

New paste-paste light-cured glass ionomer cement:

FujiFil LC/FujiFil LC Flow fluoride diffusion into tooth structure and dentin adhesion performance

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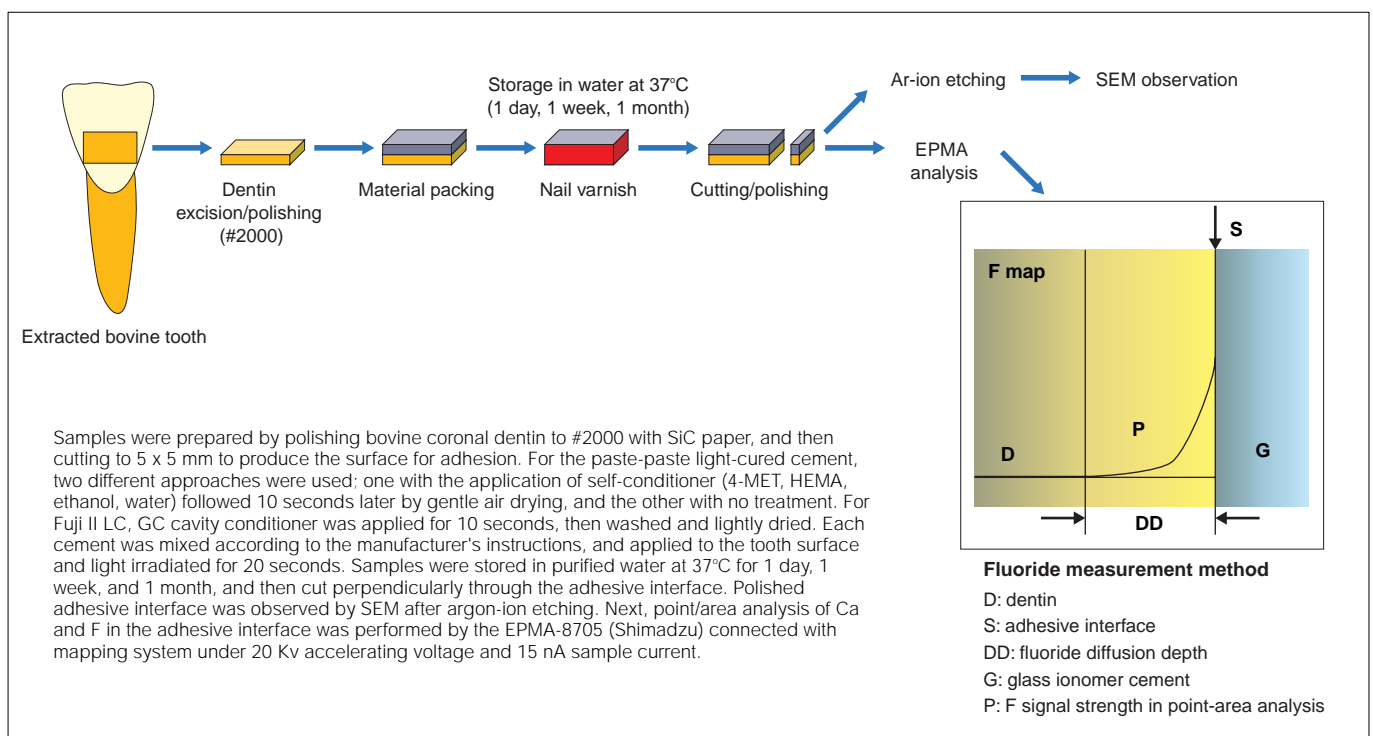
GC FujiFil LC and FujiFil LC Flow are paste-paste light-cured glass ionomer cements. Advantages include mixing and handling characteristics substantially improved over previous powder-liquid type cements, and by using a special dispenser to place the paste from its cartridge, they enable reliable setting results to be obtained. Furthermore, both cements have substantially better transparency than previous cements. FujiFil LC, has a similar viscosity to previous glass ionomer products and is suitable for

cervical area filling where there is a high caries risk. In contrast, the flowable material FujiFil LC Flow, has excellent wetting performance and fluidity, and can be injected or puddled into cavities utilizing fine-tipped instruments such as GC filling instrument No.00, making it ideal for an MI (minimal intervention) approach to filling small cavities, minimizing the preparation and cutting of the tooth structure. This material is also expected to provide an excellent seal of the root surface associated with hypersensitivity.

FujiFil LC/FujiFil LC Flow dentin-adhesive interface and fluoride diffusion into dentin

The dentin-adhesive interface and fluoride diffusion performance into dentin with the new paste-paste light-cured glass ionomer cements FujiFil LC and FujiFil LC Flow were evaluated by the method shown in Figure 1. Fuji II LC, powder-liquid light-cured glass ionomer cement, was used as a control.

Figure 1. Evaluation of dentin-adhesive interface and fluoride diffusion performance



1. Dentin-adhesive interface

Figure 2 shows SEM images of the dentin-adhesive interface for the different glass ionomer cements. Fuji II LC, samples after treatment with GC cavity conditioner for 10 seconds and washing with water, gave a hybrid layer-like structure of approximately 1 μm that was clearly observed at the adhesive interface.

In contrast, the FujiFil LC and FujiFil LC Flow, samples treated with self-conditioner for 10 seconds and polymerized, did not create such a clear structure, but still achieved good adhesion. It was confirmed that the good adhesion was still maintained after 1 month of storage in water. The adhesion mechanism of these cements is primarily the traditional chemical adhesion of the glass ionomer cement, but it is surmised that resin components such as hydroxyethylmethacrylate (HEMA) infiltrate the dentin slightly decalcified by the 4-MET, which has a mild self-etching action, producing an extremely

thin hybrid layer-like structure that results in a more reliable dentin adhesion. Furthermore, it is estimated that 4-MET, which is capable of copolymerization with HEMA, acts effectively to enhance adhesion by reacting with Ca in dentin.

2. Amount of fluoride release and diffusion performance into dentin

Fluoride release of glass ionomer cements is one of the most important characteristic for this material as a bioactive caries treatment material. In particular, the evaluation of fluoride diffusion and fluoride take-up into dentin that can enhance acid-resistance of adjacent dentin are important indices for fluoride releasing materials, along with promotion of remineralization and inhibition of demineralization by sustained-release of fluoride ions.

The depth of fluoride diffusion into dentin after storage at 37°C in purified water for 1 day, 1 week, and 1 month is

shown in Table 1, and Figure 3 shows representative F mapping images for the 3 materials after storage for 1 week. FujiFil LC, gave the greatest amount of fluoride release among all the sample materials, whilst FujiFil LC Flow and Fuji II LC has equal amount of fluoride release as shown in Figure 4 (GC data). Fluoride diffusion into the dentin increased over time for all the materials. After 1 month storage in water all 3 materials demonstrated a similar level of fluoride diffusion depth. Furthermore, it was demonstrated that tooth surface treatment using self-conditioner did not interfere with the diffusion of fluoride into dentin (Table 1). These results show that FujiFil LC and FujiFil LC Flow, the two new paste-paste light-cured glass ionomer cement restorative materials with vastly better handling characteristics than previous products, provide excellent fluoride release, diffusion into dentin and good adhesion to dentin.

Figure 2. SEM image of dentin-adhesive interface (x 5000)

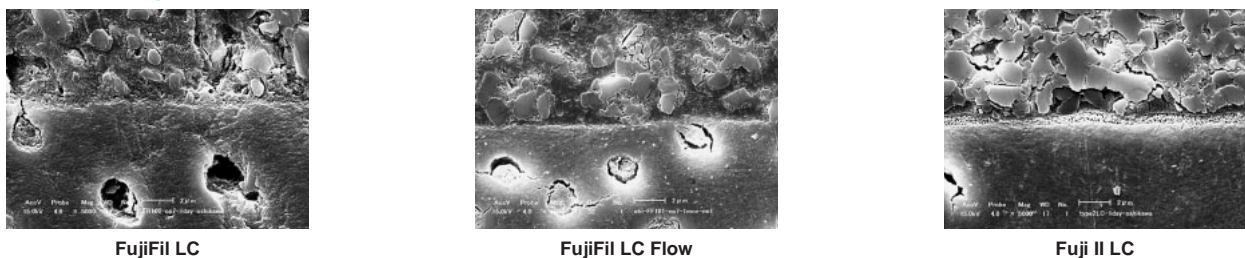


Figure 3. Fluoride mapping image Infiltration of fluoride ions into dentin after storage in purified water for 1 week.

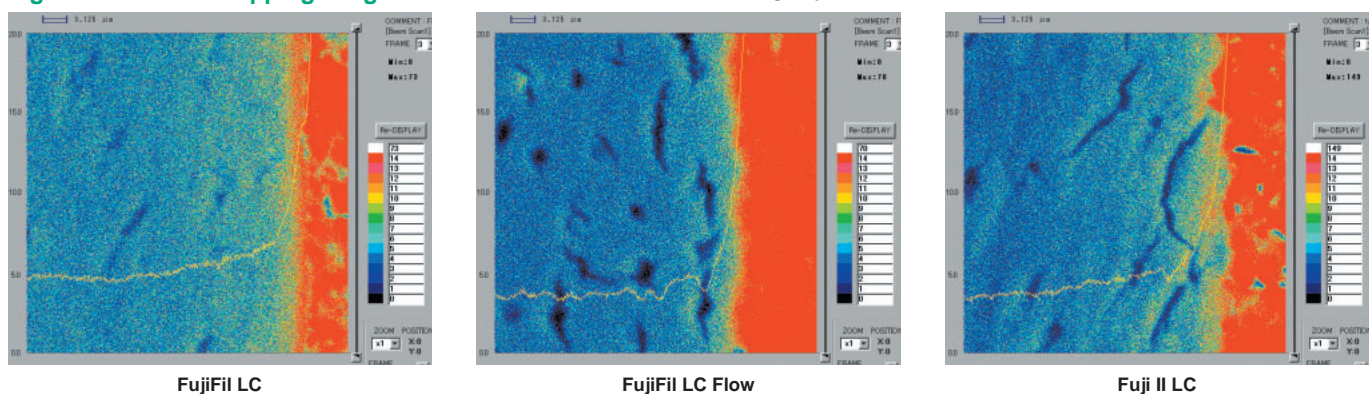


Figure 4. Amount of released fluoride ions

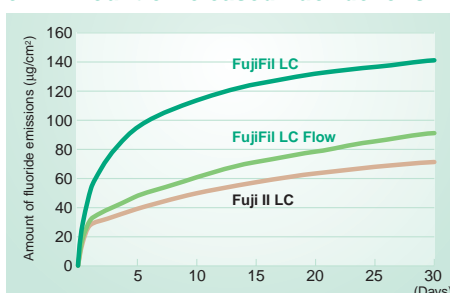


Table 1. Fluoride diffusion depth of light-cured glass ionomer cements

	1 day	1 week	1 month
FujiFil LC	5.54±1.20	8.62±2.53	9.44±0.96
FujiFil LC (N.T.)	6.71±0.60	7.73±2.40	9.89±0.87
FujiFil LC Flow	5.77±0.35	7.84±0.83	10.79±2.53
FujiFil LC Flow (N.T.)	7.38±0.19	8.34±0.97	11.34±1.57
Fuji II LC	6.32±3.14	7.28±1.89	9.70±2.61

N.T.: No tooth surface treatment

(μm :mean±S.D.) n=3