



Effect of Exposure Time and Distance of The Light Curing Unit on The Modulus of Elasticity of Dual Cure Resin Cements

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Abstract

This research aims to study the modulus of elasticity of dual-cure resin cement with different exposure time and distance from the light-curing unit. The study divided sample groups into nine groups (A to I) from a total of 90 specimens (10 pieces per group). The specimens (stainless steel molds) of size $2 \times 12 \times 2 \text{ mm}^3$ were prepared, and ceramic disc size $6 \times 14 \times 2 \text{ mm}^3$ was placed over the specimens. Then, the specimens were cured for 20 s, 40 s, and 60 s from a distance of 0 mm, 5 mm, and 10 mm. After being stored in an incubator at 37°C for 24 hours, the specimens were three-point bending tested with a universal testing machine. The results are that Group G (D0, T60) showed the closest distance and the longest exposure time with the greatest the modulus of elasticity of 3067.85 N/mm^2 . On the other hand, Group C (D10, T20) showed the lowest modulus of elasticity of 2562.36 N/mm^2 . The results also demonstrated that a more prolonged light exposure led to a higher modulus of elasticity of resin cement with a statistical significance. However, the modulus of elasticity of resin cement is not statistically significantly different when there is an increase in distance between the light-curing unit and the specimens. This study concluded that an increase in the exposure time resulted in an increase in the modulus of elasticity of resin cement.

Keywords: Degree of conversion, Distance, Exposure time, Modulus of elasticity, Resin cement

1. Introduction

The longevity of the restoration is one of the essential criteria in choosing the material, and the restoration success is the demonstrated ability of restoration to perform as expected, whereas the length that as restoration survives is often used as a measure of clinical performance. To achieve these goals, many factors involved longevity of the restoration; such as patient's oral hygiene, oral habits, dentist's skill, and material factors (Fernandes et al., 2015). Failure of the restoration is mostly caused by improper biomechanics tooth preparation, improper cementation techniques, and improper luting cement. Thus, luting procedure is a critical step in providing the best longevity of the restoration (Ladha et al., 2010).

Resin luting cement is at the center of developing predictable adhesive dentistry. Properties of resin-based cement critical to the success of adhesive restorations include adequate bond strength, low solubility, biocompatibility, film thickness and polymerization shrinkage. Resin cement is classified according to a mode of activation (photo, chemical and dual-cure) and bonding mechanism (self-etch, self-adhesive and total-etch). Resin cement is set via polymerization reaction, which the characteristics and properties of resin-based cement depended on the degree of conversion of monomers to polymers. Inadequate degree of conversion compromises the mechanical properties of the cement affecting bond stability, strength, and therefore, clinical longevity. The resin-luting agent also should provide mechanical support to prevent fracture of ceramic restorations. Increasing the elastic modulus of the supporting core structure has been suggested as a means of increasing the fracture resistance of all-ceramic crowns (Scherrer et al., 2000).

With dual-cure polymerization mechanism of dual-cure resin cement which polymerization is affected by both chemical and light activation. The mechanical properties of a dual-cure resin cement via light cure polymerization are mainly influenced by the amount of energy delivered during irradiation (Dewaele et al., 2009). The relationship between total energy was light intensity and exposure time. When increasing the light intensity and exposure time, it resulted in an increment of total energy. The light intensity depended on the distance from the tip of the light-curing unit and its type and brand (Felix et al., 2003). The distance of the light-curing unit and exposure time are also essential factors to the degree of conversion of