Effect of Different Types of Silane Coupling Agents on the Shear Bond Strength between Lithium Disilicate Glass Ceramic and Resin Cement

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Abstract

This study aimed to evaluate the effect of different types of silane coupling agents on the shear bond strength between lithium disilicate glass ceramic and resin cement. Lithium disilicate disks (IPS e.max Press) were prepared and randomly assigned to six different groups (n=20) based on the type of silane used: control group (no treatment) and five silane-treated groups (Kerr silane primer, Monobond N, RelyX ceramic primer, experimental silane, and Single bond universal). Composite resin rods were luted to the prepared surfaces with resin cement. The samples were stored in distilled water (37°C, 24 hrs) before shear bond strength test was performed. Data were analyzed by one-way ANOVA and Tukey's HSD. RelyX ceramic primer and the experimental silane groups exhibited significantly higher shear bond strengths compared to other groups ($p<0.05$). The control group showed the lowest bond strength and was significantly different from other groups. It was found that the type of silane coupling agent used significantly influences the bond strength between lithium disilicate and resin cement. Application of any type of silane coupling agent significantly increased the bond strength when compared with the untreated group.

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Introduction

Metal ceramic restorations have been available for more than five decades because of its predictable performance and good esthetic outcome.[1] However, due to a rise in demand to improve esthetics and the trend towards reduction of metal usage and its biocompatibility,[2] all-ceramic restorations have become more popular.[3] The trend for all-ceramic restoration has shifted from layered ceramic to monolithic ceramic to enhance mechanical properties. Monolithic lithium disilicate glass ceramic is one of the most popular silica-based ceramics which provides a good esthetic appearance. Its material also offers superior resistance to chipping and flexural fracture compared with veneered counterparts.[4]

Apart from the properties of the restorative materials themselves, resin–ceramic bonding greatly influences the clinical outcome.[5] Reliable resin bonding increases retention, enhances marginal adaptability, minimizes microleakage, and improves fracture resistance. Several methods, including mechanical and chemical modification, have been proposed to achieve the optimal resin–ceramic bond strength. For silica-based ceramic restorations, a reliable bond between the resin and ceramic materials can be achieved by hydrofluoric acid etching (mechanical bonding) along with silane priming (chemical bonding).[3, 6]

Silane coupling agents, which are widely used in the field of dentistry, are known for their excellent performance and biocompatibility. Trialkoxysilanes, such as 3-methacryloyloxypropyl trimethoxysilane (MPS), is one of the commonly used silane coupling agents in dentistry.[6-8] Silane molecules can react with water molecules via hydrolysis to produce three silanol groups (-Si-OH) from the corresponding methoxy groups (-Si-O-CH_3). The silanol groups are capable of forming stable siloxane networks (-Si-O-Si-O-) on the glass-ceramic surface.[6, 8, 9]

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