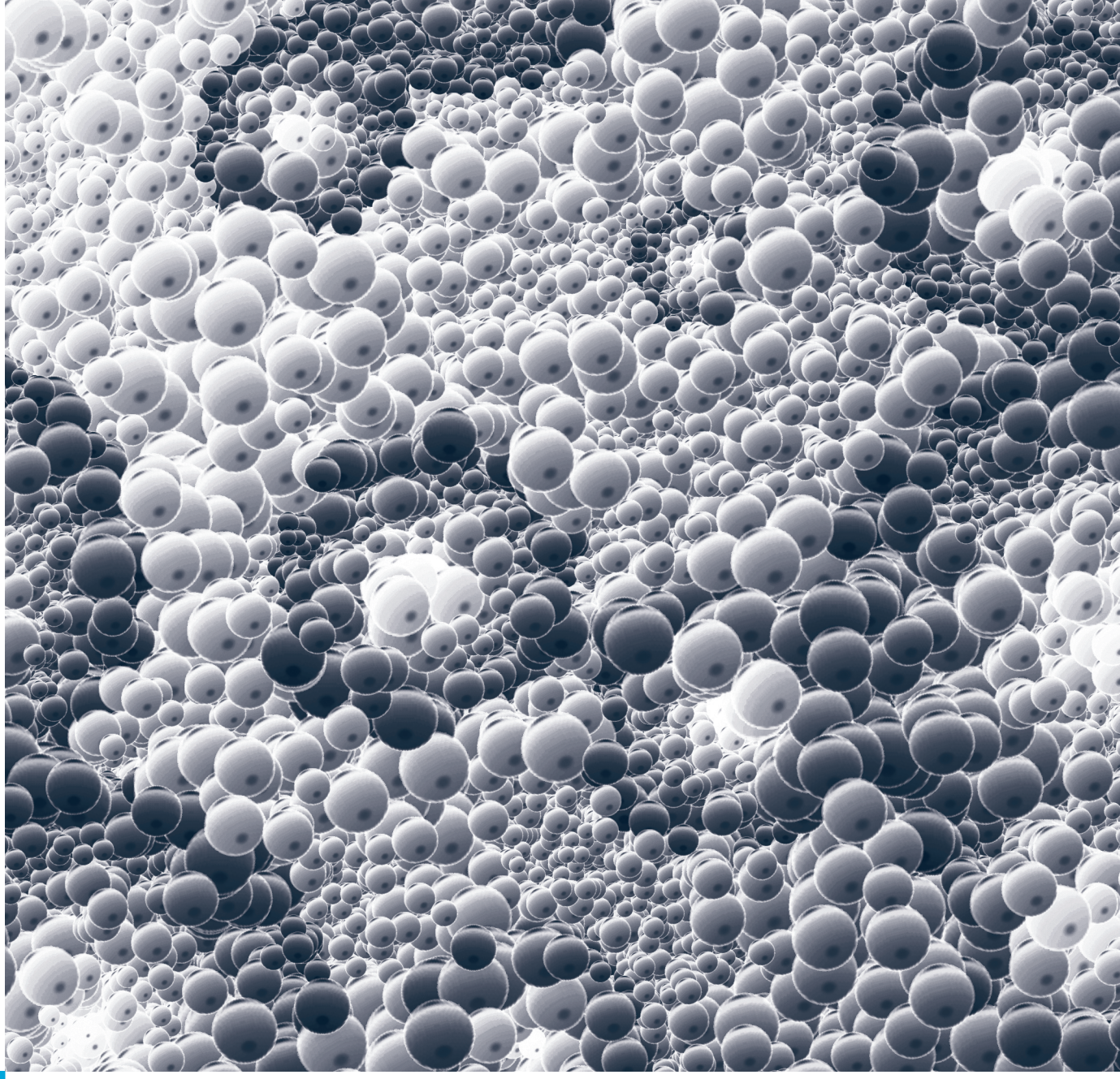

RESEARCH FINDINGS

DeltaFil

DMG

DeltaFil

Adhesion: Shear bond strength test on enamel, dentine and root dentine[1]

The shear bond strength of DeltaFil was evaluated in the context of conditioner pretreatment of different hard tissues. Glass ionomer cements were applied to exposed human buccal enamel or surface dentine with a diameter of ≥5mm, cured and then stored in distilled water at 37°C for one day. The shear bond strength was measured with a crosshead speed of 0.5 mm/min. Data was analysed to determine statistically significant differences using ANOVA and multiple comparison analysis.

Results

- Good adhesion of DeltaFil to enamel and dentine, comparable to Fuji IX GP and Ketac Universal
- Shear bond strength of DeltaFil on enamel and dentine not dependent on conditioner
- Significantly increased adhesion of DeltaFil through pretreatment of root dentine with conditioner

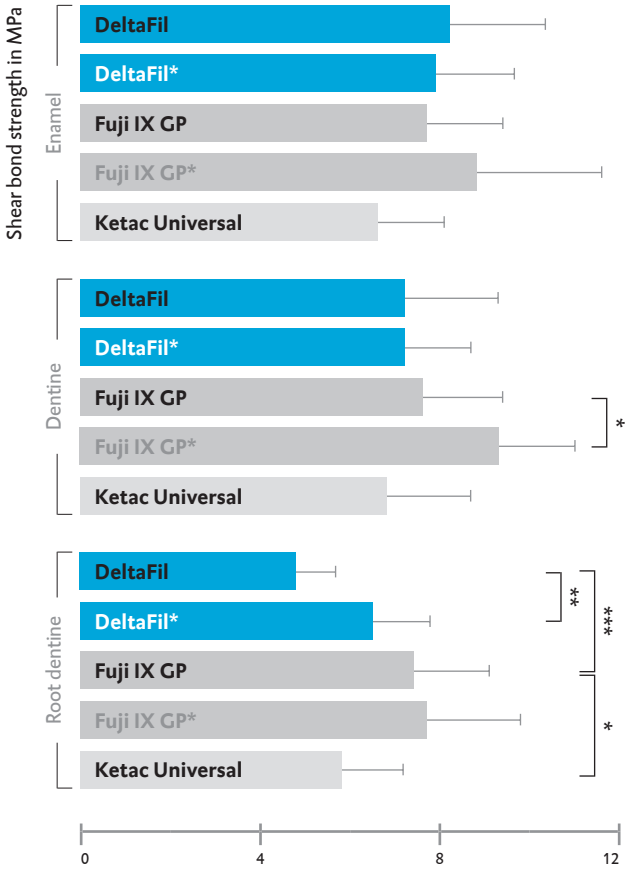

Figure 1: Mean shear bond strength (± SD) of glass ionomer cements on enamel (top), dentine (middle) and root dentine (bottom), with and without conditioner; n = 10 / group. Values marked * were obtained when conditioner was applied.

Adhesion: Shear bond strength test on dentine[2]

After appropriate pretreatment with a conditioner, the glass ionomer cements were applied to exposed dentine with a flat surface of ≥ 7 mm² in cylindrical form, cured and then stored in water for 24 hours at 37°C. The shear bond strength was measured at a crosshead speed of 0.5 mm/min. Data was analysed to determine statistically significant differences using ANOVA and multiple comparison analysis.

Results

- DeltaFil has a significantly higher shear bond strength compared to EQUIA Forte HT, Ketac Universal and Riva SC HV.

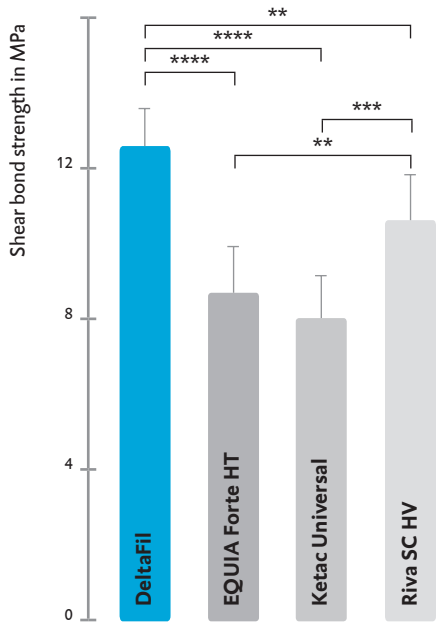

Figure 2: Mean shear bond strength (± SD) of glass ionomer cements on dentine: n = 10 / group.

Flexural strength: 3-point bend test[1,2]

The test specimens were stored in distilled water at 37°C for one day and then subjected to a 3-point bend test with a loading rate of 0.5 mm/min (figure 3)[1] and 1 mm/min (figure 4)[2] respectively. Data was analysed to determine significant differences using ANOVA and multiple comparison analysis.

Results

- DeltaFil shows significantly higher flexural strength than Fuji IX GP and Ketac Universal[1].
- DeltaFil shows significantly higher flexural strength compared to EQUIA Forte HT, Ketac Universal and Riva SC HV[2].

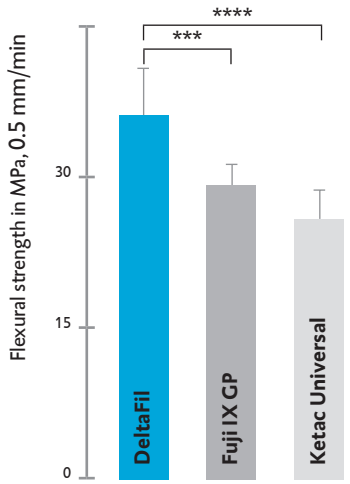

Figure 3: Mean flexural strength (± SD) of glass ionomer cements; n = 10 / group

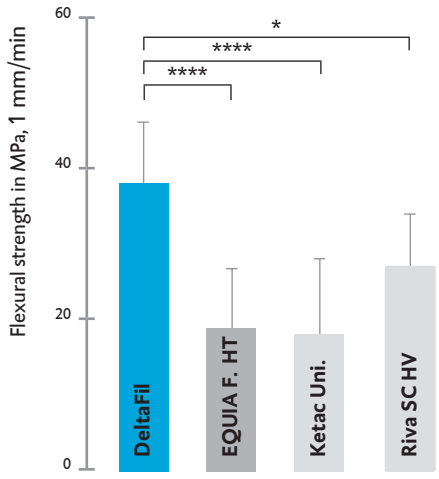

Figure 4: Mean flexural strength (± SD) of glass ionomer cements; n = 10 / group.

Chewing simulation: Wear test[3]

Class I cavitations (2 x 2 x 2 mm³) were prepared in human teeth and restored using glass ionomer cements. The test specimens were subjected to a combined vertical and lateral cyclic load of 50 N and 1.4 Hz, and to thermal stress (5°C / 55°C, 60 seconds each). The termination criterion was defined as failure of the test specimen or a maximum cycle count of 1,200,000 cycles. In addition to determining the number of cycles achieved, the abrasion volume was calculated using microCT imaging. Data was analysed to determine statistically significant differences by means of the Kruskal-Wallis test and multiple comparison analysis.

Results

- All specimens restored with DeltaFil reached the maximum cycle count of 1,200,000 cycles.
- DeltaFil shows a significantly lower abrasion volume than Ketac Universal and Fuji IX GP.

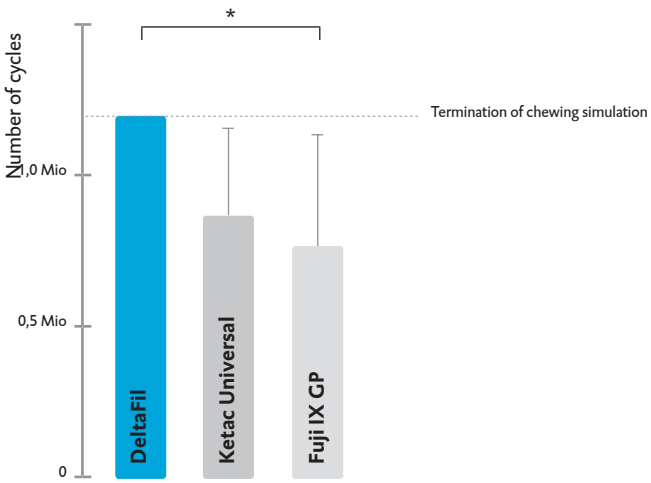

Figure 5: Mean number of cycles achieved (± SD) of glass ionomer cements; n = 8 / group.

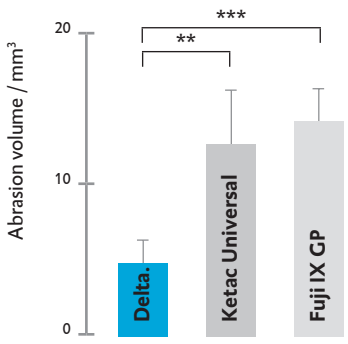

Figure 6: Mean abrasion volume (± SD) of glass ionomer cements; n = 8 / group.

Fracture toughness: Notchless Triangular Prism (NTP) Test (Ilie et al., 2020)[4]

Unnotched glass ionomer cement (NTP) test specimens were stored in distilled water at 37°C for 23 hours, then placed in a universal testing machine with a crosshead speed of 0.1 mm/min until fracture or cracking occurred. Data was analysed to determine statistically significant differences using ANOVA and multiple comparison analysis.

Results

- DeltaFil shows significantly higher fracture toughness than Fuji IX GP
- Failure during fixture in the test apparatus was observed in test specimens with Fuji IX GP, Ketac Universal and ChemFil Rock. These test specimens were not included in the statistical analysis.

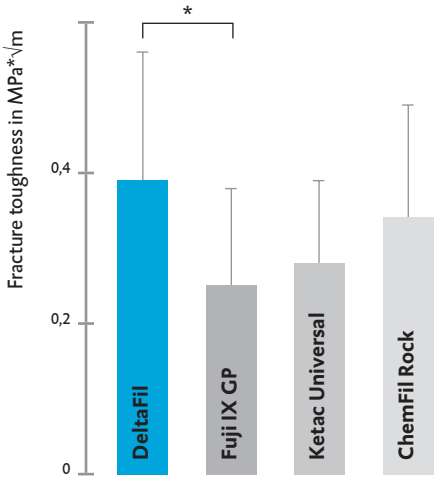

Figure 7:
Mean fracture toughness (± SD) of glass ionomer cements; n = 20 / group

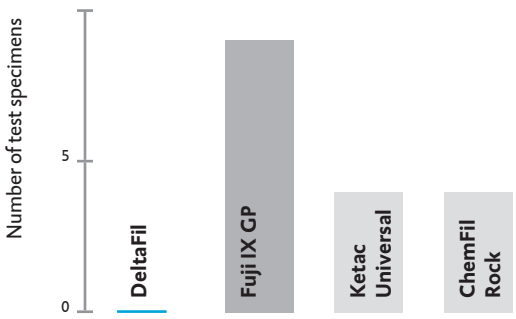

Figure 8:
Failure of test specimens when fixed in the test apparatus.

Fracture toughness: NTP test (SDM, 2020)[3]

Unnotched glass ionomer cement test specimens were stored at 37°C in distilled water. Prior to storage in water, the Fuji IX GP specimens were varnished with Fuji Varnish according to manufacturer specifications. After 24 hours, all test specimens underwent loading in a universal testing machine until fracture occurred (crosshead speed 1.0 mm/min). Data was analysed to determine statistically significant differences by means of Student t-test.

Results

- DeltaFil shows significantly higher fracture toughness, even without varnish, compared to Fuji IX GP with Fuji Varnish.

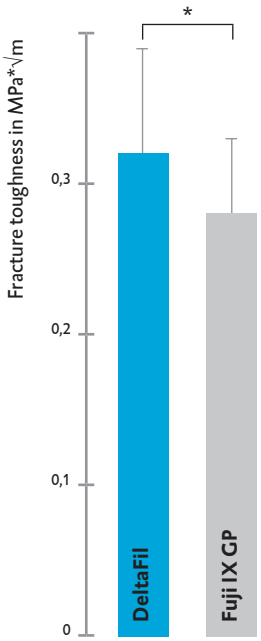

Figure 9:
Mean fracture toughness (± SD) of DeltaFil and Fuji IX GP; n > 15 / group

Materials tested and their manufacturers:

DeltaFil | DMG
Fuji IX GP | GC
Ketac Universal | 3M ESPE
ChemFil Rock | Dentsply
EQUIA Forte HT | GC
Riva SC HV | SDI

Source, data not published:

[1] Irie et al., Okayama University, August 2020
[2] Attal et al., University of Paris, July 2021
[3] SD Mechatronik Material Testing, Feldkirchen-Westerham, April 2021
[4] Ilie et al., LMU Klinikum, University of Munich, March 2020

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