

In Vitro Fracture of Fiber Reinforced Cusp-replacing Composite Restorations

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Background

Application of glass fibers into cusp-replacing resin composite restorations may increase the load-bearing capacity of restored teeth. Furthermore, fiber reinforced composite (FRC) may prevent fracture of the tooth in case of failure of the restoration.

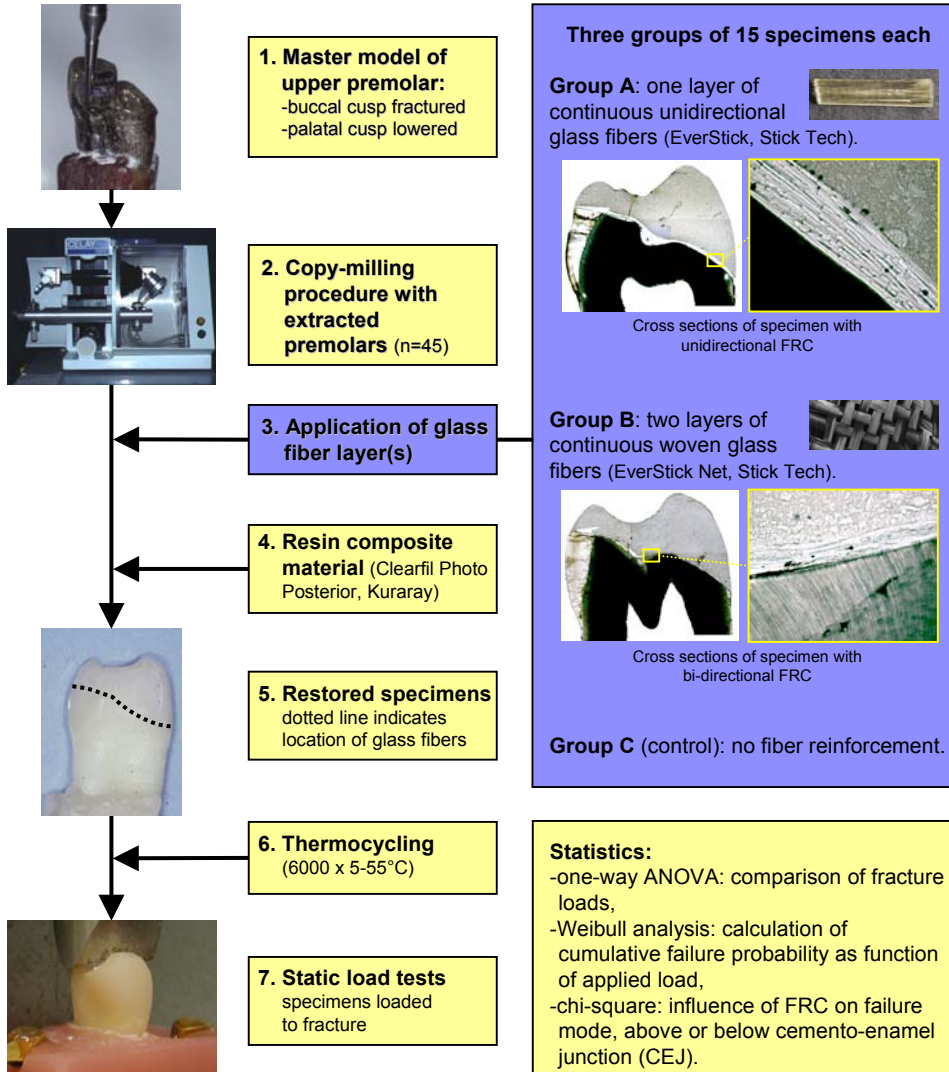


Premolar with mesio-distal restoration and tooth fracture ending below the CEJ (Fennis *et al*, IADR 2003)


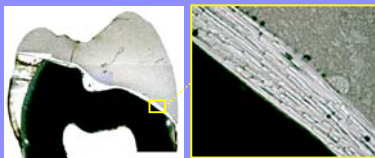
Aim


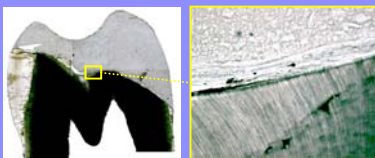
To assess the effect of uni- and bi-directional fiber reinforcement on the load-bearing capacity and failure mode of cusp-replacing resin composite restorations.

Materials & Methods



Three groups of 15 specimens each

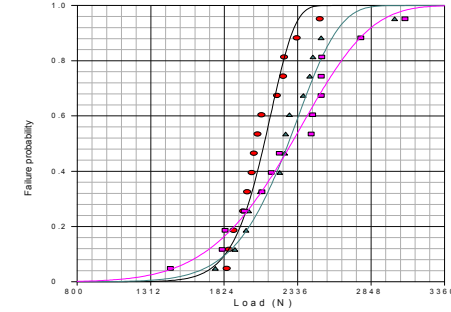
Group A: one layer of continuous unidirectional glass fibers (EverStick, Stick Tech).


 Cross sections of specimen with unidirectional FRC

Group B: two layers of continuous woven glass fibers (EverStick Net, Stick Tech).


 Cross sections of specimen with bi-directional FRC

Group C (control): no fiber reinforcement.

Statistics:
 -one-way ANOVA: comparison of fracture loads,
 -Weibull analysis: calculation of cumulative failure probability as function of applied load,
 -chi-square: influence of FRC on failure mode, above or below cemento-enamel junction (CEJ).

Results



Group	A	B	C
Fracture load (N)	2267 ± 410	2246 ± 300	2085 ± 183
Weibull modulus <i>m</i>	5.9	8.9	13.6
Characteristic strength <i>S</i> ₀ (N)	2438	2365	2160
Correlation coefficient <i>r</i>	0.987	0.955	0.942

Fracture loads were not significantly different (ANOVA, P>0.05).

Group	Fractures above CEJ	Fractures below CEJ
A	77%	23%
B	62%	38%
C	7%	93%

Specimens without FRC showed a higher proportion of fractures below the CEJ (chi-square, P<0.001).

Conclusions

1. FRC does not increase the static load-bearing capacity of premolars with cusp-replacing resin composite restorations.
2. FRC has a beneficial effect on the failure mode and thereby on the re-restorability in case of fracture.
3. The Weibull modulus indicates that bi-directional FRC provides more consistent results than unidirectional FRC.