Special Lecture I

Chairman: Sang-Jin Park (Kyung-Hee University) 10:00 -12:00 Auditorium

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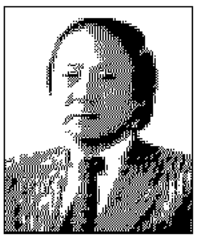

Laser Treatment in Restorative Dentistry

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Abstracts

The application of the laser to the tooth hard tissue started from the removal of carious dentin with the laser performed by Goldman in 1964. With the development of the laser technology, the laser treatment with less discomfort such as pain, vibration, and noise, etc. has been attempted. Since it is difficult to give a suitable form for inlay restoration to a cavity prepared with laser, it has to be restored with adhesive resinous materials. However, various evaluation of adhesive properties of the resinous materials to lased tooth surface on the various conditions such as adherent, irradiation condition, procedure of bond test, and adhesive materials used, etc. have been reported.

In this lecture, our study of the changes of surface characteristics of lased dentin and the adhesive properties of resinous materials to lased dentin will be discussed. This study was performed to investigate the bonding mechanism of the adhesive restorative materials of laser-irradiated dentin. The laser apparatuses used in our study were Er:YAG laser (Erwin: Morita Corp.) and CO2 laser (Topal: Yoshida Dental MFG. Co. Ltd.). From Scanning Electron Microscopic (SEM) and Atomic Force Microscopic (AFM) study, the smear layer could not be detected on the lased dentin surface, and the structural defects such as micro cracks and stratiform structure were formed. Thermographic analysis exhibited that the laser irradiation generated high heat of temperature value of above 200℃. The analysis of lased dentin using Energy Dispersive X-ray Spectroscopy, Electron Probe X-ray Microanalyser, and Nano-indentation Tester revealed the decrease in hardness and in concentration of Ca and P in the superficial layer of approximately 30㎛ thickness. According to these changes heat-denatured layer and a layer with destroyed dentinal collagen fibers were observed under Light Microscopy (LM), Transmission Electron Microscopy (TEM) and X-ray photoelectron Spectroscopy.

Early bond strength and durability of adhesion of the commercial adhesives to the lased dentin were significantly lower than those to the rotary cut dentin in micro-tensile bond test. This might be caused by the concentration of stress to those structural defects, by the inhibition of resin-impregnation due to the denatured layer, or by the deterioration of mechanical properties of the hybrid layer and the lased dentin itself. In order to adapt commercial adhesives to lased dentin, pretreatments for the removal of defects and denatured layer were examined. LM, SEM and TEM study revealed that they could be removed with 30 seconds' phosphoric acid etching followed by 60 seconds' (Er:YAG) or 120 seconds' (CO2) sodium hypochlorite treatment. This pretreatment could regain adhesive properties of commercial bond systems equally to those to rotary cut dentin.