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Fracture Resistance of Endodontically Teeth Restored with Functionally Graded Posts

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Abstract

Objectives: To evaluate the fracture resistance and failure mode of endodontically teeth restored with functionally graded structured (FGS) posts compared to titanium and cast posts.

Methods: Single canals in 70 bovine incisors were instrumented, irrigated, obturated and divided into seven groups. They were then root restored with titanium, cast and 3 experimental FGS posts of different compositions; ZrO2-Ti-HA, Al2O3-Ti-HA and Ti-HA. Two control groups were also included; sound teeth and those root treated only. All posts were cemented with zinc phosphate cement and built up with composite core. Crowns margins of 1 mm chamfer finishing line were prepared to receive full metal crowns. The fracture resistance was evaluated using Universal Testing Machine. The failure mode was also evaluated as restorable or non-restorable. Data for fracture resistance were analyzed using one-way ANOVA and post-hoc test.

Results: There is no significant difference in mean fracture resistance between cast (1398.58N±314.29), titanium (1408.65N±226.39) and FGS posts (ZrO2-HA-Ti; 1299.31N ±251.74, Al2O3-HA-Ti; 1242.53N±196.55 and Ti-HA-Ti; 1267.68N±173.00). However, cast, titanium and FGS posts groups showed significantly higher fracture resistance compared to those root treated only (1051.40N±207.78) and sound teeth (922.48N±261.59). For failure mode, FGS posts and root treated only showed high percentage of restorable cases compared to titanium, cast posts and sound teeth.

Conclusions: There was no significant difference in mean fracture resistances among FGS, titanium and cast posts. Teeth restored using titanium and cast posts resulted in higher number of irreparable fracture whilst the FGS posts and root treated only had higher number of reparable fractures.
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