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The effect of various amounts of nanohydroxyapatite on the mechanical properties and remineralization of a fissure sealant

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Objective: The main reason for failure in application of fissure sealant is its loss of bond to tooth and development of secondary decays. Nanoparticles of hydroxyapatite have convenient biologic properties and we can try to benefit from these characteristics by adding them to repair materials. The present study was performed with the aim to assess the effect of addition of various amount nanoparticles of hydroxyapatite on mechanical properties such as microshear bond strength and physical properties like curing depth and degree of conversion as well as evaluation of teeth enamel remineralization.

Methods: In the present laboratory experimental study different weight percentages comprising 0% (control), 1%, 3%, 5%, 10% and 15% of nanoparticles of hydroxyapatite with 50 nm dimensions were separately added to fissure sealant. Then degree of conversion test by Fourier transform infrared spectroscopy (FTIR) and curing depth according to ISO 4049 standard were performed on prepared samples. For the micro-shear bond strength test 35 premolar teeth without caries were used. The substance properties measurement device (Zwick) was used to do the test. Remineralization of permanent teeth enamel was assessed by Scanning Electron Microscopy (SEM). Raw data obtained were statistically analyzed by normal distribution test (Kolmogorov-Smirnov), one way ANOVA and Tukey post hoc test.

Results: Results showed that micro-shear bond strength and degree of conversion had no significant difference in various concentrations of fissure sealant containing hydroxyapatite nanoparticles (P>0/05). Between micro -shear bond strength and degree of conversion means of 3 M commercial fissure sealant and usual fissure sealant there was no significant difference (P>0/05). Curing depth in concentrations of 10% (P=0) and 15% (P=0) statistically significantly decreased compared to previous groups (P<0/05). Curing depth of 3M commercial fissure sealant group was lower compared to conventional fissure sealant group (P=0) and the difference was statistically significant (P<0/05). A remineralized region on the surface between the fissure sealant and tooth enamel was observed by SEM. This region was more remarkable in higher concentrations.

Conclusion: Fissure sealant containing hydroxyapatite nanoparticles with effect on remineralization on the surface of tooth enamel can lead to reduction of micro-leakages and prevention of development of secondary caries while mechanical properties do not decline.

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