

UNIVERSITI TEKNOLOGI MARA

**THE EFFECT OF FERRULE
HEIGHTS ON FRACTURE
RESISTANCE OF ANTERIOR
CAD/CAM ENDOCROWNS**

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ABSTRACT

Purpose: There is limited evidence regarding the effect of ferrule height on the fracture resistance and failure modes of anterior endocrowns. To address this gap, the present study aimed to evaluate how different ferrule heights influence the fracture resistance and failure modes of anterior endocrown restorations. **Materials and Methods:** Sixty extracted maxillary incisors were collected (n=60) and divided into five samples (n=12): endocrowns with 0mm ferrule height (Group Z), 1.00 mm ferrule height (Group O), 2.00 mm ferrule height (Group T), a conventional post and core followed by a lithium disilicate crown, positive control (Group P), and untreated tooth, negative control (Group N). The samples were subjected to root canal treatment followed by the placement of smart dentin replacement resin. Then the teeth were embedded in epoxy resin blocks. The preparation of the samples with different ferrule heights and the pulp chamber depth of 4.00 mm were prepared. Lithium disilicate restorations were fabricated using a CAD/CAM CEREC system and cemented with a dual-cure resin adhesive. All samples were subjected to static loading test applied at 45° angle. Fracture resistance was determined using a universal testing machine; median failure loads (N) and the failure modes were assessed by descriptive analysis and categorized under restorable and non-restorable groups. The data was recorded in SPSS and was analyzed using Kruskal-Wallis test, followed by a post hoc, Pairwise Analysis. The failure modes of the samples were analyzed statistically with Chi-Square test. The statistically significant difference was set at $p < 0.05$. **Results:** There is a statistically higher fracture resistance in Group Z (1701.82 N), followed by Group T (1387.06 N), Group O (1327.3 N), Group P (750.58 N) and the lowest was in Group N (402.97 N). Anterior endocrowns were associated with higher non-restorable failures in comparison to conventional crowns. **Conclusion:** Anterior endocrowns featuring a 0 mm ferrule preparations demonstrated the highest fracture resistance. However, majority of the samples exhibited an increased risk for non-restorable failures. Further recommendation is to conduct long-term clinical study to evaluate the success/survival rate of anterior endocrowns.

Keywords: Anterior endocrown; Endodontically treated tooth; Maxillary incisors; Lithium disilicate; Fracture resistance; Failure modes.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

For endodontically treated tooth, the primary goal of restoration is to create a hermetic and watertight seal between the oral environment and the root canal system (Rijal, 2017). It is widely accepted that the coronal seal, in addition to the apical seal, contributes significantly to the successful treatment of an endodontically treated tooth when it comes to preventing bacterial ingress. To achieve this goal, it is critical for the restoration to preserve as much of the tooth structure as possible while also contributing to the long-term survivability of the tooth (Wassell et al., 2002).

Generally, following root canal therapy, a post and core are constructed to retain a prosthesis such as a crown or bridge. Lithium disilicate, a ceramic material renowned for its exceptional optical properties and translucency, is commonly used in modern dentistry as a crown to restore damaged anterior teeth. Prefabricated posts are commonly indicated for round-shaped canals with adequate dentin wall thickness. In contrast, custom cast posts are indicated when extensive tooth structure has been lost, such as in wide or remarkably tapered canals. However, there is a risk of vertical root fracture, perforation, or even crack of the root during post-placement preparation. A post with high rigidity and a higher modulus of elasticity than dentin may exhibit an increased stress distribution throughout the post and root structures, promoting post-separation and root fracture (Kaur et al., 2012). To avoid these complications, different treatment modalities should be implemented.

Endocrown restoration is a monoblock restoration consisting of both core structures and crown restoration (Pissis, 1995). Endocrown is one of the options available which can help to restore severely damaged tooth (El-Damanhoury et al., 2015). With the emerging adhesive restoration, only minor tooth preparation is required. However, the ferrule preparations should ensure that there is adequate retention, stability, and structural durability for the restoration. The application of an endocrown is more advantageous for molars due to the larger surface area available for adhesive bonding (Bindl et al., 2005). Nevertheless, a limited number of studies have documented the use of anterior or incisor endocrowns. The success of the approach