Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 468-470 | ISSN:2251-6727

Impact of Various Irrigants on Microtensile Bond Strength of Self-Etch Universal Adhesive to Dentin

[1]Janki Maheshkumar Patel, [2]Ravleen Kaur, [3]Gopinder Kaur Jugpal, [4]Jagmohan Singh Ghumman, [5]Varun Vohra, [6]Kanwarpreet Singh

[1]Department of Conservative Dentistry and Endodontics, Narsinhbhai Patel Dental College & Hospital Visnagar, Gujrat India

[2]Department of Conservative Dentistry and Endodontics, Guru Nanak Dev Dental College, Sunam, India

[3]Department of Conservative Dentistry and Endodontics, Guru Nanak Dental College and Research Institute, Sunam, Sangrur, Punjab, India

[4]Department of Conservative Dentistry and Endodontics, DJ College of Dental Sciences and Research, Modinagar, UP, India

[5]Department of Conservative Dentistry and Endodontics, National Dental College, India

[6]Reader, Department of Conservative Dentistry and Endodontics, YIDSR Yamunanagar, India

Corresponding Author: Dr. Kanwarpreet Singh, Reader, Department of Conservative Dentistry and Endodontics, YIDSR Yamunanagar, India

(Received: 07 January 2024 Revised: 12 February 2024 Accepted: 06 March 2024)

KEYWORDS

Adhesive, NaOCl, EDTA

ABSTRACT:

Background: The objective of this laboratory-based study was to assess how different endodontic irrigants affect the micro-tensile bond strength (μTBS) of one-step self-etch adhesive systems to dentin surfaces. Material and methods: Forty-five intact human molars were utilized in this experiment, divided into three groups based on the type of irrigants used. A self-etch universal adhesive system was applied for composite restoration in all groups. Results: the groups treated with EDTA + NaOCl displayed notably reduced bond strength compared to the other two groups. Conclusion: Despite the constraints of our study, the control group demonstrated markedly lower bond strength compared to the comparative groups.

INTRODUCTION

Achieving a highly adequate apical seal, obtaining an effective coronal seal is crucial for successful endodontic dental treatment. A plethora of adhesive systems have emerged in recent times, not only to enhance the bond strength of composite resins to dentin but also to act as robust barriers, preventing coronal micro-leakage, ensuring an efficient coronal seal, and optimizing the sealing of various regional dentin areas[1,2]. Adhesion to dentin is influenced by various factors, particularly during root canal treatment where the use of chemical irrigants alters the chemical composition of the dentin surface[3]. Moreover, the pulp chamber dentin undergoes exposure to a range of irrigants with diverse wettability, surface tension, and chelating effects, leading to modifications in its mineral and organic contents as well as its surface energy[4]. Consequently, following irrigation, the dentin tissue may exhibit irreversibly altered properties that can affect its interaction with materials utilized for coronal sealing. Sodium hypochlorite (NaOCl), ethylenediaminetetraacetic acid (EDTA), and chlorhexidine (CHX) are commonly employed as irrigants during root canal instrumentation[5]. Gomes et al. discovered that Enterococcus faecalis, which is known to be highly resistant within the root canal, could be eradicated with a 30-second irrigation using 5.25% NaOCl [6].

EDTA is known for its demineralization properties and its ability to effectively clean canal walls. The combination of EDTA with NaOCl is commonly utilized during instrumentation because it allows for the simultaneous removal of organic and inorganic components from dentin. A gentle chelating irrigation method using etidronic acid (HEDP) has been suggested as an alternative approach. Another technique introduced in 2005 is termed Continuous Chelation[7] .To prevent damage to dentin collagen and enhance its stability, the formation of collagen bonds is crucial as they are more resilient to biodegradation. The application of a collagen cross-linking agent can effectively maintain collagen stability. Recent studies have investigated Grape Seed Extract (GSE), particularly a component known as Proanthocyanidins.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 468-470 | ISSN:2251-6727

GSE solutions have demonstrated the ability to eliminate the root canal smear layer and exhibit antibacterial effects against E. faecalis. Furthermore, GSE solutions have been found to possess free radical scavenging abilities, attributed to oligomeric proanthocyanidin complexes (OPCs), which are significantly more potent than sodium ascorbate. Additionally, the application of proanthocyanidin primers has shown a positive impact on the immediate bonding strength of dental adhesives in vitro, regardless of whether etch & rinse or self-etch modes are employed.

MATERIALS & METHODS

Freshly extracted human molars were collected out of which a total of forty-five intact human molars were utilized in this experiment.

Exclusion criteria: Hypoplastic and hypomineralized teeth, as well as teeth with existing restorations or crown fractures, present unique challenges in dental treatment and management. These conditions may require specialized approaches to address issues such as enamel defects, weakened tooth structure, and compromised aesthetics or function.

Forty-five intact human molars were utilized in this experiment, divided into three groups based on the type of irrigants used. A self-etch universal adhesive system was applied for composite restoration in all groups.

Control group (Group 1) the dentin surface was irrigated with sodium hypochlorite (NaOCl) followed by ethylenediaminetetraacetic acid (EDTA).

Group 2: The irrigation protocol utilized sodium hypochlorite followed by grape seed extract.

Group 3: The irrigation protocol involved using sodium hypochlorite followed by 18% hydroxyethylidene diphosphonate (HEDP).

Resin composites were applied using the Tetric N Bond Universal adhesive system. The micro tensile bond strength was evaluated using a Universal Testing Machine.

RESULTS

The groups treated with EDTA + NaOCl displayed notably reduced bond strength compared to the other two groups.

Table 1A: Comparison based on micro tensile bond strength in three groups

Group	N	Mean	SD	95% CI	p-value
Group 1	15	26.8	2.76	24.2-26.9	<0.001*
Group 2	15	35.3	3.92	33.4-35.9	
Group 3	15	31.9	2.51	31.8-37.1	

***Statistically Significant Difference (P-value<0.05); CI: Confidence Interval**

Table 1B: Intergroup comparison based on micro tensile bond strength in three groups

Group Comparison	Mean difference	P-value
Group 1 vs Group 2	7.9	<0.001*
Group 1 vs Group 3	8.1	<0.001*
Group 2 vs Group 3	2.1	0.207

***Statistically Significant Difference (P-value<0.05)**

DISCUSSION

A bonding delay of one week following endodontic treatment allows time for the dissipation of any adverse effects caused by irrigants. However, in clinical settings, immediate restoration of teeth after endodontic treatment is often necessary, making this delay impractical. The null hypothesis posits that all endodontic irrigants have a negative effect on the bond strength of dentin adhesives. Sodium hypochlorite (NaOCl) induces damage to the organic matrix of dentin and promotes oxidation, resulting in the formation of reactive free radicals. These radicals compete with the propagation of vinyl free radicals during adhesive polymerization, ultimately affecting the bonding process.

In our study, the groups treated with EDTA + NaOCl demonstrated significantly lower bond strength compared to the other two groups, consistent with numerous prior studies. In addition to its erosive properties, the oxidizing effect of NaOCl can adversely affect the bond strength of various adhesive systems.

Siso et al.[8] in 2015 and Aranda Garcia et al.[9] in 2013 reported that the application of EDTA followed by NaOCl led to peritubular and intertubular erosion, which can be attributed to the hyper-decalcification effect of EDTA. This effect was more pronounced with NaOCl +EDTA as it accelerates dentinal erosion thru organic matrix destruction.The oxidizing effect of NaOCl cud decrease bond strength of different adhesive system.

Yurdaguven et al.[10] (2015) stated that the bond strength of the NaOCl + EDTA groups was greater than that of the control groups.

The detrimental effect of NaOCl on the organic component can be alleviated by using Grape Seed Extract (GSE). The cross-linking effect of GSE is

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 468-470 | ISSN:2251-6727

attributed to the formation of hydrogen bonds between type 1 collagen and the hydroxyl group of proanthocyanidin. GSE contains 72-79% of proanthocyanidins (PA), which are natural antioxidants. PA enhances the mechanical properties of dentin and has the ability to bind covalently to metals such as iron and copper as a mild chealator[11,12]. Microtensile tests were chosen for our study because they allow for better stress dispersion over small surfaces compared to conventional bond strength tests, making them ideal for evaluating the effects of experimental variables.

In our study, the highest bond strength was observed in the GSE group, followed by the HEDP group, and then the EDTA group. Additionally, the highest bond strength was found in the HEDP group when compared with the 17% EDTA group. Therefore, our null hypothesis was rejected. The utilization of antioxidants following dentin treatment with NaOCl notably enhanced the bond strength of adhesives.

CONCLUSION

Within the limitations of this study, the control group demonstrated markedly lower bond strength compared to the comparative groups.

REFERENCES

1. Shipper G, Ørstavik D, Teixeira FB, Trope M (2004) An evaluation of microbial leakage in roots filled with a thermoplastic synthetic polymer-based root canal filling material (Resilon). J Endod 30: 342-347.
2. Saunders WP, Saunders EM (1994) Coronal leakage as a cause of failure in root-canal therapy: A review. Endod Dent Traumatol 10: 105-108.
3. Ari H, Erdemir A (2005) Effects of endodontic irrigation solutions on mineral content of root canal dentin using ICP-AES technique. J Endod 31: 187-189.
4. Santos JN, Carrilho MR, De Goes MF, Zaia AA, Gomes BP, et al. (2006) Effect of chemical irrigants on the bond strength of a self-etching adhesive to pulp chamber dentin. J Endod 32: 1088-1090.
5. B Dikmen, B Tarim; The Effect of Endodontic Irrigants on the Microtensile Bond Strength of Different Dentin Adhesives Deptt of Restorative Dentistry, İstanbul University, Turkey; Nov 2017.
6. Yasmeen S. Mahmoud, Dalia A. Saba; Evaluation of Dentin Micro-hardness and Antibacterial Efficiency against E.faecalis after Irrigation with Sodium Hypochlorite followed by either Grape Seed Extract or EDTA: A Randomized In -Vitro Study; Future Dental Journal, Vol. 6 [2020], Iss. 2, Art. 2
7. S Vidhya S Srinivasulu; Effect of Grape Seed Extract on the Bond Strength of Bleached Enamel; Operative Dentistry, 2011, 36-4.
8. A Kara Tuncer , S Tuncer , S H Siso Effect of QMixirrigant on the microhardness of root canal dentine; Australian Dental Journal,2015.
9. Aranda-Garcia, Milton carloskuga Effect of Final Irrigation Protocols on Microhardness and Erosion of Root Canal Dentin, Department of Restorative Dentistry, Araraquara Dental School, UNESP, Brazil; 2013 Wiley periodicals, inc.
10. Yurdagüven H, Tanalp J, Toydemir B, Mohseni K, Soyman M, Bayirli G, et al. The effect of endodontic irrigants on the microtensile bond strength of dentin adhesives. J Endod2009;35:1259-63.
11. Effect of grape seed extract solution on the microhardness of the root canal dentin: an in vitro study SYLVA ALINDA, ANGGRAINI MARGONO Department of conservative dentistry, Faculty of dentistry,Indonesia ,2020.
12. Matthias Zehnder, Patrick; Chelation in Root Canal Therapy Reconsidered; JOE — Volume 31, Number 11, November 2005