

Republic of Iraq
Ministry of Higher Education
and Scientific Research
University of Baghdad/ College of Dentistry
Department of Conservative and Esthetic
Dentistry



**Fracture resistance and failure mode of
endodontically treated maxillary molars restored
with direct composite, glass fiber post, full crown,
and endocrown
(A comparative *in vitro* study)**

A Thesis Submitted to The Council of the College of Dentistry at the University of
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By

Mohammed Ayad Taha

B.D.S

Supervised by

Assist. Professor

Dr. Abdulla M.W. Al-Shamma

B.D.S., M.Sc., Ph.D. (Conservative Dentistry)

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Abstract

Objectives: The purpose of this *in vitro* study was to evaluate and compare the fracture resistance and mode of fracture of maxillary molar teeth restored with different types of coronal restorations.

Materials and method: Freshly extracted forty caries-free maxillary first molar teeth of comparable size were collected and selected to be used in this study. Translucent silicon index for each tooth crown were fabricated before preparation of the teeth to transfer the same shape and anatomy of the tooth to the final restoration.

Each tooth received an endodontic treatment by using crown down technique using protaper universal system. After that, each tooth received tooth reduction to simulate grossly damaged tooth, standardized tooth preparation was performed according to the following preparation criteria: horizontal sectioning of occlusal part 2 mm above cemento-enamel junction; intra-coronal height measured from internal cavity margin to the pulp chamber floor was reduced to 2 mm; removal of undercut areas and the axial walls alignment with internal walls taper of 8-10 degrees; butt margins with smooth transitions internally; and finally, sealed canal orifices with flowable composite with a flat pulp chamber floor, except the palatal canals orifices for group A and C in order to allow post placement.

Teeth were divided into five groups (8 teeth each) according to the coronal restoration as follows:

Group A: Fiber post with direct bulkfill composite restoration.

Group B: Direct composite restoration.

Group C: As group A but with lithium disilicate crown.

Group D: As group B but with lithium disilicate crown.

Group E: Lithium disilicate Endocrown.

Bulk fill composite (3M™ ESPE™ Filtek™ Bulk Fill) was used for direct buildup (Group A, B, C, and D), and fiber post (RelyX™ Fiber Post) was used in post retained composite groups (Group A and C). A three dimensional digital impression for indirect restorations was taken by Zircon Zahn arti scanner s600. The milling process has been done by using a 5+1 axis milling unit (Zirconzahn M5 speed milling machine), then the crystallization and glazing were done. Indirect restorations were cemented with Dual cured self-adhesive resin cement (RelyX U200 3M ESPE). All samples were tested with computer controlled Universal testing machine using single load to failure and mode of fracture was recorded.

Results: This study revealed that the greatest fracture resistance ($p < 0.05$) was for Group E (endocrown restored teeth) (2676.50N+_574.86), followed by the crowned groups ($p < 0.05$) (group C 1711.62N+_326.37) and (group D 1670.75N+_401.18). The lowest means were registered for the direct groups ($p < 0.05$), group A (867N+_126.74) and group B (697.12N+_124.68). LSD test revealed that there is a statistically significant difference among the groups at $p < 0.05$ confident level, except between groups A and B, and between groups C and D. All samples in all groups showed catastrophic mode of failure (code V).

Conclusions: Using monolithic endocrown restoration was superior to the traditional crown restoration in regard to strengthening weakened endodontically treated teeth. Nevertheless, crowning such teeth still having the benefit of improving their fracture resistance when compared to direct restoration.



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مقاومة الكسر لأضراس الأسنان المعالجة لبياً و التالفة بشكل كبير والمعالجة
باستخدام تركيبات Endocrown المصنعة من مادة سيليكات الليثيوم بمساعدة
الحاسوب (دراسة مقارنة في المختبر)

رسالة مقدمة الى مجلس كلية طب الاسنان/جامعة بغداد
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من قبل

محمد اياد طه

بكالوريوس في طب وجراحة الفم والاسنان

بإشراف

أ. م. د. عبدالله محمد وجيه الشماع

بكالوريوس طب وجراحة الفم والأسنان

ماجستير معالجة الأسنان

دكتوراه معالجة الأسنان