

Abstracts of Theses Approved for the MSc at the School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia

EFFECT OF CARBONATED BEVERAGE AND FLUORIDE MOUTH RINSES ON ENAMEL SURFACE AND SHEAR BOND STRENGTH OF CONVENTIONAL RESIN BASED ORTHODONTIC ADHESIVE COMPOSITE

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Introduction: Carbonated beverages contains high amount of sugar and acids that can affect oral health negatively. There were some indications about the erosive effect of mouth rinses on enamel surface.

Objectives: This study was conducted to determine the long term consumption of carbonated beverage and the use of fluoride mouth rinses on enamel surface and shear bond strength of conventional resin based orthodontic adhesive composite.

Methods: An in-vitro study was done on 180 extracted human teeth. The brackets were bonded on the teeth with Transbond XT orthodontic adhesive. The teeth were divided randomly and equally into 6 groups. 25 days exposure cycles were done for all groups as following: group 1 control (distilled water), group 2 (Coca Cola), group 3 (Colgate mouth rinse), group 4 (Oral-B mouth rinse), group 5 (Coca Cola plus Colgate mouth rinse), and group 6 (Coca Cola plus Oral-B mouth rinse). Image analyzer was used and the percentage of enamel decalcification surface area was calculated. Universal test machine was used to determine the shear bond strength. Image analyzer was also used for calculating adhesive remnant index on enamel surface after debonding. Data were entered in PASW version 18 (SPSS Inc., Chicago, IL). Kruskal-Wallis and Mann-Whitney tests were used to compare the percentage of the enamel decalcification surface area between groups.

Result: It was found that all groups have enamel decalcification greater than control group with different degrees. One-way ANOVA test and Scheffe multiple comparisons test were used to compare significant differences of shear bond strength between study groups. There was significant difference between control group 1/group 2 ($P = 0.001$) and 5 ($P = 0.047$). There was no significant difference between group 1/group 3 ($P = 0.983$), 4 ($P = 0.480$), and 6 ($P = 0.670$). Moreover, Kruskal-Wallis and Mann Whitney tests were used to compare significant differences of adhesive remnant index among study groups. There was no significant difference among study groups.

Conclusion: This study concluded that the long period consumption of carbonated beverage caused enamel decalcification, reducing shear bond strength of the orthodontic adhesive, and cause debonding failure site at enamel-adhesive interface. The long use of acidic fluoride mouth rinses can cause enamel decalcification and debonding failure site at enamel-adhesive interface. However, it will not affect the shear bond strength. The use of fluoride mouth rinses after carbonated beverage consumption has limited effect on shear bond strength except for Oral-B mouth rinse, enamel decalcification, and failure site.

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IN VITRO EVALUATION OF THE FERRULE EFFECT AND POST MATERIAL ON FAILURE LOAD AND MODE IN ENDODONTICALLY TREATED TEETH

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Introduction: There are still controversy regarding the ferrule effect and a better bonded pre-fabricated posts on strength of endodontically treated teeth.

Objectives: The aim of this study was to compare the effect of ferrule and 2 types of bonded post materials on failure load and failure mode of restored endodontically treated teeth.

Methods: 68 extracted maxillary central incisors were sectioned 15 ± 0.1 mm coronal to the root apex using hard tissue cutter (Exakt, DE) and high speed handpiece. Then, they were endodontically instrumented using step-back technique with master apical file size 45 and obturated with gutta-percha (Meta Dental Co. Ltd, KR) and sealed with AH 26 (Dentsply Maillefer, DE) using lateral condensation technique. Post spaces were then prepared using Gates-Glidden rotary instrument to remove gutta-percha leaving 5 mm from the apex, followed by Tenax drills (Coltene Whaledent, US) up to size 1.3 mm in diameter to enlarge the canals. Samples were randomly divided into 4 groups of 17 where group A was placed with titanium post (Tenax post, Coltene Whaledent, US) without ferrule preparation, group B placed with titanium post and 2 mm ferrule preparation, group C placed with glass fiber reinforced composite post (Tenax fiber white post, Coltene Whaledent, US) without ferrule preparation, and group D placed with glass fiber reinforced composite post and 2mm ferrule preparation. All posts were cemented using

Panavia F (Kuraray Medical Inc., JP) before the core was built with Paracore (Coltene Whaledent, US) and standardise the size using paraform coreformer #1. Then, crowns fabricated using Ni-Cr where the length of each sample with the crown in place was 23 ± 0.1 mm, checked using a digital calliper. Crowns were cemented using Ketac-Cem (3M ESPE, DE). 4 metal blocks were used to hold the specimens during mechanical testing. Each block had a drilled cylindrical hole with a different diameter (5.5 mm, 6.5 mm, 7.5 mm, and 8.5 mm) to accommodate to different specimens' widths with rubber silicon impression material injected to simulate the periodontal ligament.

Result: A universal testing machine (Instron 3366, US) was used for the mechanical testing by applying a compressive load at a crosshead speed of 1 mm/min at an angle of 135° to the long axis of the sample until failure. The medians of failure load for groups A, B, C, and D were 253.10 N (76.6), 265.40 N (279.7), 203.10 N (68.7), and 251.75 N (69.2), respectively. Kruskal-Wallis test indicated that the medians of failure load were not statistically significant across the 4 groups ($P > 0.05$). Failure mode was classified as either favorable failure (failure of the restoration only) or unfavorable failure (failure of the restoration and the supporting tooth structure). Group C had the highest frequency of favorable failures (87.5% favorable and 12.5% unfavorable failures). Group A had (37.5% favorable and 62.5% unfavorable failures). Group B and D had (0% favorable and 100% unfavorable failures). Chi-square test for independence indicated a significant difference in failure mode between the groups ($P < 0.05$).

Conclusion: The ferrule effect and post material did not significantly affect the failure load of endodontically treated teeth, but those restored with glass fiber reinforced composite posts had a more favorable failure mode than those restored with titanium posts when the ferrule effect was not present.

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FABRICATION AND CHARACTERIZATION OF EXPERIMENTAL NANOCOMPOSITES FOR DENTAL RESTORATION

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Introduction: Currently, restorative dental composites have become preferred among patients due to their esthetic characteristic and also their durability. The high costs of composites, as well as the rising demand by patients have lead researchers to produce a local product with

equivalent standard as compared to the commercially available dental composites. Recently, monodispersed, spherical silica nanofillers with a size range of 10–20 nm were successfully synthesised via a sol-gel process and have a great potential to be used in fabrication of dental composites.

Objectives: This present study was carried out to fabricate and characterize the experimental dental nanocomposite from the synthesised nanosilica fillers.

Methods: Dental composites, namely experimental nanocomposite 1 (ENC1) and experimental nanocomposite 2 (ENC2) with 2 different filler content, 30 and 35 wt% respectively were fabricated, molded, and polymerized with a light curing unit for 40 seconds. The properties that were tested including their flexural strength, modulus, compressive strength, micro hardness, degree of conversion, volumetric shrinkage, water sorption, solubility, surface roughness as well as filler distribution. The data obtained were statistically analysed with one-way ANOVA with the level of significance $P = 0.05$. Various type of commercial composites such as FiltekTM Z350 (nanocomposite), Spectrum® TPH®3 (microhybrid), Z100TM (hybrid), and Durafill® VS (microfilled) were chosen to compare their properties with the experimental nanocomposites. The properties of composites were also referred to the ISO and ANSI/ADA No. 27 requirements.

Result: From the results obtained, it can be summarised that the experimental nanocomposites and commercial composites comply with the ISO and ANSI/ADA No. 27 requirements. Similar properties can be found between experimental nanocomposites and Durafill® VS (microfilled composite) regarding their flexural strength, modulus, compressive strength, hardness, and also surface roughness. These properties are sufficient to be applied for the anterior restoration. However, the properties of the experimental nanocomposites were still inferior compared with the posterior restorative composites (FiltekTM Z350, Spectrum® TPH®3, and Z100TM) particularly in flexural strength, modulus, hardness, shrinkage, and water sorption. Comparing both of the experimental nanocomposites, ENC2 seems to have better properties compared with ENC1 except for the compressive strength.

Conclusion: Overall, the main factor that contributes to the properties of dental composites is inorganic fillers including their filler content, size, morphology, and distribution. Highly filled composites exhibited excellent properties than the composites with low filler content. The synthesised nanosilica might be an option to be used for making a dental composite. However, concerns also arise regarding dental composites problem of achieving the high filler loading, which limit their application only for making anterior composite.

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