

Evaluation of pull-out bond strength of dual cured resin cement and root canal obturated with bioceramic sealer

Background

The success of endodontically treated teeth depended on the quality of endodontic treatment and coronal restoration. Therefore, the endodontic sealers and resin cements played an important role to achieve success result.

Nowadays, the resin-based cements had been widely used as luting material. In limited light access environment like root canal, dual-cured resin cement with additional 'touch cured' polymerization was developed to overcome the limitation.

Throughout the last decade, bioceramic sealers had been proposed to endodontics for root canal obturation due to its biocompatibility, flowability and ability to penetrate and bond to dentinal tubule.

Therefore, study aimed to compared the effect of bioceramic sealer and epoxy resin sealer to 3 touch-cured type and a new conventional type dual-cured resin cements.

Objective

To evaluate the pull-out bond strength of difference dual cured resin cement between fiber post and dentin in root canal obturated with Bioceramic sealer and AH plus sealer.

Null Hypothesis


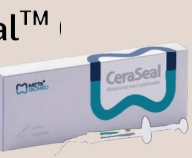
H₀: There is no difference of pull-out bond strength of the different dual-cured resin cements in the root canal obturated with the same sealer

H₀: There is no difference of pull-out bond strength of same dual-cured resin cements in the root canal obturated with different sealer.





H₀: There is no effect of resin cement and sealer to pull-out bond strength.

Material & Method

64 caries-free human mandibular premolar teeth with single canal and straight root would be selected. The teeth were further cut at 12 mm from apical root to CEJ level. The roots were obturated with either sealer

Material	Compositions
 AH Plus™	Epoxy resins, Zirconium oxide, Iron oxide, Calcium tungstate, Silicone oil
 CeraSeal™	Premixed: Calcium silicates, Zirconium oxide, Thickening agent

Then filled root canal were further prepared post space 7.5 mm with DT light post drill No.2 and fix DT light post No.2 by 4 different resin cements.

Material	Compositions
 ESTEC EM II	Paste A: Bis-GMA, TEGDMA, Bis-MPEPP, Silica-Zirconia Filler Paste B: Bis-GMA, TEGDMA Bis-MPEPP, Silica-Zirconia Filler, Camphorquinone, Peroxide
 G-CEM ONE™	Paste A: fluoroaluminosilicate glass, UDMA, MDP, dimethacrylate, initiator, stabilizer, pigment, silicon dioxide, Paste B: SiO ₂ , UDMA, MDP, trimethoxysilane, xylopropane, 2-hydroxy-1,3-dimethacrylo 6-tert-butyl-2,4-xyleneol, 2,6-di-tert-butyl-p-cresol, EDTA, MgO, disodium salt dehydrate, vanadyl acetylacetonate, TPO, ascorbic acid, camphorquinone
 Panavia™ V5	Paste A: Bis-GMA, TEGDMA, hydrophobic aromatic dimethacrylate, hydrophilic aliphatic dimethacrylate, initiators, accelerators, silanated barium glass filler, silanated, colloidal silica fluoroaluminasilicate glass filler Paste B: Bis-GMA, hydrophobic aromatic dimethacrylate, hydrophilic aliphatic Dimethacrylate, silanated barium glass filler, silanated aluminum oxide filler, accelerators, di-camphorquinone, pigments
 RelyX™ universal	Diurethanedimethacrylate, Ytterbium (III) fluoride, Glass powder, surface modified with 2- propenoic acid, 2 methyl-.3-(trimethoxysilyl)propyl ester, Silane, phenyltrimethoxy silane, Triethylene glycol dimethacrylate, L-Ascorbic acid, 6-hexadecanoate, hydrate, trimethoxyoctyl-, hydrolysis products with silica, 2-hydroxyethyl methacrylate, Titanium Dioxide, Triphenyl Phosphite

After 7 days storage in incubator 37°C, The specimens were tested for pull-out bond strength test with universal testing machine (Instron Ltd.).

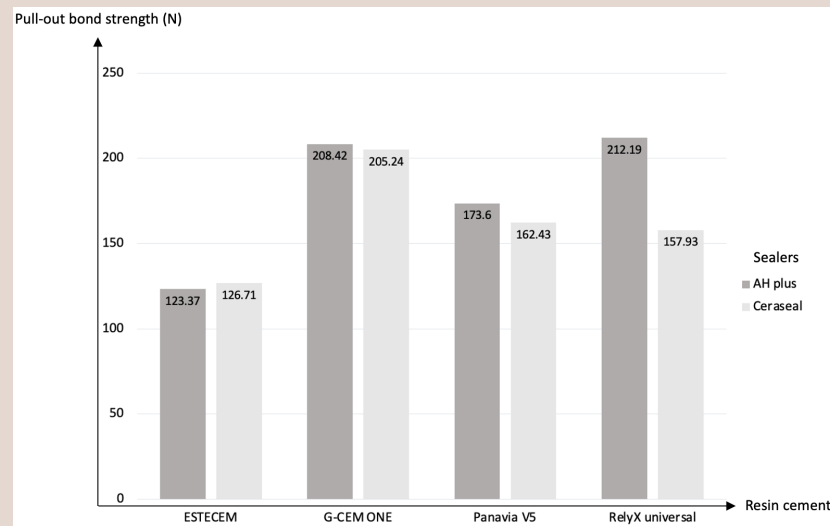


Result

Table Show Means pull-out bond strength values ± standard deviations (SD) of the experimental groups expressed in newton (N).

Material	ESTEC EM II (E)	G-CEM ONE™ (G)	Panavia V5 (P)	Rely X Universal (R)
AH Plus™ (A)	123.37 ± 59.13 ^{Aa}	208.42 ± 51.08 ^{Ba}	173.60 ± 61.44 ^{Ba}	212.19 ± 90.26 ^{Ba}
CeraSeal™ (C)	126.71 ± 64.00 ^{Aa}	205.24 ± 62.92 ^{Ba}	162.43 ± 87.3 ^{Ba}	157.93 ± 56.91 ^{Ba}

Different capital letters show significant differences within columns for each type of resin cement, whereas different small letters show significant differences within rows for each type of sealer. (p ≤ 0.05)



AE = AH plus™ & ESTEC EM II,
AG = AH plus™ & G-CEM ONE
AP = AH plus™ & Panavia V5
AR = AH plus™ & RelyX™ Universal
CE = CeraSeal™ and ESTEC EM II
CG = CeraSeal™ & G-CEM ONE
CP = CeraSeal™ & Panavia V5
CR = CeraSeal™ & RelyX™ Universal

Amongst the resin cements, there were significant differences of pull out bond strength between ESTEC EM II and G-CEM ONE, and ESTEC EM II and Relyx universal. ESTEC EM II pull-out bond strength values were statistically lower than both G-CEM ONE and Relyx universal. Whereas, there were no significant differences between AH plus and CeraSeal and both did not effect to the bond strength

Discussion

The first hypothesis was rejected. There was a significant difference in the pull-out bond strength mean values between post cemented with ESTEC EM II, G-CEM ONE and RelyX universal.

The second and third hypothesis was accepted. There was no significant difference in pull-out bond strength between two types of sealer and no interaction between sealer and resin cements.

G-CEM ONE showed significantly higher mean value than other groups, it was a developed self-adhesive composite cement along with the adhesive enhancing primer which allowed immediate polymerization with just a contact between adhesive and cement that composed of special accelerator that is not yet publicly known, it can enhance the bond strength with the dentin greatly (Kim et al., 2020) As for the second highest mean value.

RelyX Universal was developed along with scotchbond universal plus adhesive which might be the key factor of the high bond strength of RelyX Universal. The adhesive was developed by adding the amino-functional silane as 3-(aminopropyl) triethoxysilane (APTES) by the creation of intramolecular hydrogen bonding (Yao et al., 2021) and according to the manufacturer, Scotchbond Universal Plus Adhesive also contains a transition metal salt as a dual-cure accelerator which catalyzes the decomposition of the peroxide component of the dark cure initiator system.

The difference of ESTEC EM II from other resin cements is that the compositions of the adhesive (Tokuyama universal), do not contains 10 MDP as functional monomer as other groups but instead contains 3D-SR monomer which is the recently developed phosphoric acid monomer that still have limited study of its effect to dentin bonding strength. (Madrigal et al., 2021)

Conclusion

Bioceramic sealer does not have negative effect on pull out bond strength of fiber post when cemented with Touch-cured type of dual-cured resin cement.

References : Saraiva, L.O. et al., 2013, Aung, S. S. M. P. et al., 2019, Yao et al., 2021, Madrigal et al., 2021, Kim et al., 2020

Advisors



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