ISSN: 0975-833X

*Available online at http://www.journalcra.com*

*International Journal of Current Research*
*Vol. 14, Issue, 06, pp.21750-21753, June, 2022*
*DOI: https://doi.org/10.24941/ijcr.43704.06.2022*

**INTERNATIONAL JOURNAL OF CURRENT RESEARCH**

# RESEARCH ARTICLE

# PUSH OUT BOND STRENGTH OF RESIN BASED SEALER TO THE RADICULAR DENTIN TREATED WITH ANTIOXIDANTS AND DIODE LASER

**Reader Dr Siddhesh Bandekar, *Dr Pavan Tryambake, Dr Sanika Pawar, Dr. Prashant Moogi, Dr. Asmita Sonawane and Dr. Kalyani Ahirrao**

Yogita Dental College And Hospital, Khed-Ratnagiri

**ARTICLE INFO**

*Article History:*
Received 24th March, 2022
Received in revised form
29th April, 2022
Accepted 15th May, 2022
Published online 30th June, 2022

*Key words:*

Antioxidants,
Cocoa Bean Extract,
Diode Laser,
Push-Out Bond Strength.

***Corresponding Author:***
***Pavan Tryambake***

**ABSTRACT**

**Background:** The action of sodium hypochlorite is to form an oxidative layer in radicular dentin. Antioxidant not only removes the oxygen species but also increase the bond strength of sealer. **Aim:** To compare and evaluate the push out bond strength of resin-based sealer to the radicular dentin treated with antioxidants and diode laser to decrease oxidizing effect of sodium hypochlorite. **Methods:** Sixty single rooted permanent teeth were selected and decoronated. All the teeth were prepared with ProTaper Universal rotary system up to F3 and canals were irrigated using 3 mL of 5.25% sodium hypochlorite during instrumentation. The canals were flushed with normal saline as a final irrigating solution. Then samples were treated with antioxidants and diode laser according to following group: Group I – Cocoa bean extract (CBE), Group II – 10% Sodium ascorbate, Group III – 1.5W Diode laser, Group IV – 5ml Saline. All samples were obturated with Gutta percha and AH Plus sealer. Samples were sectioned to obtaining disc thickness of 2mm. Push out bond strength was performed using universal testing machine. The data was analysed using one way ANOVA and post hoc Tukey test. **Results**: Cocoa bean extract and Diode laser showed significantly higher bond strength values compared to control group ($P < 0.05$) even so, sodium ascorbate showed equivalent bond strength. Adhesive failures were predominant in all groups. **Conclusion**: cocoa bean extract as an herbal antioxidant can give better treatment outcome when treated with resin based sealer.



**Citation:** ***Reader Dr Siddhesh Bandekar, *Dr Pavan Tryambake, Dr Sanika Pawar, Dr. Prashant Moogi et al.* 2022.** "Push out bond strength of resin based sealer to the radicular dentin treated with antioxidants and diode laser*". International Journal of Current Research*, 14, (06), 21750-21753.

# INTRODUCTION

During endodontic treatment, root canals should be well irrigated (Borzini, 2016). During canal preparation of infected teeth, special attention must be given to the elimination of bacteria, their toxins and smear layer from the root canal system (Bhargava, 2015). In order to remove smear layer and to disinfect the canals. Sodium hypochlorite solutions are generally utilized for irrigation because they are capable of removing organic substances, tissue dissolution property and possesses anti bacterial properties (Estrela, 2002). According to Gomes et al, NaOCl induce oxidation in the dentin to eliminate the most resistant bacteria E. feacalis using 30s irrigation with 5.25% NaOCl (Sena, 2006). Oxidation layer compromise the bond strength between root dentin and resin sealer. Thus research has focused on improving bond between resin sealer and root dentin (da Cunha, 2010). So application of an antioxidants solution after NaOCl treatment can improve compromised bond strength (Prasansuttiporn, 2011). So in present study we are using a natural antioxidant which is proanthocynidine in the form of cocoa bean extract (Ioannone, 2015).

Another agent is sodium Ascorbate which is commonly used in the food industry as an antioxidant agents indicating that there is likely no biologically adverse effects (Freire, 2009). Sodium ascorbate is a neutral, nontoxic and biocompatible antioxidant that improves the bond strength but it is less potent than cocoa bean extract since it contains oligomeric proanthocyanidin complex (Sharafeddin, 2015). Diode laser (Epic X, Biolase, CA, USA) which is mainly used to disinfect the root canals and remove smear layer but it also helps to reduce the oxidative layer of NaOCl by photothermal action (Wright, 2017). To date, studies have focused on the effects of individual antioxidant and laser on adhesive bond strength. This study aimed to compare and evaluate the push out bond strength of resin-based sealer to the radicular dentin treated with antioxidants and diode laser to decrease oxidizing effect of sodium hypochlorite.

# MATERIALS AND METHODOLOGY

**SAMPLE PREPARATION:** 60 freshly extracted single rooted upper anterior teeth were stored in the saline until use.

The teeth were decoronated to standardized root length of 15 mm from apex to coronal. The canal patency was confirmed by inserting K-file size #10 (Mani, Inc, Tochigi, Japan). The working length was established by inserting K-file size #15 (Mani, Inc, Tochigi, Japan) until it visible at the apical foramen, then subtracting 1 mm from this measurement. All teeth were instrumented using Pro Taper universal (Dentsply Maillefer, Ballaigues, Switzerland) rotary system and prepared up to F3 apical size. The root canals were irrigated using 3mL of 5.25% sodium hypochlorite (Prime Dental Product, Mumbai, India) during instrumentation using a 27-gauge needle 1mm shorter than the working length. Finally, the canals were flushed with 0.9% normal saline as a final irrigating solution. After final irrigation samples were divided according to the following groups ($n$ = 15): Group I: Cocoa bean extract (irrigated for 10 min); Group II: Sodium ascorbate (irrigated for 10 min); Group III: 1.5W Epic X Diode laser (940nm continuous mode for 30 sec) and Group IV: 5 ml Saline (control).

**COCOA BEAN EXTRACT PREPARATION (ŻYŻELEWICZ, 2016):** Raw and roasted cocoa beans were ground and sieved to a particle size ranging from 0.200 to 1.0 mm to achieve satisfactory extractability. The extracts were obtained using ground and sieved cocoa beans (raw or roasted) and water in 1:3 (w/w) ratio, respectively. Water was used as a solvent for the preparation of extracts because given study is part of endodontically treated tooth on the application of CBEs. The suspensions in Erlenmeyer flasks were placed in a SV 1422 Memmert water baths with heating and shaker (Schwabach, Germany). After this process, suspensions were filtered under vacuum using filter paper from POCH (Gliwice, Poland) and a vacuum pump KNF 18 035.3 N (Neuberger, NJ, USA) . The extracts were then evaporated (approx. 50%) using a Heidolph evaporator (Schwabach, Germany), frozen, freeze-dried in a BETTA2-8LSC plus Christ freeze drier (Osterodeam Harz, Germany) and stored at − 24 °C until application.

**OBTURATION OF THE SAMPLES:** After antioxidant and laser treatment, the root canals were dried using paper points size #30. An epoxy resin-based sealer (AH Plus, Dentsply) was applied to the root canal walls by using #30 lentulospiral (Dentsply Maillefer, Ballaigues, Switzerland). All specimens were obturated using the single cone technique to obtain standard specimens for the push-out test. All the teeth were stored at 37º C in 100% humidity for one week to allow the sealer to completely set before testing.

**BOND STRENGTH EVALUATION:** Each specimen was sectioned perpendicular to its long axis using a precision saw at a slow speed under water cooling. The slices were obtained from each tooth approximately from 5 mm coronally obtaining the disc thickness of 2 mm. The push-out test was performed on each specimen with a universal test machine, at a crosshead speed of 1 mm/min using estimated diameter of cylindrical plugger. The diameter of the pluggers was approximately (at least) 80% of the diameter of the canal. The maximum load applied to the filling material before failure was recorded in newtons and converted to megapascals (MPa) according to the following formula:

Push-out bond strength (MPa) = maximum load (N)/adhesion area of root filling (A) ($mm^2$).
According to formula all result were formulated.

**STATISTICAL ANALYSIS:** All the data were entered into Microsoft Excel 2010. Descriptive statistics for mean force (Mpa) was expressed as mean ± standard deviation (SD) for each group. Four groups were compared for force (Mpa) by Analysis of variance (ANOVA) followed by Tukey's Post hoc Test for pair wise comparison. SPSS (Statistical Package for Social Sciences) version 19 software was used for analysis.

# RESULTS

The values of Mean ± SD push-out bond strength of all the 4 groups are represented in table no.1. Highest mean push out bond strength was observed in Group I, which was statistically significant, compared to group II and group IV showed. The mean push out bond strength value of group III was statistically significant with that of Group IV, but not with that of Group I and Group II. All the tested 'p' value was considered statistically significant when it was <0.05 represented in table no. 2.

**Table 1. Descriptive Statistics BOND STRENGTH (Mpa) among four groups**

| Descriptive Statistics | | | | | |
|---|---|---|---|---|---|
| Groups | N | Minimum | Maximum | Mean | Std. Deviation |
| Cocoa bean extract | 15 | 31 | 76 | 46.00 | 16.916 |
| Sodium ascorbate | 15 | 18 | 35 | 28.00 | 5.113 |
| Diode laser | 15 | 20 | 53 | 37.27 | 11.720 |
| Saline | 15 | 14 | 28 | 21.20 | 4.263 |

**Table 2. Comparison of BOND STRENGTH (Mpa) among four groups by Analysis of Variance (ANOVA)**

| ANOVA | | | | | |
|---|---|---|---|---|---|
| BOND STRENGTH **(Mpa)** | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 5270.850 | 3 | 1756.950 | 15.023 | <0.001* |
| Within Groups | 6549.333 | 56 | 116.952 | | |
| Total | 11820.183 | 59 | | | |

*There was statistically significant difference among four groups with <0.001

# DISCUSSION

Adhesion of the root canal filling material to dentinal walls is of paramount significance in endodontic treatment because it could help to avoid both fluid percolation between the space of the obturation and the displacement of the material during procedure (Teixeira, 2004) Adhesion to the root dentin walls can be evaluated by the push out bond strength test. As an epoxy resin-based sealer, AH Plus (Dentsply DeTrey, Konstanz, Germany) presents low solubility (SL) and disintegration, adequate radiopacity (RD) high bonding strength to root dentin adequate expansion antimicrobial activity, and other desirable biological properties (Camargo, 2017). AH plus presents no photopolymerization system on its composition. It is believed that homogenous polymerization occurs, leading to higher mean values of bond strength along the root canal (Rocha, 2012). Sodium hypochlorite breaks down into sodium chloride and oxygen; free oxygen can interfere with resin sealer polymerization (Vongphan, 2005) Sodium hypochlorite leading to strong inhibition at the resin-dentin interface and decreasing bond strength. Use of antioxidant to inhibit the action of free oxygen liberated by

NaOCl (Bast, 1991) NaOCl oxidizes a component in the dentinal matrix that interferes with free radical propagation at the resin-dentin interface during adhesive procedures. This reduction in bond strength does not appear to improve over time (El-Askary, 2009). Several studies have successfully reversed this process with the application of sodium ascorbate. Several authors have suggested that this improvement in bond strengths is the result of a redox reaction in which the sodium ascorbate or other acids changes the oxidized dentin back to a reduced substrate (Stevens, 2014). Weston et al hypothesized that the mechanism by which the reversal occurs may even be a near instantaneous process (Weston, 2007). Plants Contains Proanthocyanidins (Dixon, 2005) Proanthocyanidins extracted from cocoa bean have been shown to exhibit greater antioxidant capabilities as compare to other (Othman, 2007). Application time - 10min was effective in increasing the mechanical properties of dentin matrix, enhancing the resin dentin microtensile bond strength, and decreasing the enzymatic degradation (Nagpal *et al*., 2016). Castellan *et al*. also reported the ability of PA-rich (grape seed and cocoa seed) extracts to increase the short- and long term mechanical properties of demineralized dentin (Castellan, 2013). Biolase diode laser it has belted fluid dynamic which is helps in endodontic treatment. The irradiation of 980-nm diode laser, resulted in high bond strength, probably because this laser is able to modify the surface and remove the smear layer from dentinal tubules which affect the adhesion of resin sealer (Faria, 2013). The following limitations must be considered in the interpretation of the present results. This was an in vitro study that cannot comprehensively mimic the complexity of the oral cavity. The statistical analysis of our study revealed that cocoa bean extract as an antioxidant and diode laser affect the push out bond strength of epoxy resin sealer (AH plus) and treatment with different antioxidants yielded same results. Further studies should be conducted to evaluate application time, effect of different concentration, and type of antioxidants and laser on push out bond strength of endodontically treated teeth.

## CONCLUSION

The studies proved that the use of antioxidant agents improves the bond strength after use of NaOCl. As a result, the use of herbal antioxidants can open a new possible treatment modality for endodontic procedures to prevent the negative effects of reduced oxygen species.

## REFERENCES


Borzini L, Condò R, De Dominicis P, Casaglia A, Cerroni L. 2016. Root canal irrigation: Chemical agents and plant extracts against Enterococcus faecalis. The open dentistry journal.10:692.

Bhargava KY, Aggarwal SH, Kumar TA, Bhargava SH. 2015. Comparative evaluation of the efficacy of three anti-oxidants vs naocl and edta: Used for root canal irrigation in smear layer removal-SEM study. *Int J Pharm Pharm Sci.* 7:366-71.

Estrela C, Estrela CR, Barbin EL, Spanó JC, Marchesan MA, Pécora JD. 2002. Mechanism of action of sodium hypochlorite. *Brazilian dental journal*. 13:113-7.

Sena NT, Gomes BP, Vianna ME, Berber VB, Zaia AA, Ferraz CC, Souza-Filho FJ. 2006. In vitro antimicrobial activity of sodium hypochlorite and chlorhexidine against selected single-species biofilms. *International endodontic journal*. Nov;39(11):878-85.

da Cunha LF, Furuse AY, Mondelli RF, Mondelli J. 2010. Compromised bond strength after root dentin deproteinization reversed with ascorbic acid. *Journal of endodontics*. Jan 1;36(1):130-4.

Prasansuttiporn T, Nakajima M, Kunawarote S, Foxton RM, Tagami J. 2011. Effect of reducing agents on bond strength to NaOCl-treated dentin. *Dental Materials*. Mar 1;27(3):229-34.

Ioannone F, Di Mattia CD, De Gregorio M, Sergi M, Serafini M, Sacchetti G. 2015. Flavanols, proanthocyanidins and antioxidant activity changes during cocoa (Theobroma cacao L.) roasting as affected by temperature and time of processing. *Food chemistry.* May 1;174:256-62.

Freire A, Souza EM, de Menezes Caldas DB, Rosa EA, Bordin CF, de Carvalho RM, Vieira S. 2009. Reaction kinetics of sodium ascorbate and dental bleaching gel. *Journal of dentistry*. Dec 1;37(12):932-6.

Sharafeddin F, Farshad F. 2015. The effect of aloe vera, pomegranate peel, grape seed extract, green tea, and sodium ascorbate as antioxidants on the shear bond strength of composite resin to home-bleached enamel. *Journal of Dentistry*. Dec;16(4):296.

Wright PP, Walsh LJ. 2017. Optimizing antimicrobial agents in endodontics. antibacterial agents. May 31:87-108.

Żyżelewicz D, Zakłos-Szyda M, Juśkiewicz J, Bojczuk M, Oracz J, Budryn G, Miśkiewicz K, Krysiak W, Zduńczyk Z, Jurgoński A. 2016. Cocoa bean (Theobroma cacao L.) phenolic extracts as PTP1B inhibitors, hepatic HepG2 and pancreatic β-TC3 cell cytoprotective agents and their influence on oxidative stress in rats. *Food Research International*. Nov 1;89:946-57.

Teixeira FB, Teixeira EC, Thompson J, Leinfelder KF, Trope M. 2004. Dentinal bonding reaches the root canal system. *Journal of Esthetic and Restorative Dentistry*. Nov;16(6):348-54.

CAMARGO RV, Silva-Sousa YT, ROSA RP, Mazzi-Chaves JF, Lopes FC, Steier L, Sousa-Neto MD. 2017. Evaluation of the physicochemical properties of silicone-and epoxy resin-based root canal sealers. *Brazilian oral research*. Aug 21;31.

Rocha AW, de Andrade CD, Leitune VC, Collares FM, Samuel SM, Grecca FS, de Figueiredo JA, dos Santos RB. 2012. Influence of endodontic irrigants on resin sealer bond strength to radicular dentin. *The Bulletin of Tokyo Dental College*. 53(1):1-7.

Vongphan N, Senawongse P, Somsiri W, Harnirattisai C. 2005. Effects of sodium ascorbate on microtensile bond strength of total-etching adhesive system to NaOCl treated dentine. *Journal of dentistry*. Sep 1;33(8):689-95.

Bast AA, Haenen GR, Doelman CJ. 1991. Oxidants and antioxidants: state of the art. *The American journal of medicine*. Sep 30;91(3):S2-13.

El-Askary FS. The outcome of immediate or delayed application of a single-step self-etch adhesive to coronal dentin following the application of different endodontic irrigants. European journal of dentistry. 2009 Apr;3(02):83-9.

Stevens CD. 2014. Immediate Shear Bond Strength of Resin Cements to Sodium Hypochlorite–treated Dentin. *Journal of endodontics*. Sep 1;40(9):1459-62.

Weston CH, Ito S, Wadgaonkar B, Pashley DH. 2007. Effects of time and concentration of sodium ascorbate on reversal of NaOCl-induced reduction in bond strengths. *Journal of Endodontics*. Jul 1;33(7):879-81.

Dixon RA, Xie DY, Sharma SB. 2005. Proanthocyanidins–a final frontier in flavonoid research?. New phytologist. Jan;165(1):9-28.

Othman A, Ismail A, Ghani NA, Adenan I. 2007. Antioxidant capacity and phenolic content of cocoa beans. *Food chemistry*. Jan 1;100(4):1523-30.

Nagpal R, Singh P, Singh S, Tyagi SP. 2016. Proanthocyanidin: A natural dentin biomodifier in adhesive dentistry. *J Res Dent.*4(1):1-6.

Castellan CS, Bedran-Russo AK, Antunes A, Pereira PN. 2013. Effect of dentin biomodification using naturally derived collagen cross-linkers: one-year bond strength study. *International journal of dentistry*. Jun 1;2013.

Faria MI, Sousa-Neto MD, Souza-Gabriel AE, Alfredo E, Romeo U, Silva-Sousa YT. 2013. Effects of 980-nm diode laser on the ultrastructure and fracture resistance of dentine. Lasers in medical science. Jan;28(1):275-80.

*******