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Original Research

Comparative assessment of effectiveness of different root canal Irrigants on Microtensile Bond Strength of Adhesive Systems to Dentin

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ABSTRACT

Objective: The advancement and consistent application of adhesive materials are transforming various facets of restorative and preventive dentistry. Hence; the present study was conducted for evaluating the efficacy of various root canal Irrigants on Microtensile Bond Strength of Adhesive Systems to Dentin.

Material and methods: Assessment of 40 freshly extracted maxillary second premolars were included in the present study. Randomized division of all the specimens was done into four study groups with ten specimens in each group as follows:Group A: Specimens treated with sodium hypochlorite (NaOCl),Group B: Specimens treated with chlorhexidine (CHX),Group C: Specimens treated with NaOCl + sodium ascorbate, and Group D: Control group- Specimens treated with distilled water. Resin composites were utilized in conjunction with a universal adhesive system, and the micro-tensile bond strength was evaluated through a universal testing machine. The resulting data were analysed using SPSS software to ascertain the outcomes related to bond strength.

Results:A total of 40 tooth specimens were included. Mean micro-tensile bond strength among specimens of Group A, Group B, Group C and Group D was 56.9 N, 45.1 N, 92.7 N and 43.8 N respectively. Significant results were obtained while comparing the micro-tensile bond strength among specimens of all the four study groups. Greatest strength was exhibited by specimens irrigated with NaOCl + sodium ascorbate.

Conclusion: Various irrigants exhibited distinct impacts on the bonding efficacy of different adhesive systems. The application of sodium ascorbate following sodium hypochlorite treatment demonstrated the potential to reinstate diminished bond strengths.

Introduction:

The advancement and consistent application of adhesive materials are transforming various facets of restorative and preventive dentistry. The approach to cavity preparation is evolving, as the use of adhesive materials eliminates the need for traditional mechanical retention methods, such as dovetails, grooves, undercuts, and sharp internal angles, which were previously essential for securing fillings. Consequently, these modern techniques contribute to the preservation of significant amounts of healthy tooth structure that would otherwise be compromised by dental drilling. Additionally, microleakage, a significant concern in dentistry often linked to the onset of secondary caries, can be minimized or eradicated through the use of these adhesives. Thus, they play a vital role in the efficacy of aesthetic restorative materials in contemporary dental practice.[1- 3]

In 2003, Meerbeek and colleagues introduced a straightforward classification system that categorizes adhesives according to their interaction with dental substrates and the number of application steps involved. This classification includes etch-and-rinse adhesives (which can be further divided into two- and three-step variants), self-etch adhesives (available in one- and two-step forms), and glass ionomer materials. Over the years, significant advancements have been made to these adhesive systems, driven by a deeper understanding of their compositions and the mechanisms underlying adhesion.The enhanced comprehension of how dental substrates influence the adhesion process has facilitated both researchers and manufacturers in the development

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and refinement of dental adhesive technologies.[4, 5]Hence; the present study was conducted for comparatively evaluating the effectiveness of different root canal Irrigants on Microtensile Bond Strength of Adhesive Systems to Dentin.

Materials & methods:

Assessment of 40 freshly extracted maxillary second premolars were included in the present study. Only teeth were enrolled which were extracted because of orthodontic or periodontal reasons. Grossly carious teeth or grossly deformed teeth were excluded from the present study. Access opening was done in all the tooth specimens followed by working length assessment. Biochemical preparation was done by employing intermittent root canal irrigation. Afterwards, randomized division of all the specimens was done into four study groups with ten specimens in each group as follows:

Group A: Specimens treated with sodium hypochlorite (NaOCl),

Group B: Specimens treated with chlorhexidine (CHX),

Group C: Specimens treated with NaOCl + sodium ascorbate, and

Group D: Control group- Specimens treated with distilled water

Resin composites were utilized in conjunction with a universal adhesive system, and the micro-tensile bond strength was evaluated through a universal testing machine. The resulting data were analysed using SPSS software to ascertain the outcomes related to bond strength.

Results:

A total of 40 tooth specimens were included. Mean micro-tensile bond strength among specimens of Group A, Group B, Group C and Group D was 56.9 N, 45.1 N, 92.7 N and 43.8 N respectively. Significant results were obtained while comparing the micro-tensile bond strength among specimens of all the four study groups. Greatest strength was exhibited by specimens irrigated with NaOCl + sodium ascorbate.

Group	Mean (N)	p-value
Group A	56.9	0.001 (Significant)
Group B	45.1	
Group C	92.7	
Group D	43.8	

Table 1: Comparison of Micro-Tensile Bond Strength among three experimental groups

Discussion:

The selection of endodontic irrigants is pivotal in determining the efficacy of adhesive systems employed in restorative dentistry, especially in relation to bonding with dentin. These irrigants are integral to the cleaning and disinfection processes within the root canal system; however, their chemical interactions with dentin can significantly influence the performance of adhesives. Various irrigants have the potential to modify the structural and chemical characteristics of the dentin surface, thereby affecting the adhesion and durability of composite restorations. It is essential to comprehend the impact of different irrigants on micro-tensile bond strength to enhance adhesive systems and promote lasting clinical results.[6- 9]

A total of 40 tooth specimens were included. Mean micro-tensile bond strength among specimens of Group A, Group B, Group C and Group D was 56.9 N, 45.1 N, 92.7 N and 43.8 N respectively. Significant results were obtained while comparing the micro-tensile bond strength among specimens of all the four study groups.

Greatest strength was exhibited by specimens irrigated with NaOCl + sodium ascorbate.Hence; the present study was conducted for comparatively evaluating the effectiveness of different root canal Irrigants on Microtensile Bond Strength of Adhesive Systems to Dentin.Wattanawongpitak N et al. conducted a study to assess the impact of various endodontic irrigation protocols and the use of calcium hydroxide root canal sealer (Sealapex) on the microtensile bond strengths (muTBS) of dual-curing resin composite (Clearfil DC Core Automix) to intrapulpal dentin. The investigation involved forty standardized coronal-half root canal dentin specimens sourced from human premolars, which were categorized into four distinct groups: group A served as the control with no treatment; group B received Sealapex; group C was treated with NaOCl followed by Sealapex; and group D underwent treatment with EDTA, NaOCl, and Sealapex. Following a 7-day period of storage in an environment of 100% relative humidity, the Sealapex was removed. The dentin surfaces were subsequently bonded using either etch-and-rinse (Single Bond) or self-etching (Clearfil SE Bond) adhesives, followed by the application of resin composite. The bonded specimens were then shaped into an hourglass configuration with a cross-sectional area of 1 mm^2 for the purpose of microtensile testing (n = 20). The analysis of muTBS to intrapulpal dentin was performed utilizing two-way ANOVA and Dunnett's TC test. Additionally, two teeth from each group were prepared for micromorphological examination of the dentin surface. The results indicated that the presence of the root canal sealer, regardless of the endodontic irrigation method employed, significantly influenced the bond strengths of the resin composite to intrapulpal dentin when compared to the control group ($p < 0.05$). No significant differences were observed in the muTBS among the experimental groups when comparing etch-and-rinse and self-etching adhesive systems. Notably, the dentin surface exhibited a mud-like residue following the application of the sealer for 7 days. The use of the root canal sealer was found to diminish the muTBS of dual-curing resin composite when applied with both etch-and-rinse and self-etching adhesive systems to intrapulpal dentin.[10]Dikmen B et al evaluated the effects of different antioxidant treatments on the microtensile bond strength of an adhesive system to sodium hypochlorite (NaOCl)-treated dentin.Thirty extracted third molars were sectioned 3 mm below the occlusal surface and divided into six groups according to the antioxidant treatment received: control group: distilled water; NaOCl group: 5.25% NaOCl and distilled water; proanthocyanidin (PA) group: 5.25% NaOCl, 5% PA and distilled water; 1-week storage group: 5.25% NaOCl and storage for 1 week in distilled water; Accel group: 5.25% NaOCl, Accel, and distilled water; noni group: 5.25% NaOCl, noni fruit juice, and distilled water. NaOCl, PA, Accel, noni, and distilled water were administered for 30 s, 10 min, 30 s, 10 min, and 30 s, respectively. A self-etching adhesive system (Single Bond Universal Adhesive) was applied to each specimen and a resin composite (Filtek Z550) was built up to a height of 5 mm on the dentin surface. Each specimen was serially sectioned to obtain sticks with a cross-sectional area of 1 mm^2, and their microtensile bond strength was determined. Microtensile bond strength in the NaOCl group was significantly lower than in all other groups. However, there were no significant differences in the bond strength between the groups treated with different antioxidants.NaOCl significantly reduced the microtensile bond strength of the adhesive system. The application of PA, Accel, and noni fruit juice to NaOCl-treated dentin significantly improved the microtensile bond strength.[11]

Conclusion:

Various irrigants exhibited distinct impacts on the bonding efficacy of different adhesive systems. The application of sodium ascorbate following sodium hypochlorite treatment demonstrated the potential to reinstate diminished bond strengths.

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