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P63 - Evaluation of caries progression in dentin treated by fluoride-containing materials using PIGE/PIXE system

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Fluoride in some fluoride-containing materials (FCMs) was demonstrated as a great benefit for preventing dental caries. Although it is well known that fluorine (F) from FCMs penetrates directly into tooth structures, whether F penetrated from material inhibits caries progression is a matter of debate. The purpose of this study is to investigate rates of caries progression of dentin in various amount of F uptake using PIGE/PIXE system at the Wakasa Wan Energy Research Center.

The dentin sections of six extracted human teeth were prepared to being in various amount of F uptake by three kinds of FCMs. F uptakes into dentin from FCMs were analyzed using PIGE/PIXE system. $1000\ \mu\text{m} \times 1000\ \mu\text{m}$ area at the surface of dentin was scanned and two line analyses at an arbitrary position in the scanned area were subsequently performed. F and calcium distribution of specimens were obtained. The surface margin of dentin was defined as the spot containing 5% of calcium concentration in intact dentin. The average amount of F in the outer $100\ \mu\text{m}$ of each specimen was obtained.

After evaluation, the specimens were immersed for 7 days in 10 ml of demineralizing solution (pH 4.5) for simulating caries attack. To estimate caries progression rates, the same area of the specimens were evaluated again using PIGE/PIXE system after caries attack treatment. The outermost surface and the innermost portion of the carious lesion were defined as the position containing 5% and 95% of the calcium concentration in intact dentin. Calcium and F distribution of specimens was calculated every $10\ \mu\text{m}$ distance from the defined surface. As the caries progression rates, the area of calcium loss with the caries attack was calculated by an average of calcium loss and the depth of the caries lesion. The results suggest the negative correlation between the F uptake in dentin and its rate of caries progression. Therefore, caries progression was inhibited with increasing the amount of F uptake from FCMs. We will discuss the potentiality with the analysis for evaluation of preventive effects of FCMs.

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