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STUDY OF COMPOSITE MATERIAL SAMPLES0

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ABOUT ARTICLE

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Abstract: According to scanning electron microscopy, mechanical tests of Filtek Ultimate composite material samples for compression and bending with an increase in polymerization temperature showed an increase in the level of structuring and a decrease in defects in the material, which had a positive effect on the mechanical properties of the material.

INTRODUCTION

A change in the polymerization temperature leads to a change in the degree of conversion of the polymethacrylate matrix and a change in the mechanical properties of composite repair materials. Scanning electron microscopy is a widespread method of evaluating the surface of various objects. It is of scientific interest to study the surfaces of composite samples with varying degrees of inversion after destruction.

The purpose of the study is: to analyze the results of SEM samples of composite restoration materials with varying degrees of inversion after failure in bending tests. Materials and methods The study used samples of dentin-based composite materials and Filtek Ultimate after compression tests and Filtek Ultimate samples after bending tests. Composite materials were preheated to 24°C, 55°C and 70°C before polymerization. The research was carried out in a specialized laboratory of the Institute of Geology and Geochemistry of the Russian Academy of Sciences (head: Professor, Doctor of Geological and Geochemical Sciences of the Russian Academy of Sciences Votyakov S.L.) using a scanning electron

microscope Jeol JSM-6390LV. The results and discussion of the SEM photos of the dentin + composite samples after compression tests are shown in 1a cracks penetrating from the composite into the dentine are clearly visible (arrow 1), and numerous satellite cracks formed in the dentine (arrow 2). in b, the polymerization temperature was increased to 55°C. It can be seen that when the polymerization temperature rises to 55 °C, cracks do not pass through the entire sample. Cracks in the filler material stop at the interface with the adhesive. Cracks are observed in the filler material, branching at an angle of 45 °. This is typical in the presence of tensile stresses. Such phenomena are explained by the difference in the Poisson's ratio between dentin and the filling material. As shown in Fig. 1c, when the polymerization temperature rises to 70°C, cracks penetrating the entire sample are no longer observed. With such an increase, cracks in the dentin are barely noticeable (arrows). The SEM photos of composite samples after the bending test are shown in clusters of composite material and filler particles are visible. Clusters and aggregates of inorganic filler are larger in samples with polymerization temperatures of 55C and 70C. This can be explained by an increase in the conversion of the reacting monomer. Due to an increase in the number of reacted double bonds, the degree of polymer structuring increases, the defectiveness of the organic matrix decreases and the adhesive strength of the polymer matrix to the particles of the inorganic filler increases. Thus, an increase in the degree of conversion leads to a change in the shape of cracks. As the polymerization temperature increases, the cracks have a more linear orientation, and the number of branched cracks decreases. The analysis of scanning electron microscopy of Filtek Ultimate composite samples with increased conversion after compression and bending tests shows an increase in the degree of structuring and a decrease in the defect rate of materials with an increase in conversion, which correlates with data from previous studies of the mechanical strength of composite materials under preheating [1, 2].

CONCLUSION

During mechanical tests of Filtek Ultimate composite material samples, in which the compressive and bending strength increases with increasing polymerization temperature, scanning microscopy data show an increase in the level of structuring and a decrease in material defects, which has a positive effect on the mechanical properties of the material.

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