are left behind. studies have shown even for a period of 1 year the microorganisms which are left behind in cavity may be viable and are capable of causing secondary caries in presence of microleakage, hence leading to failure of treatment. Sterilization of prepared cavity is one of Black’s instructions. He has advocated surgical sterilization of dentinal walls before insertion of restorative material. 4,5 Several human studies have shown that Iodine solution can reduce *Streptococcus mutans* levels on smooth surface for prolonged intervals.

Meiers and Schachtele have investigated the ability of iodine to penetrate and kill the bacteria in fissures known to contain incipient caries lesions and reduced the *S. mutans* found in fissures. There was a significant reduction in Shear Bond Strength to dentin, when compared with that of control group. They also concluded that the effect of cavity disinfectants on Shear Bond Strength of composite to dentin treated with dentin bonding resin was material-specific regarding their interactions with various dentin bonding system ability to seal dentin. 6

Sodium hypochlorite application prior to acid etching significantly increased the bond strength. They attributed the increase bond strength to the elimination of collagen layer which was removed by application of NaOCl leading to a better penetration of the adhesive into intertubular dentin. This increase in bond strength may be also due to removal of smear

layer by NaOCl. Complete removal of smear layer might enhance the bonding to dentin as it facilitates the penetration of resin monomer leading to complete infiltration of the demineralized layer by numerous resin tags. Sodium hypochlorite application prior to acid etching significantly increased the bond strength.<sup>7</sup> They attributed the increase bond strength to the elimination of collagen layer which was removed by application of NaOCl leading to a better penetration of the adhesive into intertubular dentin. This increase in bond strength may be also due to removal of smear layer by NaOCl. Complete removal of smear layer might enhance the bonding to dentin as it facilitates the penetration of resin monomer leading to complete infiltration of the demineralized layer by numerous resin tags.<sup>7,8</sup>

It was found that EDTA treated dentin recorded the highest shear bond strength followed by NaOCl treated dentin and then iodine treated dentin. While the control group showed the lowest shear bond strength. Our result is in agreement with previous studies which attributed the improvement in bond strength to the removal of the smear layer, which prevents direct contact of the self-etching adhesive with dentin; consequently, removal of the smear layer facilitates the formation of a stronger and more homogeneous hybrid layer.<sup>9,10</sup>

## CONCLUSION

The antibacterial effectiveness of different disinfectants has been well documented. The surface treatment of dentin before bonding, positively affects the shear bond strength between resin composite and dentin.<sup>11</sup>

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