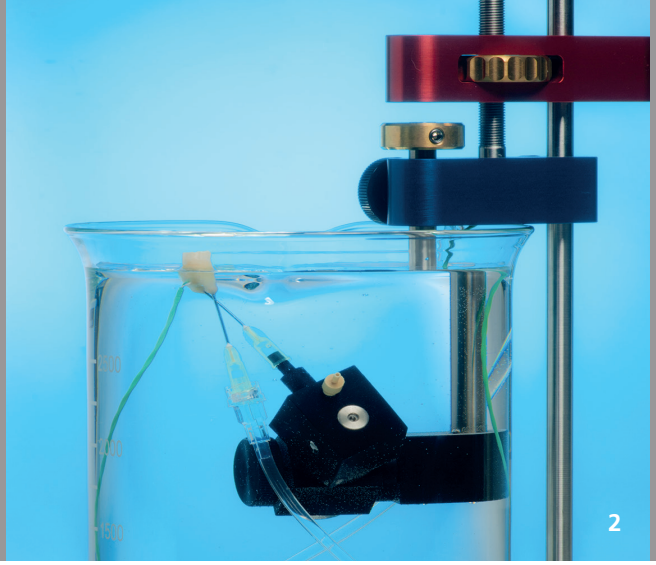

LASER-BASED PROCESS TO COAT DENTAL SURFACES FOR PREVENTION OF CARIES

Task

One of the main oral health problems today stems from decay or erosion caused by the consumption of acidic foods. And yet, current preventive measures, such as sealing the vulnerable areas with plastic-based composite materials, have limited durability. In order to provide a permanent preventive measure against this growing loss of hard dental substance, Fraunhofer ILT has functionalized, by means of laser radiation, a coating material applied to the tooth surface as a microparticulate dispersion. The particular challenge in doing this arises from the difference between the high firing temperatures, between 700 – 1,000 °C, of the glass-ceramic materials used in the coating and from the underlying tooth material, which can be damaged irreversibly when the temperature on the tissue changes by only 5.5 °C.

Method

Uncoated hard dental substances are first processed with modulated CO_2 laser radiation. To simulate the conditions existing in the mouth, a setup has been developed in collaboration with the Department of Restorative Dentistry at RWTH Aachen University; it heats the tooth during laser processing to body temperature and simulates blood flow through the tooth.

At the same time, temperatures are measured both within the tooth by means of thermocouples as well as on the tooth surface by means of a thermal camera.

Result

The investigations show that the temperature needed to melt the glass ceramic at the tooth surface does not exceed the critical difference in temperature of 5.5 °C within the tooth when the process parameters are chosen suitably.

Applications

This process for the functionalization of glass ceramic layers can be utilized in preventive dentistry.

The R&D project underlying this report was funded by the German Research Foundation, grant number GZ PO 591/40-1.

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2 Tooth in a water bath heated to body temperature before laser treatment.