Heat treatment during setting on properties of resin-based provisional-restorative materials
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Purpose: To study the effect of heat treatment during setting on the physical properties of four resin-based provisional restorative materials.

Methods and materials: Four commercial restorative resin materials were employed, namely Duralay (polymethyl methacrylate), Trim II (polyethyl methacrylate) and Protemp 4 (bis-acrylic composite). Specimens were prepared at 23°C, 37°C or 60°C in a water bath for evaluation of flexural strength, surface profile, color stability and marginal discrepancy. Flexural strength was determined by 3-point-bending test on each specimen after thermocycling (3000 cycles, between 5-55°C), and its fractured surface was examined under scanning electron microscopy. Surface profile of the specimens was studied using atomic force microscopy. Color stability (ΔE*) was evaluated by comparing the color of the specimens before and after placed in coffee for 14 days. Standardized crowns were prepared for assessment of marginal discrepancy using a travelling microscope.

Results: Flexural strength of Trim II and Protemp 4 at 60°C (Trim II: 51.52 ± 5.59 MPa, Protemp 4: 115.41 ± 12.76 MPa) were higher than those at 37°C (Trim II: 43.61 ± 6.21 MPa, Protemp 4: 89.38 ± 8.59 MPa) and 23°C (Trim II: 41.79 ± 5.37 MPa, Protemp 4: 87.50 ± 10.29 MPa) (p < 0.05). Flexural strength of Duralay and Luxatemp were not significantly different at different curing temperature (p > 0.05). Slight difference of surface morphology could be seen between different curing temperatures of all types of materials. Luxatemp and Protemp 4 have lower ΔE* compared with other materials, in all the three curing temperatures. Marginal discrepancy of Trim II, Luxatemp and Protemp 4 were higher at 60°C than those at 23°C and 37°C.

Conclusion: Increase in curing temperature enhances flexural strength of certain resin-based acrylic provisional veneers; however, there is also an increase in the marginal discrepancy. Different curing temperature slightly altered the surface morphology and color stability of material, while different materials have obvious different properties in terms of surface morphology and color stability.

Keywords: Resin; Provisional; Restorative

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Polymerization shrinkage-stress kinetics of resin-composites
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Purpose: To investigate the effect of monomer matrix of several dimethacrylate based resin-composites, on their shrinkage-stress kinetics.

Methods and materials: Eighteen commercially available resin-composites with varying resin matrices were investigated including nanohybrid, microhybrid and bulk fill resin-composites. The investigated materials were a range of flowable and non-flowable resin-composites. Three specimens (n = 3) were made per material and light-cured with an LED unit (1200 mW/cm²) for 20 s. The Bioman shrinkage-stress instrument was used to measure shrinkage-stress. The shrinkage-stress kinetics at 23°C were monitored for 60 min. Maximum stress was recorded at 60 min. The shrinkage-stress rate was calculated using numerical differentiation. Data were analysed by One-way ANOVA and Dunnett test (p = 0.05).

Results: Shrinkage-stress values ranged from 3.94 (0.40) MPa for Tetric Evoceram (TET), to 10.49 (0.41) MPa for Beautifil flow plus (BFP). BFP showed no significant differences when compared to the other flowable materials Estelite flow quick (EFQ), Grandio SO heavy flow (GSO) and G-aenial universal flow (GUF). The lowest stress rate was recorded by Venus diamond (VD) 0.32 (0.01) MPa s⁻¹, whereas the highest value was recorded by G-aenial universal flow (GUF) 1.64 (0.10) MPa s⁻¹. GUF showed no significant difference when compared to Spectrum TPH (STPH).

Conclusion: Investigated resin-composites demonstrated a different shrinkage behaviour that was strongly related to their different monomer systems. The nature of the monomer system determines the amount of the bulk contraction that occurs during polymerization and the resultant stress. Flowable materials had the highest values of shrinkage stress. The bulk fill materials showed comparable result when compared to traditional resin-composites.

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Effect of fiberglass post-customization on the properties of adhesive interface
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Purpose: The aim of this study was to evaluate the mechanical properties (elastic modulus and Martens hardness) of resin cement and underlying dentin of the adhesive interface
Structural and mechanical properties of IPN FRC posts

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Purpose: The distribution of interpenetrating polymer network (IPN) of polymethylmethacrylate (PMMA)-bisglycidylmethacrylate (BisGMA) and cross-linked polymer matrix in everStick (ES, Stick Tech. Ltd., a member of GC Group) fibre-reinforced composites (FRC) has not been studied, although data of the function of IPN has been demonstrated by mechanical bonding tests. The aim of this study was to demonstrate distribution of the IPN structure in ES FRC before and after dissolving the surface with dimethacrylate resin (Stick Resin). Information of the polymer structure was compared to mechanical push-out results of bonding luting cement to the post.

Methods and materials: Plate like (25 mm × 5 mm × 0.5 mm) ES specimens with even surfaces was prepared to measure surface roughness (Ra) of dimethacrylate resin dissolved (1 h) and non-treated surface. The surface was studied with μ-Surf confocal microscope and atomic force microscope (AFM) by using non-contact mode. The change in surface hydrophilicity was studied with water contact angle (CA) measurement. Light-cured ES posts and G-CEM Link Ace resin composite luting cement (GC Corporation) was used for push-out tests (n = 8–10) of the post to cement.

Results: The average Ra difference between control and resin treated samples was 0.888 μm across the fibers and 0.07 μm along the fibers for the ES specimens. Roughness increased clearly after 1 h resin dissolving time for the everStick specimens. According to the rms (Å) values from AFM topography images (0.5 μm × 0.5 μm) it can be seen that the nanoscale roughness decreased after the resin dissolving treatment. The average contact angle (CA) difference between the control and resin treated samples was 17.41° for the ES specimens. CA decreased clearly after 1 h resin treatment for the everStick polymer. Bis-GMA was more hydrophilic than PMMA. According to the CA results there was more bis-GMA in contact with water drop after the resin dissolving treatment. Push-out results showed a difference between resin dissolved ES and non-treated ES. Push-out bond strength was 40 MPa for the resin treated specimen and 27 MPa (p < 0.05, ANOVA) for the non-treated specimen.

Conclusion: It was shown that the IPN structure was detectable by confocal microscope and AFM after resin treatment in the structure of everStick FRC. In addition the push-out results showed the benefit of IPN structure in enhancing bond strength to cement after resin treatment.

Keywords: IPN; Resin; Bonding strength

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Push-out test modification for bond strength evaluation of root-end sealers

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Purpose: To propose an adaptation to the push-out test for evaluation of the bond strength of root-end sealers to root-end cavities

Methods and materials: Forty maxillary central incisors were subjected to biomechanical preparation (#80 file) and cut transversally 2 mm short of the apex and 4 mm coronally to this point. The root cylinders were embedded in acrylic resin...