



Maxcem Elite™

Bond Strength

Immediate and Delayed Bond Strength of Different Self-Adhesive Cements to Different Substrates

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Purpose

The purpose of this study is to evaluate the initial bond strength of a newly developed resin cement (Maxcem Elite) to different substrates and comparing the results to other commercially available self-adhesive cements. Phase 1 of the study will evaluate the bond strength of Maxcem Elite to dentin and enamel at 15 minutes and 24 hours.

Equipment/Materials

The experimental resin cement was supplied by the manufacturer and the other resins were purchased in the open market.

Cements Tested

1. Maxcem Elite
2. Maxcem
3. RelyX Unicem Clicker
4. G-Cem
5. FujiCem Automix

Study Methods

Teeth Selection and Mounting

The dentin or enamel substrate to bond the specimens was obtained from freshly extracted, caries-free, unrestored human molars. Teeth were stored at 4° C in 100% humidity containing 0.1% chloramine T. Twelve teeth were used per group.

The teeth were sectioned using a water-cooled diamond grit cutting disc. For enamel testing, teeth were sectioned mesio-distally. For dentin testing, teeth were sectioned buccal-lingually. These sectioned molars were mounted in a chemically polymerized methacrylate with the outer surface exposed. The exposed molar surface was coarse ground flat, on a model trimmer, until an adequate dentin or enamel surface was revealed. This surface was finished with 400 grit silicon carbide wet/dry

sanding paper. The prepared specimens were stored in deionized water until ready to be bonded. Prior to bonding the specimens, the surface was slightly refinished with 600 grit silicon carbide paper to expose fresh enamel or dentin. Sixty enamel specimens and 144 dentin specimens were prepared.

Test Groups

(Phase 1) Groups A to E. All groups were bonded directly to the cement to be tested. In other words, the cement was served as the rod.

A. Enamel 24 Hours (self-cure)

- a. Maxcem Elite
- b. Maxcem
- c. Unicem
- d. G-Cem
- e. FujiCem

B. Dentin 24 Hours (self-cure)

- a. Maxcem Elite
- b. Maxcem
- c. Unicem
- d. G-Cem
- e. FujiCem

C. Dentin 15 Minutes (self-cure)

- a. Maxcem Elite
- b. Maxcem
- c. Unicem
- d. G-Cem
- e. FujiCem

D. Dentin 15 Minutes (light-cure)

- a. Maxcem Elite

E. Dentin 24 Hours (light-cure)

- a. Maxcem Elite

Testing

Excess cement was removed and the bonded specimens were placed in a 37° C incubator. Groups A, B and E were left in the incubator for 24 hours. Groups C and D were tested after 15 minutes.

Shear bond strength was measured using a Dillon Quantrol testing machine at a test speed of 1mm/min. A notched cross head designed to match the diameter of the bonded specimen was used to apply the testing load.

The specimens were placed in a test base clamp, which is free to move to facilitate positioning under the load. The test position was then positioned so that the notched crosshead is placed against the dentin/enamel surface and the notch is fitted on the diameter of the bonded composite specimen.

The load required to debond the specimens was recorded and the mean bond strength of the ten specimens was calculated by dividing the load by the surface area of the bonded specimen and expressed in MPa's.

Data Entry, Tabulation and Analysis

The calculated parameters were analyzed by using one-way analysis of variance (ANOVA) to evaluate if there is any difference between tested materials. If differences were found, a Newman Keul's test was used to identify the differences.

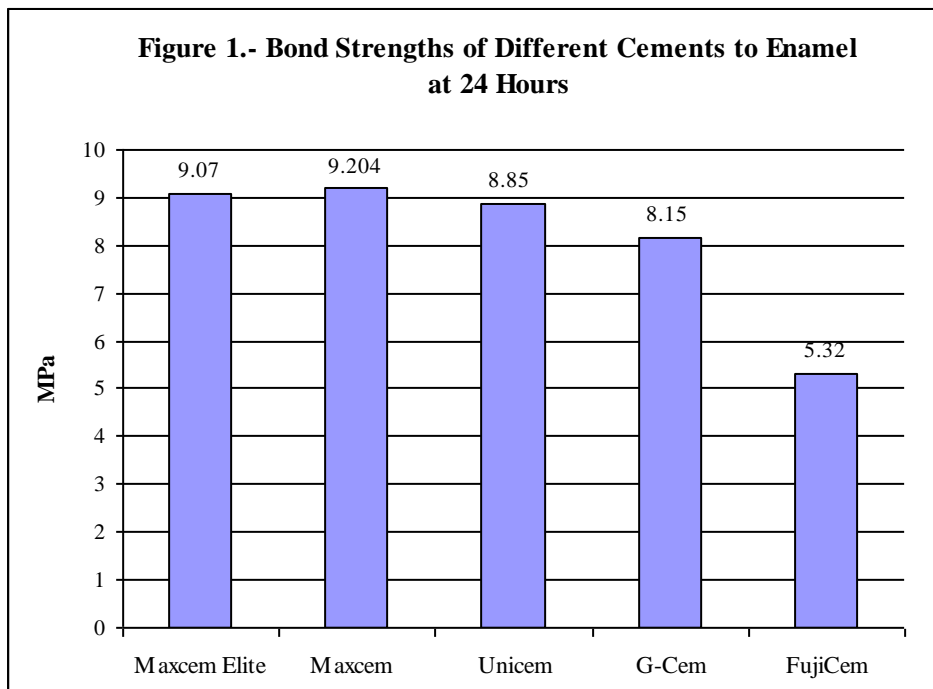
Results

Results are found in Table 1 and Figures 1-3.

Table 1.- Bond Strengths of Enamel and Dentin to Different Cemen			
Mean (SD). MPa			
	Enamel (24 Hrs)	Dentin (24 Hrs)	Dentin (15 Min)
Maxcem Elite (LC)		21.30 (5.75)c	10.11 (4.13) c
Maxcem Elite	9.07 (1.59)a	16.44 (4.94)a	6.37 (4.94)b
Maxcem	9.204 (3.22)a	8.62 (3.38)b	4.84 (2.10)a
Unicem	8.85 (0.85)a	7.34 (3.34)b	2.30 (1.53)a
G-cem	8.15 (3.18)a	16.37 (5.28)a	3.62 (0.38)a
FujiCem	5.32 (2.28)b	3.18 (3.77)b	3.41 (1.29)a

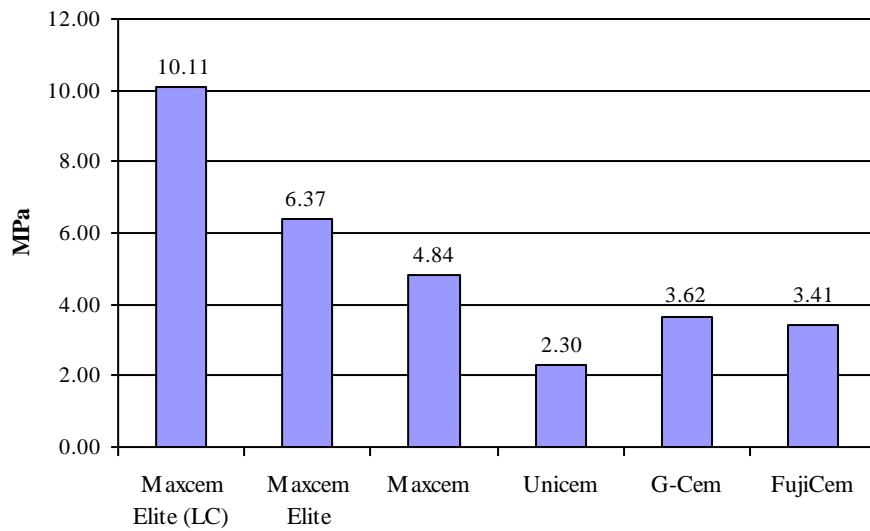
Groups identified by the same letter are not statistically different.

When Maxcem and Maxcem Elite were bonded to enamel and tested at 24 hours, both had the highest bond strength but were not statistically different to each other. ($p > 0.05$). Unicem and G-Cem were also not statistically different to each other or to Maxcem Elite. FujiCem had the lowest values and was statistically different to all the other groups. ($p = 0.002$).



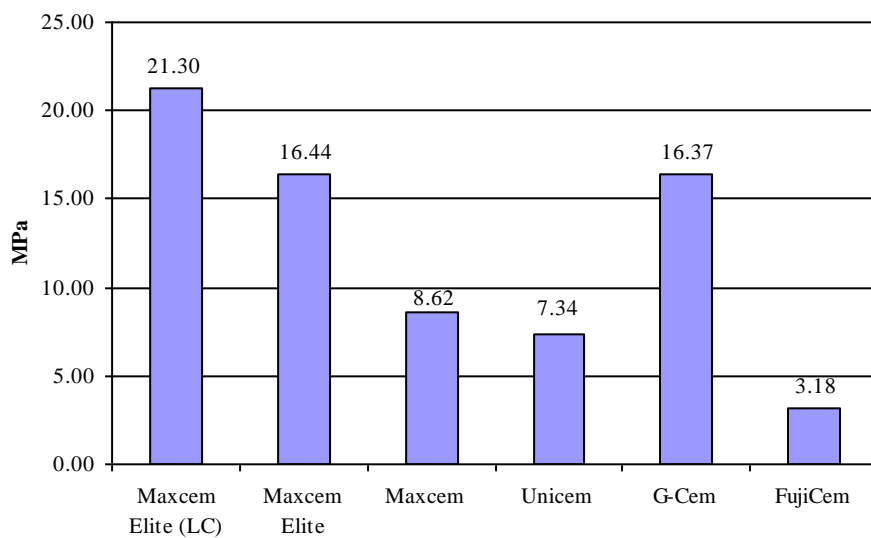
When the cements were tested to dentin at 15 minutes, Maxcem Elite light-cured (LC) had the highest bond strength and was statistically different to all other groups ($p < 0.001$). When Maxcem Elite was left to polymerize in self-cure mode, it had the second highest bond strength and was statistically different to all other groups ($p < 0.001$). Maxcem, G-Cem, FujiCem and Unicem were not statistically different to each other ($P > 0.05$). Mean and standard deviation values for each tested group are summarized in Table 1 and Figure 2.

Figure 2.- Bond Strength of Different Cements to Dentin at 15 Minutes



When the cements were tested to dentin at 24 hours, Maxcem Elite light-cured (LC) had the highest bond strength of all cements 21.30 (5.74) MPa and was statistically different to all the other groups ($p > 0.001$). Maxcem Elite self-cure had the second highest bond strength but was not statistically different to G-cem ($p > 0.973$). Fuji-Cem had the lowest values when compared to the other groups. Mean and standard deviation values for each tested group are summarized in Table 1 and Figure 3.

Figure 3.- Bond Strength of Different Cements to Dentin at 24 Hours



Optical microscope analysis indicated that all failures were adhesive in nature.

Discussion

Maxcem Elite self-adhesive cement in self-cure or light-cure mode to dentin and enamel provides clinically acceptable results when compared to other cements.