Abstract # 13

Do Physical Properties of Luting-resins Correlate with CAD/CAM Composite-Dentin Adhesion?

Farid El-Askary[1], Abdullah hassanein[2], Emad Aboalazm[2], Nader Tadros[1], Mohamed Amr kamel[1], Mutlu Özcan[3]

[1]Ain Shams University-Egypt, [2]Egyptian-Russian University-Egypt, [3]University of Zurich-Switzerland

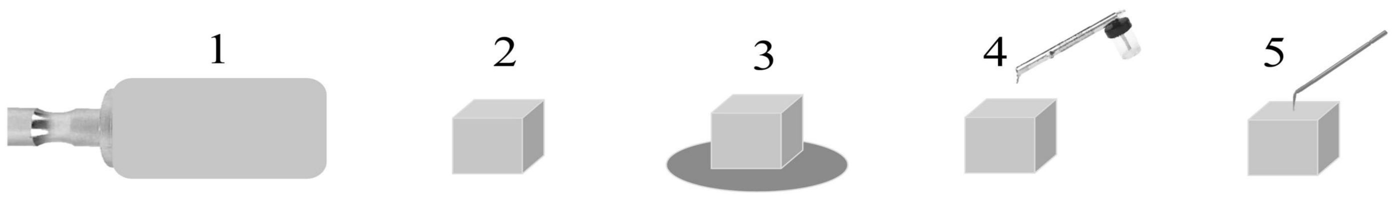
I. Objective

To correlate CAD/CAM composite-dentin micro-tensile bond strength (µTBS) with film thickness (FT), Vicker`s hardness (HV) and ultimate-tensile strength (UTS) of photo- and dual-polymerized luting resins. The hypothesis tested was that there would be correlation between the CAD-CAM/Dentin µTBS with FT, HV and UTS of photo- and dual-polymerized luting resins.

II. Materials and Methods

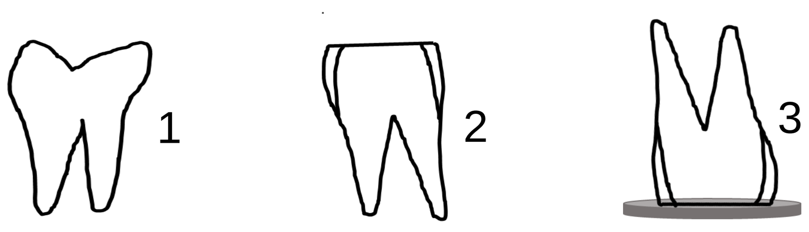
II.1. µTBS

II.1.A. Preparation of CAD/CAM composite blocks



1. Five-intact Grandio CAD/CAM blocks (A2, HT, VOCO), 2. Sectioned into 7mm x 7mm x 4mm multiple small blocks, 3. Wet ground over #600 SiC papers for 10s, rinsed and air-dried, 4. Air-abraded using 50µAl_2O_3 (0.2MPa/10mm/10s/45°), 5. Silane (Ceramic primer, VOCO) was applied (60s)/air dried (10s).

II.1.B. Dentin surface preparation



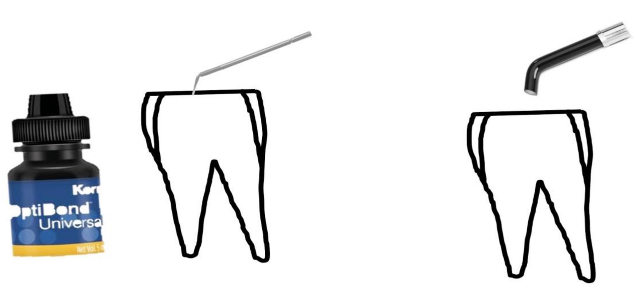
1. Thirty-intact human molars, 2. Occlusal enamel was removed using diamond coated discs, 3. Dentin was wet ground over #600 SiC papers for 30s to create a standardized smear layer.

II.1.C. Adhesive application

- Etch-and-rinse approach

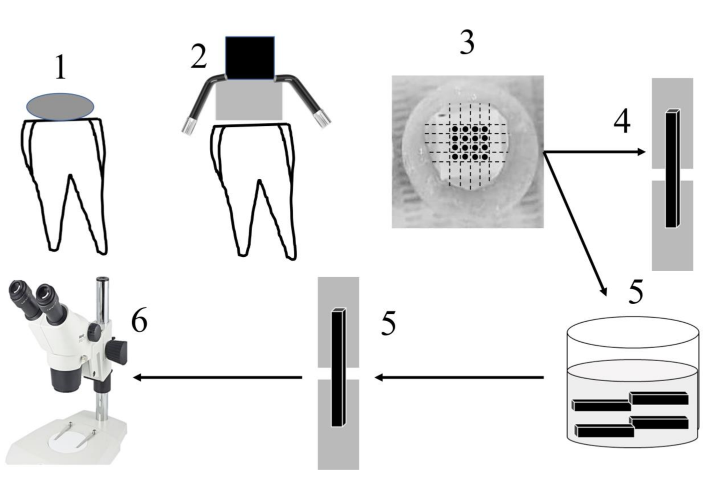
1. Dentin was acid etched (37% phosphoric acid, Meta Biomed) for 15s, rinsed for 30s and blot dried, 2. Adhesive (Optibond Universal, Kerr) was applied for 20s, air dried for 5s and 3. light cured for 10s.

- Self-etching approach



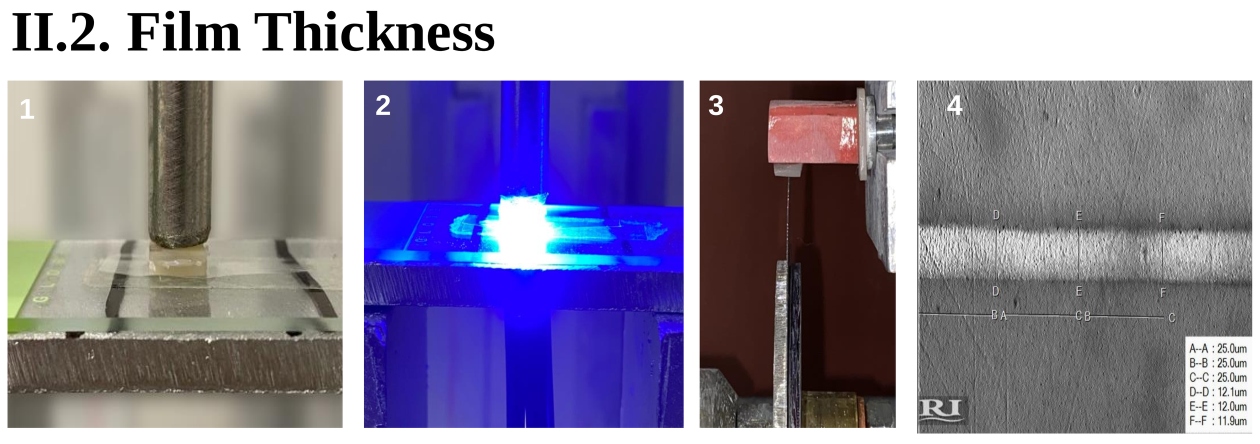
Adhesive was applied for 20s, air dried for 5s and light cured for 10s.

II.1.D. Luting materials application, µTBS testing and failure mode analysis



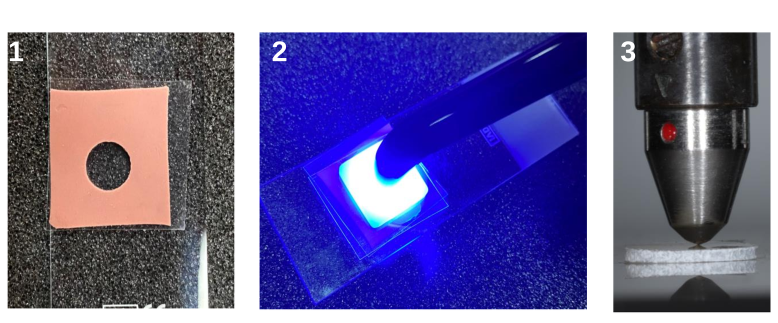
1. Luting materials were applied [Bifix QM (BF, Dual-polymerized resin cement), GrandioSO Heavy Flow (GHF, Photo-polymerized flowable composite) and VisCalor Bulk (VB, photo-polymerized heated bulk-fill composite), VOCO] 2. CAD/CAM blocks were loaded (1Kg), photo-polymerized (40s x 4 = 200s, and stored 48h/37°C), 3. Specimens were cut in x and y directions into 1mm x 1mm rods (8 – 16 rods/each tooth), 4. Half of the rods were tested for µTBS immediately (24h), 5. The other half were stored (6-month/37°C) then tested for µTBS, and 6. CAD/CAM and dentin sides of all fracture rods were evaluated for failure mode analysis using stereomicroscope (SMZ 745 T, Nikon, Tokyo, Japan).

II.2. Film Thickness



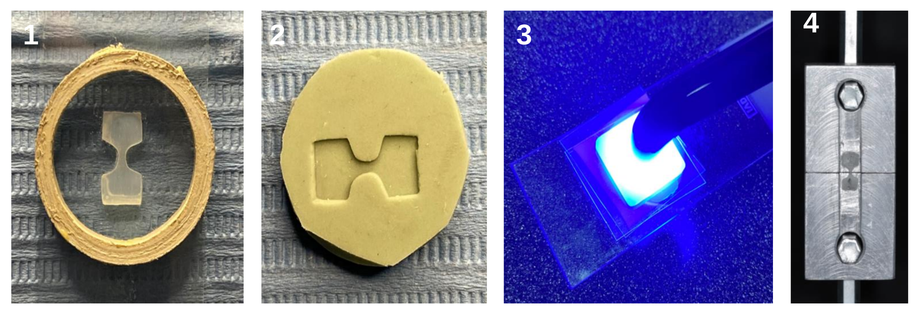
1. Twin-blocks bonded together and loaded (1Kg), 2. Photo-polymerized for 40s, 3. Cut into serial slabs (Each of ≈1mm thickness, n=9/each luting resin), and 4. Film thickness was evaluated using the soft wear (RI Viewer, Nikon, Tokyo, Japan) of the stereomicroscope at x40.

II.3. Hardness Vickers



1. Luting resin discs (7mmx0.5mm, n=5/each luting resin) were prepared in rubber mold, 2. Each disc was photo-polymerized for 40s, 3. Each disc was evaluated for HV (load: 200g, dwell time: 10s).

II.4. Ultimate Tensile Strength



1. Hour-glass shape composite replica with constricted area of ≈1mmx0.6mm^2, 2. Rubber molds were prepared, and luting resin material was injected inside the prepared mold, 3. Hour-glass specimens (n=8/each luting resin) were photo-polymerized from central area and the two-ends, each for for 40s, 3. Each specimen was pulled in tension at crosshead speed of 1mm/min.

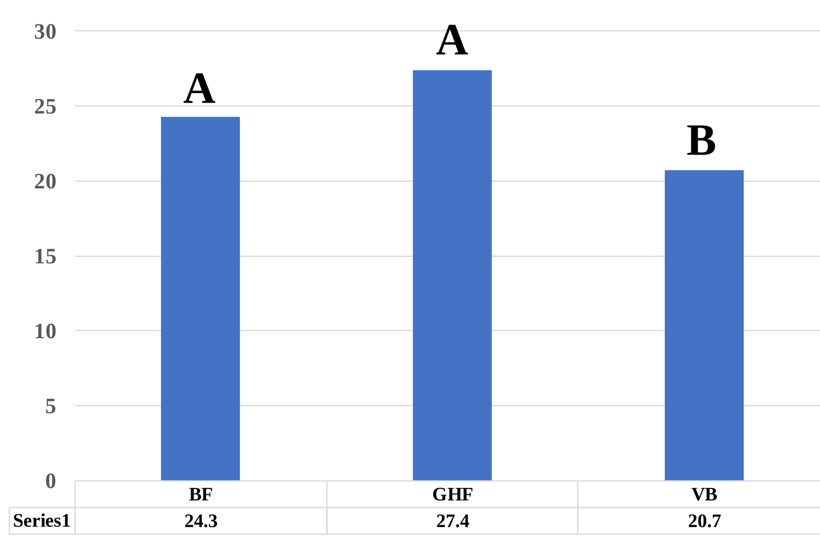
III. Results

III.1. µTBS

While correlation between µTBS/HV was not revealed (r=.322, P=.242), strong correlation between µTBS/FT(r=.766, P<.0001) and positive correlation between µTBS/UTS(r=.487, P=.016) were observed.

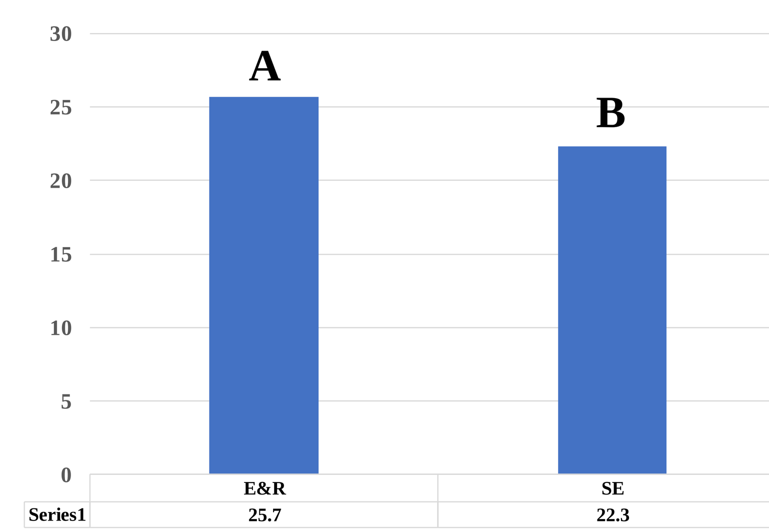
Three-Way ANOVA showed that “Luting-resin”, “adhesive-protocol”, and “storage-time”, showed significant effect on µTBS (MPa) (P<0.05).

III.1.A. Effect of luting resin



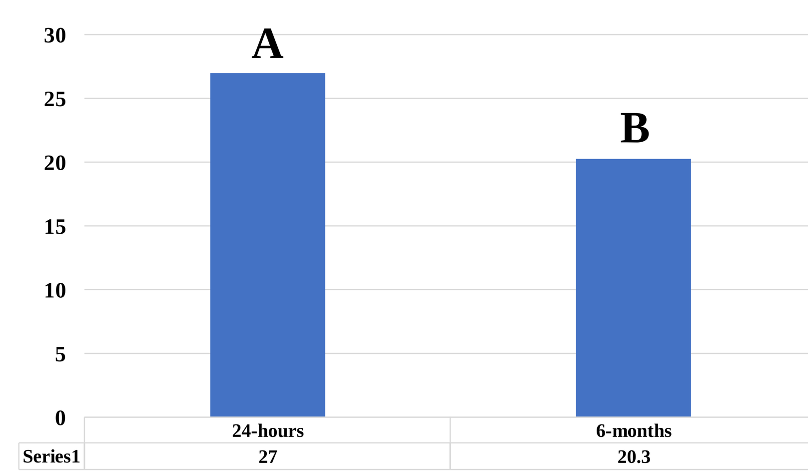
Means with same capital letters revealed no statistically significant difference at P = 0.05.

III.1.B. Effect of adhesive protocol



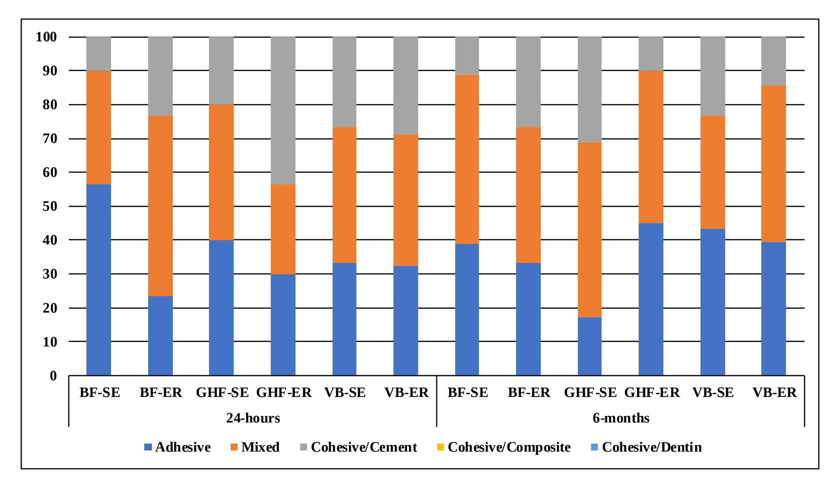
Means with different capital letters revealed statistically significant difference at P = 0.05.

III.1.C. Effect of storage time



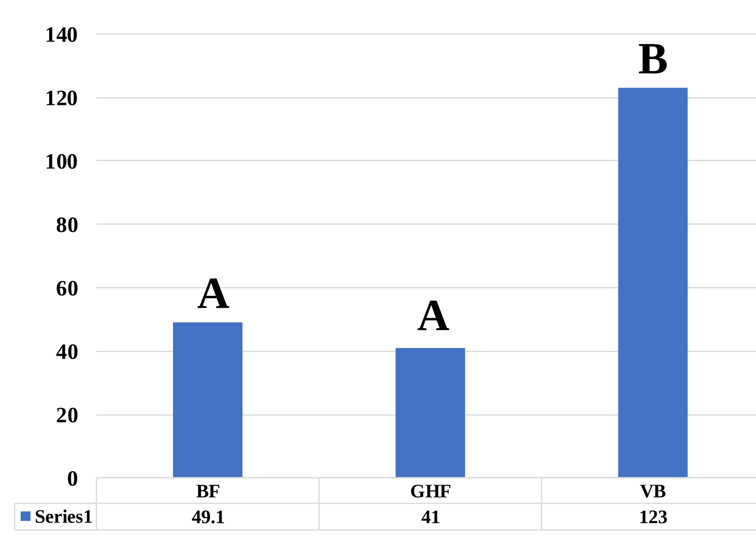
Means with different capital letters revealed statistically significant difference at P = 0.05.

III.1.D. Failure mode analysis



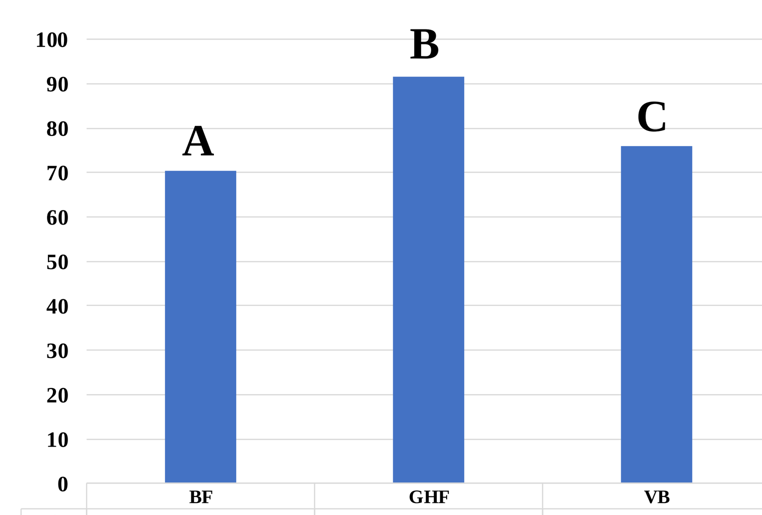
Percentage distribution of failure mode within each experimental group.

III.2. Film thickness



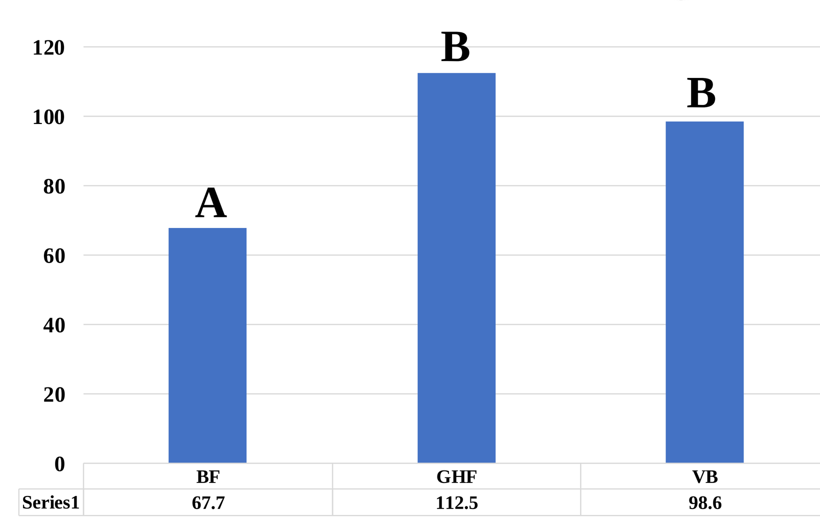
Means with same capital letters revealed no statistically significant difference at P = 0.05.

III.3. Vicker’s hardness



Means with different capital letters revealed statistically significant difference at P = 0.05.

III.4. Ultimate tensile strength



Means with same capital letters revealed no statistically significant difference at P = 0.05.

IV. Conclusions

1. Among tested materials, photo-polymerized flowable luting-resin (GHF) can substitute dual-polymerized resin-cement (BF) for CAD/CAM composite-dentin bonding.
2. Film thickness and ultimate tensile strength significantly affects CAD/CAM-to-dentin µTBS, while Vicker’s hardness had no significant effect on the µTBS.
3. Mixed failure was more frequently observed (42.1%), while no cohesive failure either in composite or dentin were evident.

V. Acknowledgment

The authors would like to thank VOCO GmbH, Germany for supplying CAD/CAM blocks, photo- and dual-polymerized luting resins used in this study.

VI. conflict of interest

The authors declare no conflict of interest regarding any materials used in this study.