Title: A simple 2-step silane treatment for improved bonding durability of resin cement to quartz fiber post.

Author: Kim Y and et al.


Reviewer: Ricky Gonzalez-Lopez, DMD

Introduction: Fiber posts are used extensively in clinical practice to restore endodontically treated teeth because of the similar elastic modulus of dentin. Several micro-mechanical of chemical surface treatment procedures have been investigated. Organofunctional silane coupling agents can achieve interfacial chemical bonds between the resin matrix of resin composite and the exposed glass of quartz fibers of the post. Non-organo-functional silanes are not coupling agents but rather surface-modifying ones.

Purpose: To investigate the potential use of BTSE (Non-organo-functional silane) coupled with methacyroloxsilane (Organofunctional silane) as a “2-step” silanization approach to obtain a hydrolytically stable bond between the fiber post and the resin composite.

Materials & Methods:

- Experimental BTSE was prepared in ethanol water and MPTS based saline primer used.
- 24 light posts embedded in rectangular silicone rubber molds using acrylic resin.
- MS was applied on the post surface and air dried for 60 sec
- BTSE was applied and air dried for 60 sec.
- Posts were immersed in 24% H2O2 for 10 min. and the coated with MS and BTSE primer.
- 4 composite cylinders were built up on each silanized post surface and double-sided adhesive tape with 4 aligned 1 mm diameter perforations was positioned on the surface.
- 4 clear PVC Tygon tubes were filled with RelyX Unicem and light cured.
- After 1 hr of storage at 37˚ C the Tygon tubes and tape were carefully removed.
- The bonded samples were mounted in a jig attached to a machine and a thin ligature wire was looped around the base of the composite cylinder making contact with half of his circumference then shear load was applied.
- All fractured interfaces were examined under an optical microscope.

Results: The Turkey test showed that the bond strengths for the BM and HBM groups were significantly higher than the M and HM groups at 5000 thermocycles. All debonded fibers showed some fracture fibers under scanning electron microscope. There was a statistically difference for silanization and surface pretreatment. BTSE primer application made the polished surfaces significantly hydrophilic.

Conclusions: The BM and HBM showed higher microshear bond strengths than M and HM. This finding indicates that the 2-step silanization produced more hydrophilically stable fiber post/resin composite bonds.

LOE: 5
Purpose: The purpose of this study was to evaluate the physiochemical properties of two novel sealers (MTA Fillapex® and EndoSequence® BC) and compare them with a silicone based sealer (Gutta-Flow®) and a zinc oxide eugenol based sealer (Pulp Canal Sealer).

Materials and Methods: The physical properties tested included working time, setting time, flow, solubility, and dimensional change. The viscosity was tested at different injection rates, such as 72mm/min, 10 mm/min, and 5mm/min at room temperature. The film thickness of sealer was determined as the difference in thickness between two 5mm thick glass plates after sealer was interposed between them. Working time was determined to be the length of time it took for a 10% decrease in diameter of sealer (when interposed between two glass plates) from its original diameter directly after mixing. Setting time was identified as the point when an indenter needle failed to make an indentation. Solubility of sealers was identified as a percentage of the mass of specimen material removed from distilled water compared with the original mass of the specimen. Dimensional changes of specimens of each sealer were measured before and after being placed in an incubator. The pH change of freshly mixed sealer was evaluated after 1 day and the pH change of set sealer was evaluated after 5 weeks.

Results: The flow, dimensional change, solubility, and film thickness of all the tested sealers were in agreement with ISO 687/2001 recommendations. MTA Fillapex® sealer exhibited a higher flow than EndoSequence® BC sealer. MTA Fillapex® and EndoSequence® BC sealers showed the highest film thickness among the tested samples. EndoSequence® BC sealer exhibited the highest value of solubility. MTA Fillapex® and EndoSequence® BC sealers had an alkaline pH at all times. The pH of AH Plus® and ThermaSeal® sealers were alkaline at first and then decreased significantly after 24 hours. The viscosity of the tested sealers increased with decreased injection rates.

Conclusion: MTA Fillapex® and EndoSequence® BC sealers each possessed comparable flow and dimensional stability but higher film thickness and solubility than other sealers tested.

LOE: 5
Title: Comparison of the time required to create secondary fracture of separated file fragments by using ultrasonic vibration under various canal conditions

Author: Terauchi Y et al.

Journal: JOE, Vol. 39, Number 9, pg. 1300-1305

Reviewer: Sean Nguyen, DMD

Purpose: The aim of this study was to determine the amount of time that it takes the ultrasonics to cause secondary fracture of separated NiTi files under 5 different conditions that simulate separated files in straight and curved canals.

Materials & Methods: Fifty nickel-titanium file fragments were divided into 5 groups. An ultrasonic tip was activated on a file fragment positioned between dentin blocks simulating several canal conditions: Group 1 consisted of the fragment protruding from a pair of straight dentin blocks. For group 2, the fragment was also positioned between 2 straight dentin blocks except one block was positioned 1 mm more apically than the other block, simulating a troughed area that is often created during file removal attempts. For groups 3–5, the fragment was positioned similarly as group 2 but between blocks with 30°, 45°, and 60° curvatures, respectively. The time it took for secondary fracture to occur was recorded, and the data were statistically analyzed.

Results: Fragments with dentin wall supporting on the opposite side of ultrasonic activation site resisted fracture significantly longer than those without it. Fragments in 30° and 45° curved blocks took significantly longer to fracture than the other groups (Fisher protected least significant difference, \( P < .05 \)).

Conclusion: Secondary fracture of separated files appeared to be reduced when the ultrasonic tip was applied to the inner curvature of the canal.

LOE: 5
Title: Effects of piezoelectric units on pacemaker function: an in vitro study

Author: Gomez G et. al

Journal: Journal of Endodontics Vol 39(10) 1296-1299

Reviewer: Kevin Baweja, DDS

Purpose: The use of piezoelectric units on patients with pacemakers is generally discouraged although there is no empirical evidence to support. Electromagnetic interference (EMI) is an external signal that may interfere with implanted cardiac pacemakers. This study observed the effects of 4 piezoelectric units and 2 magnetostriction units on a type of pacemaker in vitro.

Materials and Methods: Four piezoelectric units, (Piezosurgery®3, Piezotome, Piezotome®2 and VarioSurg) and 2 magnetostriction units (Piezotome and Piezotome®2) were tested for EMI with the SENSIA® SESRO1 pacemaker. The pacemaker was immersed in saline-solution bath and adjusted between 400-800 ohms to simulate the electrical resistance of the human body. The pacemaker was tested with each ultrasonic device to analyze the presence of EMI at different distances, with the ultrasonic switched on and off and during operation. If the devices produced any interference, the characteristics of the interference were recorded. EMI were defined as follows: EMI=0 (no presence of EMI), EMI=1- (presence of EMI with no effect on the pacemaker) and EMI=2 (EMI that interfered with the functioning of the pacemaker). A positive control for the presence ofEMI-2 was conducted by making direct contact between either the electrode or the generator and the piezoelectric or magnetostriction unit when they are switched on

Results: In the positive control (direct contact between either the electrode or the generator and the ultrasound device when switched on). With all scenarios and all distances, no EMI was produced by the ultrasound devices

Discussion: No EMI or permanent changes in the functioning of the pacemaker were detected in this in vitro model. There are no strict guidelines for the use of electrical dental devices in patients with a pacemaker

Conclusion: Patients cardiologist should usually be consulted before beginning any treatment that involves the use of the ultrasound device

LOE: 5
Title: Effectiveness of antibiotic medicaments against biofilm formation of Enterococcus faecalis and Porphyromonas gingivalis

Author: Alaa H et al.

Publication: Journal of Endodontics, Vol.39, #11, 1385–1389

Reviewer: Nadia Liss, DMD

Purpose: The objective of this study was to compare the antibacterial effect of triple antibiotic paste (TAP), double antibiotic paste (DAP), and calcium hydroxide (Ca(OH)₂) against Enterococcus faecalis and Porphyromonas gingivalis biofilm.

Materials and Methods: E. faecalis and P. gingivalis were grown in anaerobic blood agar plates. The minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), minimum biofilm inhibitory concentration (MBIC), and biofilm formation were measured by using microtiter plate methods. The two bacteria were treated with different dilutions of TAP (metronidazole, ciprofloxacin, and minocycline), DAP (metronidazole, ciprofloxacin), and Ca(OH)₂ solutions. A two-fold dilution method was used: overnight the bacterial cultures were treated with dilutions of Ca(OH)₂, TAP, or DAP solutions for 24 hours. The turbidities of the bacterial cultures in the microtiter plate were measured by optical density at 490 nm by using a spectrophotometer. The biofilm was washed with saline, fixed with 10% formaldehyde, and stained with 0.5% crystal violet for 30 minutes. The extract was diluted (1:5) with 2-propanol and read at 490 nm with 2-propanol used as a blank control. The biofilm formation was read at 3 time intervals of 24, 48, and 72 hours to ascertain the ability of the medicaments to inhibit biofilm over time. Optical absorbance of the diluted crystal violet stain represents the actual bacterial biofilm mass. A higher absorbance indicates higher biofilm mass. Data were analyzed by 2-way analysis of variance (a = 0.05).

Results: For TAP, the MIC and MBIC values were 0.003 mg/mL for E. faecalis and 0.006 mg/mL for P. gingivalis. The MBC values for TAP were 0.3 mg/mL for both bacteria. The MIC and MBIC values for DAP were 0.001 mg/mL for E. faecalis and P. gingivalis. The MBC values for DAP were 0.14 mg/mL for both bacteria. Biofilm formation of the 2 bacteria was significantly decreased with TAP and DAP at all tested dilutions (P < .0001) compared with control groups; however, TAP and DAP biofilm formations were not significantly different from each other. Ca(OH)₂ significantly decreased bacterial biofilm formation compared with the control, but it was significantly less than TAP and DAP (P < .05).

Conclusion: Both TAP and DAP were more effective than Ca(OH)₂ against E. faecalis and P. gingivalis. DAP can be considered an effective and comparable antibacterial substitute for TAP. No MIC and MBC values for Ca(OH)₂ were obtained in this study, which suggests a poor antimicrobial activity of the medicament. This agrees with previous studies that found Ca(OH)₂ to be ineffective against E. faecalis and P. gingivalis (Gomes, de Souza et al). Low numbers of E. faecalis bacteria still survived even after exposure to saturated solution of Ca(OH)₂ for 24 hours. Mixing Ca(OH)₂ paste with glycerin results in significantly better antibacterial effects (Gomes et al). However, Ultralcal aqueous Ca(OH)₂ paste was used in this study, which is one of the most common clinically used materials. To confirm the findings, another Ca(OH)₂ powder material (Dentonics) was used in this study, and the results were identical.

LOE: 5
Effect of smear layer against disinfection protocols on *Enterococcus faecalis* infected dentin

**Title:** Effect of smear layer against disinfection protocols on *Enterococcus faecalis* infected dentin

**Author:** Wang Z and et al.

**Journal:** JOE, Vol.39, No. 11, 1395

**Reviewer:** Milad Azadi, DMD

**Purpose:** To evaluate the effectiveness of bacterial killing by different disinfecting solutions used alone and in combinations in dentin with and without a smear layer.

**Materials and Methods:**

- 22 caries free single rooted teeth were used to make 44 semicylindric dentin halves, shaped into blocks and immersed in 5.25% NaOCl and 6% citric acid for 4 minutes
- *E. faecalis* suspension was sequentially centrifuged into the dentinal tubules of the dentin samples and incubated at 37°C for 3 weeks
- Dentin samples were removed and rinsed with sterile water for 1 min, air dried and cemental sides were sealed with nail varnish
- Smear layer was produced on the root canal wall of 40 specimens using a medium grit round bur and the remaining specimens had no smear layer
- Smear layer specimens were randomly subjected to 10 different disinfecting solutions or their combinations with 4 specimens in each group for 3 or 10 min:
  - Group 1 - Sterile Water
  - Group 2 - 2% NaOCl
  - Group 3 - 6% NaOCl
  - Group 4 - 2% CHX
  - Group 5 - 17% EDTA
  - Group 6 - QMiX
  - Group 7 - 2% NaOCl + 2% CHX
  - Group 8 - 2% NaOCl + QMiX
  - Group 9 - 6% NaOCl + QMiX
  - Group 10 - 6% NaOCl + 17% EDTA +2% CHX

- 50 uL of each irrigant were placed on the root canal side of each dentin specimen
- 1st applied solution was removed by pipette from the root canal wall and surface was dried using paper points before applying the second or third solution to avoid chemical reactions between the solutions.
- 4 control specimens without smear layer were divided into 2 and subjected to 2% CHX for 3 min or 6% NaOCl for 3 min.
- Samples were vertically fractured, stained and examined using confocal laser scanning microscopy to analyze the proportions of dead and live bacteria inside the dentin.

**Results:** In the presence of smear layer, 10 min of exposure to QMiX, 2% NaOCl + QMiX, 6% NaOCl + QMiX, 6% NaOCl + 17% EDTA +2% CHX resulted in significantly more dead bacteria than 3 min of exposure to these solutions. No statistically significant difference between 3 and 10 min was found in other groups. Six percent NaOCl + QMiX and 6% NaOCl + 17% EDTA + 2% CHX showed the strongest antibacterial effect. In the absence of smear layer, 2% CHX and 6% NaOCl killed significantly more bacteria than they did in the presence of a smear layer.

**Discussion:** The poorer effect of NaOCl and CHX in the presence of smear layer could be caused by at least 2 different mechanisms: 1. smear layer may act as a barrier so that less irrigant gets through in effective concentrations and 2. irrigants are partly inactivated when they penetrate through the smear layer. EDTA may affect the bacterial cell wall enough to allow red viability stain to penetrate into many cells even though they are not killed. The smear layer reduces the effectiveness of the antibacterial activity of NaOCl and CHX in dentin. Use of QMiX or 6% NaOCl followed by either QMiX or possibly by EDTA and CHX together results in good disinfection of dentin.

**LOE:** 5
Title: Treatment outcome after repair of root perforations with mineral trioxide aggregate: A retrospective evaluation of 90 teeth.

Authors: Krupp C et al.

Journal: J Endod.;39(11):1364-8

Reviewer: Christopher Maguire-Adams, DMD

Purpose: In this retrospective study, the success rate for the repair of root perforations using mineral trioxide aggregate was investigated.

Materials and Methods: One hundred forty consecutive cases of teeth with perforations were included in the sample. All treatments were performed between 1999 and 2009 in a dental office limited to endodontics. Perforations were sealed with mineral trioxide aggregate using a dental operating microscope. Treatment success was assessed by analyzing clinical data and radiographs one to ten years after treatment. The radiographs were evaluated by 2 independent calibrated examiners. The outcome measure was dichotomized as "healed" or "failure." The relationship between preoperative data and treatment outcome was examined to determine potential prognostic factors.

Results:

- From 128 teeth, 90 were accessible for recall (70.3%).
- The mean follow-up interval was 3.4 years.
- Sixty-six teeth (73.3%) were classified as healed.
- A significant relationship between treatment success and the presence of a preoperative lesion at the perforation site was found.
- Those teeth in which a lesion at the perforation site was present before treatment showed a lower healing rate.
- Teeth with a preoperative communication between the perforation and the oral cavity showed the lowest success rate.

Conclusions: Two prognostic factors for healing of teeth with perforations were identified. The presence of a preoperative lesion at the perforation site and direct contact between the perforation and the oral cavity were related to lower treatment success rates.

LOE: 5
Purpose: To evaluate and compare the residual activity of different concentrations of chlorhexidine (CHX) and alexidine (ALX) for 1 minute against *E. faecalis* biofilm on a dentin volumetric unit.

Materials and Methods: Non carious, non-erupted, extracted third molars were sectioned discarding the apical thirds and coronal enamel. The dentin was then cut into serial blocks. Dentin blocks were exposed to 17% EDTA for 1 minute (to eliminate inorganic tissue) and dried. The blocks were then immersed for 1 minute in different antimicrobial solutions (2% ALX, 1% ALX, 2% CHX, and 0.5% CHX). Positive control - block was inoculated with bacterial suspension. The sterility control was brain heart infusion (BHI) broth. The experimental dentin blocks were dried and incubated with the bacterial suspension with *E. faecalis*. The goal was to determine if there was any antimicrobial substantively during this 80 day period.

Results: ALX produced the best results when compared to CHX regardless of concentration. *E. faecalis* growth was detected in all samples of CHX. ALX showed growth in 5/8 cases. The log-rank test showed significantly longer survival with samples of ALX then CHX regardless of concentration. Positive controls showed bacterial growth. Negative control remained uncontaminated.

Conclusion: This study showed that 2% and 1% ALX used for 1 minute provides longer antimicrobial substantively against *E. faecalis* than CHX. CHX at a 2% concentration is the irrigant of choice to use in endodontic therapy as a final irrigation solution because it has proven its substantively. ALX in a preliminary study showed effective eradication of *E. faecalis* biofilms in dentin. ALX is significantly better than CHX in this study. This could be due to the fact that ALX binds to lipoteichoic acid of gram + bacteria better than CHX does. It took 78 days for the first 2% ALX specimen to permit growth of *E. faecalis*. This shows prolonged substantively. Overall 1% or 2% ALX might be a good alternative to CHX as a final rinse in endodontic treatment. Further research needs to be done clinically.

LOE: 5
Title: Retrospective evaluation of perforation repairs in 6 private practices

Author: Pontius V et al.

Journal: JOE, Volume 39, Issue 11, Pages 1346-1358

Reviewer: Hao Tran, DDS

Purpose: To investigate retrospectively the clinical outcome of 70 perforated teeth.

Material and Method: Seventy perforation repairs (69 patients) between 1998 and 2010 were observed using nonsurgical or combined nonsurgical/surgical approach by 6 endodontists internationally (majority of cases where in Germany) under dental operating microscope. Recalls of at least 6 months were obtained on 49 patients (50 teeth). Two calibrated observers evaluated the radiographic results on recalls ($\kappa = 0.77–0.84$, each indicating substantial agreement). Recalls up to 116 months were viewed with a mean of 37 months. Forty percent of the recalls were 4 years or longer.

Results:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Teeth</th>
<th>Success</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Sex of patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
<td>65</td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>35</td>
</tr>
<tr>
<td>Localization of perforation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supracrestal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Crestal</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>Subcrestal</td>
<td>27</td>
<td>54</td>
</tr>
<tr>
<td>Size of perforation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small (≤1 mm)</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Middle (1–3 mm)</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td>Large (&gt;3 mm)</td>
<td>29</td>
<td>58</td>
</tr>
<tr>
<td>Coronal leakage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>47</td>
<td>94</td>
</tr>
<tr>
<td>Yes</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Forty-five of 50 perforations had sign of repair, a success rate of 90%. Significant prognostic factors included the location of the perforation, sex of the patient, and restorative status of the tooth before perforation repair. The overall success rate of this study was higher than reported in other studies.

Discussion:

- 47/50 teeth had no clinical symptoms and were rated “functional” (94%).
- Combining radiographic and clinical findings, 45 of 50 teeth (90%) were rated as “success.”
- Mineral trioxide aggregate (MTA) is often the choice for perforation repair (37/50), but other materials were used, such as gutta-percha, glass ionomer cement, or composite. No difference in the outcome between MTA and the other materials in this study (92% vs. 85% respectively, $P = .60$), but a firm conclusion cannot be drawn due to small sample size.
- There are case reports on successful perforation repairs up to 13 year, but there are no studies with adequate sample sizes and long-term data.
- 90% success rate was similar to the study of Mente et al (18), who detected an 86% healing rate in perforations repaired with MTA alone.
- No significant difference was observed in this study between the initial treatment (87%) and retreatment (93%).
- No significant difference with the presence or absence of preoperative apical periodontitis and the periodontal status at the perforation site.
- The location of the perforation, the coronal status of the restoration, and the sex of the patient were factors that significantly affected the outcome.

LOE: 4