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Evaluation of Micro-Tensile Bond Strength to Dentin, Failure mode, and Fluoride release of GDMA-Based Versus HEMA-Based Universal Adhesives after Aging: An in vitro study

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GDMA BASED ADHESIVES

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Abstract

The aim of the present study is to evaluate the micro-tensile bond strength to dentin, failure mode, and fluoride release of GDMA-base bonding agent vs HEMA-based universal adhesive after aging. A total of 50 freshly extracted caries-free human molars will be used in this study. The specimens will be divided into 2 groups according to the used adhesive. Group (A1) refers to the intervention group using GDMA based universal adhesive, while Group (A2) refers to control group using conventional HEMA-universal adhesive. The specimens of all groups will be subjected to 10,000 thermo-cycles as an aging period. For micro-tensile bond strength test, the beams will be mounted onto the universal testing machine and tensile load was applied, until bonding failure of the specimen occurred.After μ-TBS testing, failure mode will be analyzed. Elemental analysis of resin-dentin interface will be assessed using energy dispersive x-ray (EDX) analysis

Materials

a) GDMA based Universal Adhesive. (CLEARFIL Universal Bond Quick, Kurary, Japan)
b) Conventional HEMA-Universal adhesive (Single Bond Universal Adhesive, 3M ESPE Deutschland GmbH, Germany)
c) resin composite.

Samples, interventions and outcomes

1 Sample size calculation

2 Sample preparation
total of 50 freshly extracted caries-free human molars will be used in this study. The occlusal enamel will be removed at 90º to the long axis of the tooth by means of a model trimmer under running water to obtain mid-coronal dentin. The dentin surfaces will be prepared with 600-grit SiC paper to create a standardized smear layer.

3 Grouping of samples:
The specimens will be divided into 2 groups according to the used adhesive. Group (A1) refers to the intervention group using GDMA based universal adhesive, while Group (A2) refers to control group using conventional HEMA-universal adhesive. The specimens of all groups will be subjected to 10,000 thermo-cycles as an aging period.

4 Intervention application for micro-tensile bond strength test
For micro-tensile bond strength test, a total of 24 sound human permanent molars will be randomly divided between the experimental groups. The tested adhesives will be applied according to the manufacturer's instructions. After light curing of the adhesives, the reduced occlusal surface will be built with 3 mm layer by layer using resin composite restoration and light cured to facilitate longitudinal sectioning of the restored teeth.

5 Failure mode analysis
After μ-TBS testing, each specimen will be photographed using USB Digital microscope with a built-in camera (Scope Capture Digital Microscope, Guangdong, China) connected to an IBM compatible computer using a fixed magnification of 65x. A digital image analysis system (Image J 1.43U, National Institute of Health, USA) will be used to evaluate the failure mode. Failure modes will be classified as one of three types: adhesive (failures occurred exclusively at adhesive interfaces), cohesive (failures occurred exclusively within dentin or the resin composite and mixed (adhesive and cohesive failures of the adjacent substrates). The percentage of the failure modes will be calculated

Assignment of interventions

6 Randomization
Randomization will be generated using (www.randomization.com).

7 Allocation concealment mechanism
A checklist will be designed to identify each material specimen. A series of sequentially numbered opaque envelopes will be used for each group.

8 Implementation
A participant who has the checklist and the envelopes will allocate the randomly selected specimens into the envelopes to prevent bias.

Statistical methods

9 Continuous data will be described using mean and standard deviation. Intergroup comparison between continuous variables will be performed using independent t test and intragroup comparison will be done using repeated measures ANOVA followed by tukey's post hoc test. Categorical data will be described as frequency and percentage. Intergroup comparison between categorical data will be performed using chi square test and intragroup comparison will be performed using Cochran's Q test followed by multiple comparisons. A p-value less than or equal to 0.05 will be considered statistically significant and all tests will be two tailed. Statistical power of the study will be set at 80 % with 95 % confidence level.

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