Time-course Study of Fluoride-releasing Restorative Materials on Dentin Remineralization and Following Acid Resistance in vitro

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Abstract: This study evaluated the time-course remineralization effect of fluoride-releasing materials on dentin in vitro. Restorative materials used in this study were Beautifil (BF) and Reactomer (RE) as fluoride-releasing light-cured composites, Beautifil Flow (BFF) as fluoride-releasing flowable resin composite, Glasionomer-F (GI) as a conventional glass ionomer, and Lite-Fil II A (LF) as a non-fluoride releasing composite.

Root dentin single-sections were demineralized with 10 ml of acetic acid solution (0.1 mol/l acetic acid, 1.5 mmol/l CaCl₂, 0.9 mmol/l KH₂PO₄, 0.5 ppm F, pH 5.0) for 3 days. Each material was filled in a cylindrical cavity in a perspex block and a demineralized root dentin single-section was inserted into the groove at a distance of 1 mm from the material. The block was immersed in 10 ml of remineralization solution (1.5 mmol/l CaCl₂, 0.9 mmol/l KH₂PO₄, 130 mmol/l KCl, 20 mmol/l HEPES, pH 7.0) for 1, 2, 4 and 6 weeks, at 37°C. After the 6 weeks of remineralization period, an acid resistance test was performed for 3 days with fluoride-free acid demineralization solution (pH 5.0). After each period of remineralization and acid resistance test, the sections were subjected to transverse microradiography (TMR) analysis.

Remineralization was found in all groups, however, significant differences were not recognized among all the groups throughout the remineralization periods. On the other hand, characteristics of remineralization profiles were found between the LF and the GI. The mineral profile of LF showed that the surface layer and body of lesion were slowly remineralized, however, GI and BF showed a steep increase in the surface layer, but the body of the lesion was left. As a result of the acid resistance test, GI had a significantly lower mineral loss than the other materials.

It is concluded that the remineralization characteristics of fluoride-releasing materials and non-fluoride-releasing materials were different, however, the total amounts of remineralization were not significantly different throughout the experimental period under the conditions of this study which simulated an oral environment with predominant saliva flow and diminished plaque accumulation. Glass ionomer may exhibit beneficial acid resistance characteristics when the demineralization environment is advanced.

Key words: Remineralization, Single-section, Microradiography, Fluoride-releasing materials