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# Monoblocks :Hype or Hope!!! “an In-Vitro Comparison of Push Out Bond Strengths of Resilon with Two Different Resin-Based Sealers”

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## ABSTRACT

Introduction: The purpose of this study was to evaluate the push-out bond strengths of different resin-based sealers..Methods: Sixty single-rooted human extracted teeth were used in this study. The teeth were instrumented and irrigated by using 5.25% NaOCl, 15% ethylenediaminetetraacetic acid, and sterile water. The teeth were then filled with Resilon/RealSeal, Resilon/RealSeal SE, or Resilon/AH-Plus sealer. The roots were then sectioned into 1-mm-thick slices and subjected to vertical loading to displace the obturating material toward the coronal side of the slice. The bond strength was then calculated and subjected to statistical analysis. Slices were examined by using a stereomicroscope at 30x to determine the mode of failure.Results: The mean push-out bond strengths were as follows: Resilon/RealSeal, 0.56 +/- 0.09MPa; RealSeal SE, 0.56 +/- 0.08 MPa; Resilon and Resilon/AH-Plus sealer, 0.95+/- 0.04 MPa.Conclusions: The push-out bond strengths of Resilon/AH-Plus sealer were significantly ($P < .05$) higher than either Resilon/RealSeal or Resilon/RealSeal SE.

**Introduction:**
The success of endodontic treatment includes three essential elements, viz. thorough debridement, disinfection and a complete three dimensional obturation1. The objective of three-dimensional obturation is to completely seal the canal system from any bacterial ingress from oral cavity and periradicular tissues2.Over the past century, numerous obturation materials & delivery techniques have been introduced in an attempt to obtain a microbiological barrier within the confines of root canal system3.

The introduction of Resilon (Resilon Research, North Branford,Conn.) as an alternative root filling material offers the promise of adhesion to root dentin. Resilon is a thermoplastic synthetic resin material that is based on polymers of polyester and contains difunctional methacrylate resin, bioactive glass and radiopaque fillers like bismuth oxychloride and barium sulphate. It performs, handles and looks like gutta-percha8.

Currently in endodontics, one of the resin obturation systems using dentin adhesive technology is RealSeal (SybronEndo, Orange, CA), formerly known as Epiphany (Pentron Clinical Technologies, Wallingford, CT). The two-step self-etching (sixth generation) adhesive system utilizes an acidic primer applied to the dentin surface16.

The acid and primer have been combined that eliminates one step in the process. After the acidic primer is dried, RealSeal sealer, a dual-cured resin cement, is applied to the root canal system and polymerized.

Recently, a new version of the RealSeal sealer, based on the self-adhesive cement concept (seventh generation) was introduced with the promise of optimizing clinical performance with a simplified one-step application procedure.

Thus, the manufacturers have stated that the new RealSeal Self-Etch sealer (RealSeal SE; Pentron Clinical Technologies LLC, Wallingford, CT) could bond simultaneously to both radicular dentin and Resilon points. An addition to the Resilon system the new sealer, RealSeal SE , eliminates the primer from the series17.

Hence,these newer resin-based sealers show improvements in interfacial strength and dislocation resistance between the root filling material and intraradicular dentin10..

An improved bond and the creation of a monoblock root canal obturation are claimed to be the main advantages of these materials2.Only few studies to date have looked at the bond strength of MetaSEAL and RealSeal SE .

Hence ,the present in-vitro study is an attempt to evaluate and compare the push-out bond strengths to the intra-radicular dentin by using Resilon along with two different resin-based sealers (methacrylate based) : Resilon/RealSeal; Resilon /RealSeal SE; and Resilon/AH Plus (an epoxy-resin based sealer as a control group).

**Methodology**
A total of sixty extracted human single-rooted, single-canal anterior teeth were selected for this study. The teeth were immersed in 3% Sodium Hypochlorite solution at room temperature for 15 minutes to remove organic debris, then washed under tap water. Any remaining debris were mechanically removed using an ultrasonic scaler with attention not to damage the root surfaces and were then stored in 0.1% thymol solution until use.

The teeth were decoronated at cementoenamel junction (CEJ) as a reference point with diamond disc using water spray to eliminate any variables in access preparation. Root specimens were standardized to 10+1mm length to serve as a stable and equivocal reference for all measurements.Instrumentation was done with K3 Rotary system.

The canals were dried with sterile paper points and specimens were then randomly assigned into two experimental groups and one control group of 20 teeth each based on the sealer used.

**Group I** : Resilon and RealSeal
**Group II**: Resilon and RealSeal SE
**Group III**: Resilon / AH Plus (Control group)

**Obturation of the samples:**
**Group I: Resilon and RealSeal system**
**Group II: Resilon and RealSeal Self-Etch system**
**Group III: Resilon and AH Plus sealer:**

All the root canal procedures were performed by a single operator to eliminate bias. Then all the samples were wrapped in moist gauze piece and stored in incubator at 370 C for 2 weeks to simulate the clinical situation and allow the sealer to set.

**Preparation of samples for mechanical testing:**
After 2 weeks, root samples were prepared for push-out testing. Each root was horizontally sectioned into approximately 2mm thick slices with the diamond disc.

Because of the small size of the filling material in the apical 3mm of the root, this portion was not evaluated using push-out technique. If the sample contained filling material of a non-circular shape, it was discarded, as this would result in non-uniform stress distributions during testing & inaccurate measurements.

This resulted in variance of sample size per group, which was accounted for during statistical analysis.

Overall, this produced approximately 3 slices per root with n=18 for Resilon/RealSeal,n=18 for Resilon/RealSeal SE group, and n=17 for Resilon/AH Plus group..The slices were wrapped in moist gauze and kept in petri dishes.

On the apical side of the slices, the smallest diameter was measured to select a punch to be used to supply load with that side, making sure that the punch would not contact the dentin around the obturating material, causing a crack and erroneous results. Thus, a 0.5mm-diameter cylindrical plunger was made.

Each specimen was attached to a support jig with clearance for the dislodged material on the base of the universal testing machineThe punch moved downward at a crosshead speed of 1mm/min until extrusion of the obturated material from the specimen was manifested.The universal testing machine gave the debonding force for individual specimen.

The push-out bond strength was calculated using the formula:

Debond stress(MPa) = Debonding force(N) / Area(mm2)

Where debonding force is the maximum force before debonding and area is the average value of the perimeter times the thickness.This was done for all the specimens.

After measurement of the bond strength both sides of the failed bond was evaluated under stereomicroscope at 30 X magnification to determine the mode of failure. Each sample was evaluated and placed into 1 of the 3 failure modes:

**Type 1** : adhesive failure at sealer/dentin interface
**Type 2** : cohesive failure at sealer to resilon interface
**Type 3** : mixed cohesive and adhesive failure

The data obtained from push-out test were subjected to One Way Analysis of Variance (ANOVA),Scheffe's test and Post hoc Tukey's test and data from stereomicroscopic analysis were subjected to Chi-Square test.

**Results**
It can be observed that Resilon/AH Plus (Group III) had more bond strength compared to Resilon/RealSeal SE (Group 2) and Resilon/RealSeal (Group I). [Table-1] When intergroup comparison was done it was observed that each pair of the groups differed significantly except group I and II.[Table-2].When Interlocation comparisons were done it was observed that that no significant difference in bond strength existed for segment location within each group.[Table-3]

Overall percentage of failures –[Table-4]
Group I- Resilon/RealSeal Group : Adhesive -90.74% ,Mixed -9.25%, Cohesive -0%
Group II-Resilon/RealSeal SE Group :Adhesive -88.88% ,Mixed -11.11%, Cohesive -0%
Group III- Resilon/AH Plus(control) Group :Adhesive -100% ,Mixed -0%, Cohesive -0%.
Mostly all the three groups showed adhesive failures.

**Discussion**
Numerous investigations have shown that the resin-based sealer AH Plus has higher bond strength than most other sealers (Wennberg & Orstavik 1990, Gettleman et al 1991, Pecora et al 2000,Ungor et al 2006). In the present study also, the AH Plus sealer and Resilon core combination showed greater push- out bond strength in comparison with both Resilon/RealSeal or Resilon/RealSeal SE.

An explanation for these results is the formation of a covalent bond by an open epoxide ring to any exposed amino groups in collagen3. Other investigations have further shown high-quality properties with AH Plus sealer, including its very low shrinkage while setting and long-term dimensional stability28-31.

A plausible explanation for the significantly lower bond strengths detected in the groups containing methacrylate resin-based sealer (Group I and II) is the effect of cavity configuration factor(C-factor). C-factor is found to be extremely high in long, narrow root canals. In these situations, there is very limited unbonded surface area to provide relief from the stresses created by polymerization shrinkage. It is likely that the bond between sealer core and sealer dentin is not adequate enough to resist this debilitating stress that develops during polymerization resulting in gap formation3.

The results obtained in the present study are in accordance with those obtained in study by stiegemeier17 et al. However,the only difference is in the values of bond strength obtained are a little lower in the present study as compared to those of stiegemeier et al. This might be attributed to the use of lentulospiral in their study which was avoided in the present study as it could have led to the generation of heat and premature setting of the sealer limiting its plastic flow.

**Conclusion**
From a practical standpoint, close examination of the present results yield an interesting thought for further consideration. Despite the theoretical development reached by the introduction of current dentin adhesive technology to be used for root-filling procedure; further research is needed to understand the properties of these methacrylate based sealers as well the concept of monoblock and thus making their use more effective in endodontic practice.

REFERENCE

1. Seltzer S, Bender IB. Cognitive dissonance in Endodontics. Journal of Endodontics Nov 2003;29(11): 714-719. 2. Skidmore, David W. and James K. An in-vitro comparison of the intraradicular dentin bond strength of Resilon and gutta-percha. Journal of Endodontics Oct 2006; 32:963-965. 3. Matthew A., David W. and James K. An in-vitro comparison of bond strength of various obturation materials to root canal dentin using a push-out test design. Journal of Endodontics July2007;33:856-858.4. Ryan KS, Michael JA, Pete M. A fluid filtration comparison of gutta-percha versus Resilon, a new soft resin endodontic obturation system. Journal of Endodontics 2006;32(7):642-645.5. Serge B, John CW, Franklin RT. Initial in- vitro biological response to contemporary endodontic sealers. Journal of Endodontics 2006 ;32 (10): 989-92.6. Fabricio BT, Erica CNT, MartinT. Fracture resistance of roots endodontically treated with a new resin filling material. JADA May 2004;135:646-652.7. B. Ureyen Kaya, A.D. Kececi. H. Orhan. Micropush-out bond strengths of gutta-percha versus thermoplastic synthetic polymer-based systems – an ex vivo study. International Endodontic Journal 2008; 41: 211-218.8. Ungor M, onay EO, Orucoglu H. Push-out bond strengths: the Epiphany-Resilon endodontic obturation system compared with different pairings of Epiphany, Resilon, AH Plus and gutta-percha. International Endodontic Journal 2006; 39: 643-647.9. Venturi M, Breschi L. Evaluation of apical filling after warm vertical gutta-percha compaction using different procedures. Journal of Endodontics. 2004; 30(6): 436-440.10. Teixeira FB, Teixeira ECN, Thomson JY, Trope M. Fracture resistance of roots endodontically treated with a new resin filling material. Journal of American Dental Association. 2004, 135: 646-652. 11. Michael Tagger, Etty Tagger, Tjan, Bakland. Measurement of adhesion of endodontic sealers to dentin. Journal of Endodontics May 2002;28(5):351-355.12. Harty FJ, Pitt Ford TR. Herty's endodontics in clinical practice. 5th Edition. Wright, An imprint of Elsevier Science. 2008;118. 13. Teixeira FB, Teixeira ECN, Thomson JY, Trope M. Dentin bonding reaches the root canal system. Journal of Esthetic and Restorative Dentistry. 2004;16:348-354. 14. Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. J Dent Res 1955;34:849-53.15. Marilia M, Keith Moore, Jeffrey Platt and Cecil E. Brown. Push-out bond strength of a new endodontic obturation system (Resilon/Epiphany). Journal of Endodontics 2007; 33:160-162.16. Schwartz R. Adhesive dentistry and endodontics: part 2 – bonding in the root canal system: the promise and the problems – a review. Journal of Endodontics 2006; 32:1126-34. 17. Danielle Stiegemeier., Craig Baumgartner and Jack Ferracane. Comparison of push-out bond strengths of resilon with three different sealers. Journal of Endodontics 2010; 36: 318-321. 18. Gustavo De-Deus et al. Push-out bond strength of Resilon/epiphany and Resilon/epiphany self-etch to root dentin. Journal of Endodontics 2009; 35: 1048-1050. 19. Nakabayashi N. Bonding of restorative materials to dentine: the present status in Japan. International Dental Journal. 1985 June; 35(2): 145-154.20. Swift EJ, Perdigao J, Heymann H. Bonding to enamel and dentin: A brief history and state of the art, 1995. Quintessence International. 1995 Feb; 26(2): 95-110. 21. Gesi A, Raffaelli O, Goracci C, Pashley DH, Tay FR, Ferrari M. Interfacial strength of Resilon and gutta-percha to intraradicular dentin. Journal of Endodontics. 2005 Nov; 31(11): 809-813. | |