Fracture Resistance of Endodontically Treated Teeth Restored with Direct and Indirect Biomimetic Techniques: An In-Vitro Study

Basma Fayad
The British University in Egypt, Al Shorouk City, Cairo, Egypt

Hala Fayek Khalil
The British University in Egypt, Al Shorouk City, Cairo, Egypt

Fatma Makkeyah
The British University in Egypt, Al Shorouk City, Cairo, Egypt

Islam Mohamed Heiba
The British University in Egypt, Al Shorouk City, Cairo, Egypt

Abstract

Introduction: Conventional full-coverage restorations for endodontically treated teeth often necessitate excessive tooth reduction, particularly in structurally intact cases.

Aim: This in vitro study compared fracture resistance and failure modes of endodontically treated molars restored with biomimetic approaches using bioceramic sealers: direct short fiber-reinforced composite (SFRC) versus indirect 3D-printed hybrid composite endocrowns.

Materials and Methods: Thirty-six intact human mandibular second molars were equally divided into three groups (n=12): Group A received a standardized endodontic treatment then restored with direct SFRC restoration (everX Posterior), Group B received a standardized endodontic treatment then restored with indirect endocrowns (Permanent Crown Resin) cemented with self-adhesive resin cement (RelyX Unicem), and Group C served as intact controls without endodontic treatment. specimens underwent thermal cycling (20,000 cycles, 5-55°C) before fracture testing in a universal testing machine. Failure modes were categorized as restorable, possibly restorable, or non-restorable.

Results: Statistical analysis employed ANOVA with Tukey HSD post-hoc tests for load values and chi-square for failure modes (α=0.05). Results demonstrated significantly higher fracture resistance in Group B (2180.33±142.15N) compared to Group A (1941.63±135.62N) and Group C (1254.00±98.34N) ($p<0.001$). However, Group A exhibited significantly more restorable fractures (48.7%) versus Groups B (10%) and C (16.1%) ($p<0.01$). While 3D-printed endocrowns showed superior load-bearing capacity, direct SFRC restorations demonstrated more favorable failure modes

Conclusion: Material selection should consider both fracture resistance and reparability potential when employing biomimetic approaches for endodontically treated molars.