Glass ionomer cement auto-repair: an optical microscopy study

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INTRODUCTION: The aim of this study was to verify, with optical microscopy, whether the hydrogel structure of the cement allowed auto-repair of cracked material at several maturation steps.

METHODS:

MATERIAL: The materials used in this study included one conventional GIC (Fuji IX®) and one resin modified (RM) GIC (Fuji II LC®, GC, Tokyo). Nine groups of five specimens were used.

STORAGE CONDITIONS: Three different storage media were chosen: demineralized water, tap water and Fusayama modified solution (FSM). Specimens were immersed for 8 days.

METHOD:

First method:

Five spontaneously cracked Fuji IX® specimens were placed in demineralized water (group 1), five in tap water (group 2), and five in FMS (group 3).

Second method:

Five specimens of Fuji IX® and five of Fuji II LC® indented with a Vickers diamond indentor with a load of 50, 100, 200 or 300g were immersed in demineralized water (groups 4 and 7), in tap water (groups 5 and 8), and in FSM (groups 6 and 9).

RESULTS : After contact with air, surface cracking was been noted in all specimens of Fuji IX®. After hydratation for 8 days in tap water or FSM, all the materials exhibited crack closure. No closure was observed with demineralized water.

The indentations made in Fuji IX® and Fuji II LC® were still present in the specimens after 8 days' storage in all solutions. But a blurred zone around all the initial indentations was observed in specimens immersed in tap water and FSM. No modification could be seen in specimens immersed in demineralized water.

DISCUSSION & CONCLUSIONS: Conventional glass ionomer cements present spontaneous cracking when exposed to the air.

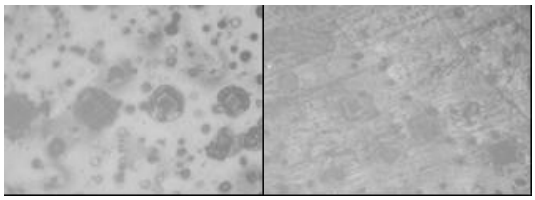

Figure 1:Initial in Fuji IX® specimen and Blurred zone after 8 days in FSM

When the samples are immersed in media containing several ionised species (tap water, FSM), the cracks close up because the gel structure confers interactivity on the material. This is not the case when samples are immersed in distilled water. The same is true for resin-modified glass ionomer specimens except that they need indents as they do not spontaneously crack in contact with air due to the polymer network. For both types of materials, ionised media could not restore the defect *ad integrum* but created a blurred zone. This zone could signify a regenerating process. The results show that external cracks and defects could react with the solution, and this could also be the case for internal defects, visible in confocal microscopy. Ionic exchanges allow self-repair processes to act in conventional and resin-modified glass ionomer. This self-repair property is interesting when the material is dehydrated, for example under rubber dam after the filling. As saliva contains many ion species, the cracks at the surface and at the tooth/filling interface could undergo a closing process

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