INFLUENCE OF CARBODIIMIDE CROSS-LINKING ON BOND STRENGTH TO RADICULAR DENTIN

The porosity percentage varied between 0 to 2.94 %.
Conclusion: High mechanical properties, low rate of porosity and very low shrinkage were demonstrated. This in vitro experiment demonstrates that Sonicfill can be used as a bulk technique, in a posterior restorative situation.

129

Category: Biomaterials

ANTIBACTERIAL FUNCTIONALIZATION OF A MINERAL CEMENT (BIODENTINE™) FOR DENTAL USE

Lieven Robberecht[1,2,3], Feng Chai[2,3], Etienne Deveaux[1,2,3]
[1]Faculté de Chirurgie-Dentaire. Université de Lille 2
[2]INSERM U1008: Médicaments et biomatériaux à libération prolongée: mécanismes et optimisation, Lille
[3]Laboratoire de bactériologie clinique - Faculté de Pharmacie, Université de Lille 2

Objective: The aim of this study was to add a long term antibacterial activity to a mineral cement: the Biodentine™; without decreasing neither physico-chemical and mechanical properties, nor biocompatibility.
Methods: Several antibacterial agents were selected: nanometric zinc oxide (0.5 and 0.2 %/weight) and silver sulphate (1 and 2 %/weight). After blending powder/liquid (0.6 g/137 µl) the samples (disks of 15× 1.5 mm) were stored in humid environment at 37 °C, 100 % humidity. The parameters studied were: initial setting time, tensile strength, viability of exposed epithelial cells (L132) to the cements, vitality of osteoblastic cells (MG63), MIC's of the antibacterial agents on *Staphylococcus aureus*, and antibacterial activity on *S. aureus* (colony forming unit).
The data were analyzed with non-parametric Mann-Whitney tests ($p \leq 0.05$).
Results: Initial setting time was increased for the cements functionalized with zinc oxide; a reduction of tensile strength for zinc oxide and silver sulphate ($p > 0.05$) was observed. The cytotoxicity of silver sulphate was higher than zinc oxide ($p < 0.05$) and Biodentine™ ($p < 0.01$). The cytotoxicity of the functionalized cements was not higher than the control samples ($p > 0.05$), except silver sulphate concentrated at 2 % ($p < 0.01$). A decrease of *S. aureus* adhesion on the surface of the the samples funtionalized by silver sulphate was observed compared to the control group ($p > 0.05$).
Conclusion: The addition of zinc oxide to the cement slows down its hydration without altering the mechanical properties and biocompatibility, but does not show any antibacterial effect. The addition of silver sulphate into the cement does not influence the setting time, but decreases its mechanical properties and trends to an antibacterial activity.

130

Category: Biomaterials

NEW METHACRYLIC MONOMERS FOR DENTAL APPLICATIONS

Kun Zhang[1], Wilms Baille[1], Marc Gauthier[1], X. X. Zhu[1], Sophie Lerouge[2], Daniel Fortin[3]
[1]Département de chimie, [2]CHUM, [3]Faculté de médecine dentaire, Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, QC, H3C 3 J7, Canada
[2]Département de génie mécanique, École de Technologie Supérieure, 1100 Notre-Dame Ouest, Montréal, QC, H3C 1 K3, Canada

Objective: The organic matrix of dental composites is typically a mix of two or more dimethacrylate monomers, of which the most common are BisGMA, UDMA and TEGDMA. The polymerization shrinkage and the release of organic leachates remain concerns in their uses. The objective of our work is to compare methacrylate derivatives of natural compounds with BisGMA and UDMA in dental composites, including the polymerization behavior in the presence of TEGDMA and the thermo-mechanical properties of the resulting polymers and composites.
Methods: The methacrylate derivatives of natural compounds were prepared. Composites were prepared by incorporating the monomer mixture to the silinated filler (1:3 w/w), followed by the addition of the photo-initiator and photo-irradiation. The degree of conversion was obtained from the near-IR spectra. Polymerization shrinkage was measured by axiosymmetric drop analysis using a dynamic contact angle analyzer.
Results: After visible light curing, the conversion of the commercial model systems is higher than those containing the new methacrylic monomers. Post-curing by heat increased conversion significantly for all systems, with a greater effect on those containing the new monomers. The results showed that the materials had reduced polymerization shrinkage, leaching and cytotoxicity, while retaining comparable mechanical properties, demonstrating advantages of such materials as new dental composites. The new polymers have a more complex thermo-mechanical spectrum, likely resulting from their significantly more complex structure. The new polymers despite their lower crosslinking density showed greater thermal stability, demonstrating greater rigidity within the polymer network.
Conclusion: The polymers and composites made from the new monomers demonstrated comparable mechanical properties, lower cytotoxicity, higher hydrophobicity and lower polymerization shrinkage than BisGMA and UDMA, making them good candidates as starting materials for dental monomers.
Financial support from the CHRP program of NSERC and CIHR of Canada, FQRNT of Quebec and the Canada Research Chair program is gratefully acknowledged.

132

Category: Biomaterials

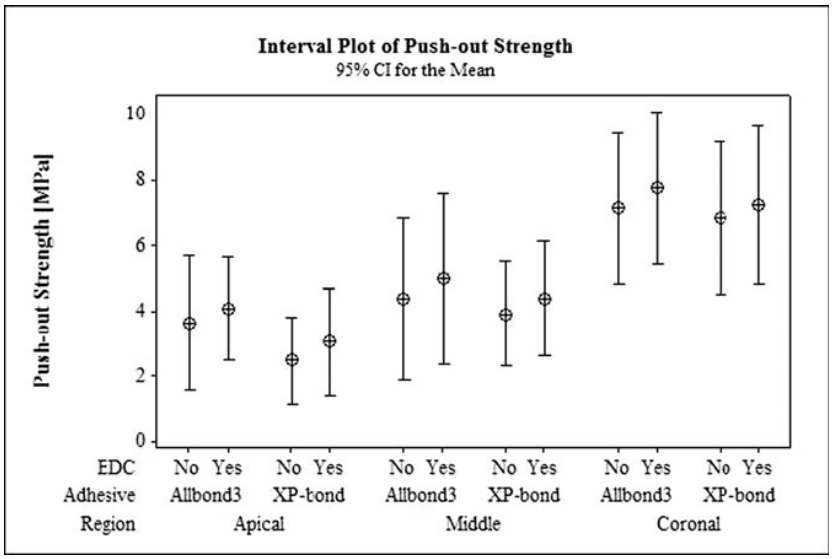
INFLUENCE OF CARBODIIMIDE CROSS-LINKING ON BOND STRENGTH TO RADICULAR DENTIN

Guido Gregori[1], Riccardo Rota[1], Annalisa Mazzoni[2], Lorenzo Breschi[2], Davide Paolino[3], Elio Berutti[1], Nicola Scotti[1]
[1]University of Turin, Department of Surgical Sciences, Dental School
[2]Department of Medical Sciences, University of Trieste
[3]Politecnical School of Turin, Department of Mechanics

Objective: Etching of dentin and bond application can activate matrix metalloproteinases (MMPs), contributing in the deterioration of the dentin collagen network of the hybrid layer. Recent studies demonstrated that collagen cross-linking agents strengthen the collagen network and inhibit MMPs activity. The aim of this *in vitro* study was to evaluate the effect of a cross-linker agent (carbodiimide, EDC) used as additional therapeutic primer in luting fiber posts to radicular dentin. The null hypothesis tested was that EDC improves the fiber post bond strength.

Methods: 52 extracted intact single-root teeth were selected for this study. Samples were endodontically treated and a 10 mm post space was prepared in each sample. 40 specimens were selected and equally and randomly divided into four groups ($n=10$) according to the adhesive protocol: 1) All Bond 3 (3-steps etch-and-rinse; Bisco); 2) All Bond 3+0.3 M EDC; 3) XP-Bond (2-steps etch-and-rinse; Dentsply); 4) XP-Bond+0.3 M EDC. EDC was applied after phosphoric acid etching for 1 min and prior bonding application. Fiber posts (RelyX Fiber Post) were luted with a dual-cure resin cement (Core-X Flow) and cured. Teeth were cut in 1 mm-thick slices and pushed until failure with an Instron Machine. Results were statistically analyzed with one-way ANOVA test. Statistical significance was set at $p=0.05$. 12 specimens were prepared for the SEM analysis.
Results: Means and standard deviations of push-out bond strength (expressed in MPa) of the tested groups are expressed in table 1. No influence was revealed by either EDC ($p=0.332$) or adhesive system ($p=0.216$) in affecting the bond strength to radicular dentin. No differences were observed with SEM with or without EDC application.

		BOND STRENGTH		
	ADHESIVE PROTOCOL	CORONAL	MIDDLE	APICAL
GROUP 1	AllBond 3	7.3 (±3.6)	4.5 (±3.9)	3.7 (±3.2)
GROUP 2	AllBond 3 + EDC	7.5 (±3.5)	4.7 (±4.0)	3,9 (±2.4)
GROUP 3	XP Bond	7.0 (±3.2)	4.0 (±2.4)	2.5 (±2.0)
GROUP 4	XP Bond + EDC	7.2 (±3.6)	4.1 (±2.4)	2.8 (±2.0)



Conclusions: Despite a slight improvement in bond strength, EDC-treated specimens showed no difference in bond strength when luting fiber posts to endodontically treated dentin. Further studies should evaluate if collagen cross-linking could stabilize the bond over time inhibiting dentin bound MMPs.

136

Category: Biomaterials

FIBER POST BOND STRENGTH IN CANALS OBTURATED WITH A CROSS-LINKED GUTTA-PERCHA CORE OBTURATOR

Coero Borga Francesco[1], Alovisi Mario[1], Paqualini Damiano[1], Bergantin Emanuele[1], Marchionni Silvia[2], Berutti Elio[1], Scotti Nicola[1]
[1]University of Turin, Department of Surgical Sciences, Dental School
[2]Alma Mater Studiorum, University of Bologna

Objectives: This aim of this study was to compare the bond strength of fiber posts cemented in root canal filled with different root canal obturation techniques.

Methods: 33 single-root teeth were endodontically treated and assigned to three groups ($n=8$) according to the endodontic obturation technique employed. G1: continuous wave technique; G2: plastic core obturator technique (Thermafill, Maillefer); G3: cross-linked gutta-percha core obturator technique (Guttacore, Maillefer). Fiber posts (Radix, Densply) with a etch-and-rinse adhesive system (All Bond 3, Bisco) and a dual-cure resin cement (Core-X Flow) and cured. Teeth were cut in 1 mm-thick slices and pushed until failure with an Instron Machine. 3 samples per group were prepared for the SEM analysis. The presence of debris particle and open dentinal tubules was evaluated with a 0 to 3 score scale. The final results were statistically analyzed with one-way ANOVA test. Statistical significance was set at $p=0.05$.
Results: Means and standard deviations of push-out bond strength (expressed in MPa) of the tested groups are expressed in table 1. The ANOVA test of bond strength values reveals a p value of 0.0051, considered very significant. The Bonferroni's test showed a significant difference between Group 1 and other groups only related to apical section of the post space ($p=0.004$). Open tubule and debris scores revealed that the use of a plastic or cross-linked guttapercha obturator significantly influenced the debris score but not the open tubule score.