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Shear bond strength of resin composite to aged CAD/CAM ceramic materials using different dental adhesives (in vitro study)

A Thesis

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Abstract:

The aim of this study was to evaluate and compare the immediate shear bond strength of three CAD/CAM ceramic blocks: lithium disilicate reinforced ceramic IPS e.max CAD; a feldspar ceramic (CEREC blocs CPC) and a resin nano ceramic (VITA ENAMIC) bonded to a nano-hybrid composite resin (Tetric EvoCeram/A2 , universal composite, Ivoclar Vivadent, Liechtenstein Germany) using three different adhesives: (1) Two-steps adhesive (Monobond Plus primer, and Heliobond bonding agent) Ceramic repair kit (IVOCLAR Vivadent, Liechtenstein Germany) (2) Scotchbond™ universal light-cured adhesive (3M ESPE, Germany) (3) Palfique universal self-cure bonding (Tokuyama Dental Corporation, Japan).

A total of 72 specimens (10×10×2 mm) of ceramic mini-blocks were prepared and divided into three groups (n=24) according to the type of ceramic materials: Group A: A resin nano-hybrid ceramic (VITA ENAMIC EM-14 2m2HT), Group B: A feldspar ceramic (Cerec block CPC-14 A2C; Sirona Dental, Germany) and Group C: A lithium disilicate reinforced ceramic (IPS e.max HTA2 CAD, IVOCLAR). All material surfaces were subjected to surface roughness using silicon carbide paper with a grit size of 120p, and thermocycing (500 cycles, 5°C to 55°C). Then, each group was divided into three subgroups (n= 24) treated with three type of dental adhesives: (1) Two-steps adhesive (Monobond Plus primer, and Heliobond bonding agent) Ceramic repair kit (Ivoclar Vivadent, Liechtenstein Germany) (2) Scotchbond™ universal adhesive by 3M ESPE (3) Palfique universal self-cure bond (Tokuyama Dental Corporation, Japan). All blocs were repaired using the Nano-hybrid resin composite (Tetric EvoCeram /A2). The ceramic-composite blocs were subjected to shear bond strength testing machine after 24 h, the failure modes were determined using a stereomicroscope at magnification X40 power. The data were analysed using Two-way ANOVA and Bonferroni post-hoc test (multiple Pairwise comparisons) at a significance level of 0.05. The result of this study revealed that for the VITA ENAMIC group,

IVOCLAR two-steps adhesive (Monobond Plus primer, and Heliobond bonding agent) Ceramic repair kit showed significantly higher bonding strength values ($p=0.030$) than the Palfique universal bond. For CEREC CPC group, Palfique universal bond showed significantly higher bonding strength values ($p=0.001$) than the Scotchbond™ universal adhesive and IVOCLAR two-steps adhesive (Monobond Plus primer, and Heliobond bonding agent) adhesives, respectively. For the IPS e.max CAD group, Palfique universal bond showed significantly higher bonding strength values ($p=0.005$) than the IVOCLAR two-steps adhesive (Monobond Plus primer, and Heliobond bonding agent).

As a conclusion, Palfique universal bond achieved higher bonding strength values ($p<0.05$) with each type of ceramic material tested in this study. The type of ceramic materials produces a major effect on the bonding strength regardless the type of dental adhesives, additionally the two-steps adhesive (Monobond Plus primer, and Heliobond bonding agent) Ceramic repair kit (IVOCLAR Vivadent, Liechtenstein Germany) enhances the bonding strength when used with Vita Enamic ceramic materials. Moreover, Scotchbond™ universal adhesive improves the bonding strength with IPS e.max CAD. However, the Palfique universal bond revealed no statistically significant differences in bonding strength values among the three types of ceramic materials ($p=0.126$).