SHEAR BOND STRENGTH OF TWO CHEMICALLY DIFFERENT DENTURE BASE POLYMERS TO RELINE MATERIALS

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DECLARATION

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Name of Degree: Master of Clinical Dentistry in Restorative (Prosthetic) Dentistry

Title of Research Report: Shear bond strength of two chemically different denture base polymers to reline materials

Field of study: Prosthetic Dentistry

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ABSTRACT

Introduction: A denture which is relined to improve tissue adaptation can only be successful if a satisfactory bond exists between the denture base and the reline material. The latest addition to light-activated denture base polymer in the market is a urethane-based known as Eclipse resin (Dentsply Int. York, USA).

Objectives: The aim of the study was to evaluate the shear bond strength of Eclipse light-polymerized urethane dimethacrylate (UDMA) and Meliodent heat-polymerized polymethylmethacrylate (PMMA) denture base polymers to various reline materials.

Materials and Methods: The reline materials selected for this study were 2 intra-oral (Kooliner & Secure) and 2 laboratory-processed (Meliodent RR and Eclipse) reline materials. Denture base specimens of Eclipse were prepared by investing multiple brass columns each measuring 15 mm in diameter and 4 mm in height in a stone mould, which was sandwiched between two circular Perspex blank. Prior to finger adaptation into the mould, Eclipse resin was warmed in an oven at 55ºC for 2 minutes. Air barrier coating agent was applied and polymerization was accomplished in a processing unit by exposing the specimens to visible light of 400-500nm wavelength for 10 minutes. Six halogen lamps of 41 volts each were employed for polymerization. Meliodent denture base specimens were invested in the same manner as for Eclipse material except that a metal flask was used. The powder:liquid ratio of 35g:10ml was used and polymerization was accomplished in a water bath using a curing cycle of 7 hours at 70ºC followed by 1 hour at 100ºC. Thirty specimens were prepared for each denture base material and they were mounted in epoxy resin with one surface exposed. They were then immersed in water at 37ºC for 30 days before relining. The specimen was then dried and a customized brass ring of 2.5mm height and 6mm internal diameter was placed to cover the specimen surface except for a known area in the center of the ring. Reline materials

were applied to the confined denture base surface within the ring and were left to polymerize. Kooliner and Secure reline materials were polymerized in a chamber at 37ºC to simulate the oral environment temperature while Meliodent RR resin was polymerized in a pressure pot at 55ºC with 2 bar pressure to simulate laboratory reline procedures. When relining with Secure material, dichloromethane adhesive was applied to the denture base as recommended by the manufacturer. Ten additional Eclipse denture base specimens were prepared and were relined using the same Eclipse resin. For this relining procedure, polymerization was carried out in the processing unit for 6 minutes. All bonded specimens were immersed in water at 37ºC for 24 hours before testing. The shear bond test was carried out using an Instron machine at a crosshead speed of 1.0 mm/min. Examination of failure mode was performed under a stereomicroscope. Samples of an Eclipse denture base-Eclipse reline and Meliodent denture base-Secure reline combinations were further examined under Scanning Electron Microscope (SEM). The effect of surface treatment with dichloromethane adhesive was also observed under SEM. One-way ANOVA was used for comparison of shear bond strength amongst seven denture base-reline polymer combinations and Post-hoc Dunnett's T3 test to compare the significance difference between the groups. Two-way ANOVA was used to determine the effect of denture base material, reline material and the interaction between them. For this analysis, Eclipse reline material was excluded. Statistical analyses were carried out at a 95% significance level.

Results: The highest mean shear bond strength was observed in PMMA denture base-Meliodent RR reline combination (14.5±0.5 MPa) while the lowest value was observed in UDMA denture base-Kooliner reline combination (2.4±0.5 MPa). Within UDMA reline groups, the highest shear bond strength was achieved when they were relined with the same Eclipse material (11.4±0.6 MPa). For all the three auto-polymerized reline

materials (Meliodent RR, Secure and Kooliner) their shear bond strengths to PMMA were significantly higher than to UDMA denture base polymers ($p<0.05$). Between the 2 intra-oral reline materials, (Secure and Kooliner), Secure material showed a significantly higher shear bond strengths to both PMMA and UDMA polymers ($p<0.05$).

All denture base-reline combinations showed 100% adhesive failure except for PMMA denture bases that were relined either with Meliodent RR (100% cohesive failures) or Secure materials (100% mixed failures). SEM views of denture base specimens before and after dichloromethane application showed some alteration to the surfaces.

Conclusion: The results of this study showed that there was a significant different in the shear bond strength values among denture base-reline material combinations ($p<0.05$) except for PMMA-Kooliner and UDMA-Meliodent RR denture base-reline combinations ($p>0.05$). There were statistically significant differences on the shear bond strength values because of the denture base polymer ($p<0.05$), reline materials ($p<0.05$) and their interaction ($p<0.05$). UDMA denture base polymer (Eclipse) showed the highest mean shear bond strength when relined using similar base material while PMMA denture base polymer (Meliodent) showed the highest mean shear bond strength when relined with auto-polymerized PMMA reline material (Meliodent RR).

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