

Novel RMGIC: May The Forces Be With You

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Purpose: A caries-infected tooth can lead to infection of the periapical tissue and, without timely intervention, can progress to significantly more serious complications. Following debridement and disinfection, conventional Endodontic procedures have used a gutta percha filling material and a separate sealer to restore the tooth. However, even following final crown placement this approach can lead to vertical tooth fracture due to insufficient strength of the filling material and possible dentin dehydration. To address this, the present study considers an Endodontic Monoblock approach to connect the dentin 'wall-to-wall'. A novel resin-based material was developed with the following aims: 1) Chemically bond to both radicular and coronal dentin, 2) Reduce internal stress concentration within the tooth by minimizing different material interactions and, 3) Achieve mechanical properties similar to Dentin.

Methods: Resin (ThTUDMA) and Glass Ionomer components were mixed with varying percentages of monomeric and polymeric acrylic acid, a crosslinking agent and 40 vol% of water. Combinations achieving greater than 90 % resin-phase conversion were subjected to 3-point bend testing following storage dry, in water or in artificial saliva. Additionally, micro-tensile tests were conducted to assess bonding to Dentin.

Results: From over 30 formulations, the best performing showed an average flexural strength of 174.5 MPa and Young's Modulus of 15.71 GPa on dry storage. The average Dentin bond strength was 11.6 MPa. When stored wet, the average strength and stiffness reduced to 19.2 MPa and 1.58 GPa, respectively.

Conclusions: Overall, the outstanding properties under dry storage conditions can be attributed to the hydrophilic compound forming an unusually strong resin matrix while the ion exchange with the Glass Ionomer enables bonding to the Dentin. The reduction when the samples were stored wet may be due to excessive water uptake that could be mitigated when the material is confined by a tooth, which requires further study.

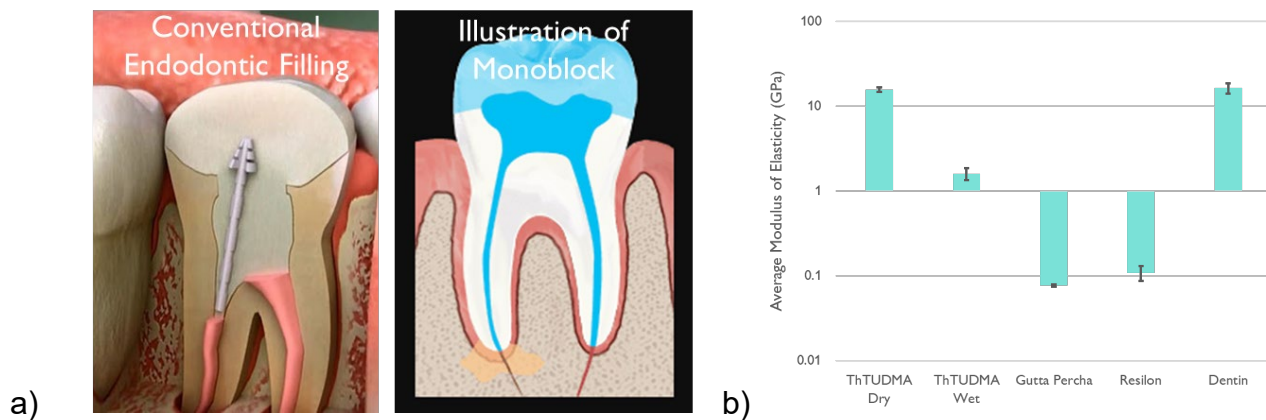


Figure 1: a) Comparison between conventional, multi-material and Monoblock Endodontic treatment; b) Illustrative results demonstrating the measured average and ranges of modulus of elasticity for the novel resin-based material compared to existing materials and Dentin

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