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Comparison of fracture resistance among restorative techniques for endodontically treated mandibular premolars: an in vitro study

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Abstract

Endodontically treated teeth often have compromised tooth structure, which increases their susceptibility to fracture. This in vitro study compared the fracture resistance of endodontically treated mandibular premolars restored using the sandwich technique, Nayyar core composite, and semi-direct composite onlay. Seventy-six extracted mandibular premolars were randomly allocated into four groups (n = 19): intact teeth (control), conventional sandwich technique, Nayyar core composite, and semi-direct composite onlay. All groups except the control teeth group underwent standardized root canal treatment and obturation, followed by composite restoration according to the group allocation. Specimens were loaded axially in a universal testing machine until fracture. Fracture resistance was recorded in kilonewtons (kN). Data were analyzed using one-way ANOVA and Dunnett T3 post-hoc tests ($p < 0.05$). Mean fracture resistance was highest in the intact control

group (8.70 ± 4.09 kN), followed by the sandwich technique (7.50 ± 1.55 kN), Nayyar core composite (6.10 ± 1.61 kN), and semi-direct composite onlay (4.94 ± 3.16 kN). The overall difference among the groups was statistically significant ($p = 0.001$). Post-hoc analysis showed significant differences between the control and semi-direct onlay groups ($p = 0.019$) and between the sandwich technique and semi-direct onlay groups ($p = 0.022$). Within the limitations of this in vitro study, the sandwich technique demonstrated the highest fracture resistance when compared with Nayyar core composite restoration and semi-direct composite onlay in endodontically treated mandibular premolars with conservative access preparation and intact marginal ridges. © The Author(s) 2026.

Author keywords

Endodontically treated teeth; Fracture resistance; Nayyar core composite; Sandwich technique; Semi-direct composite onlay

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