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Mémoire de Recherches

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Er:YAG (2940nm) laser cavity preparation and semidirect composite resin restorations.

A microleakage study

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Er:YAG laser cavity preparation and semi-direct composite resin restorations. A microleakage study.

Summary

INTRODUCTION

Effective ablation of dental hard tissues by means of the Er:YAG laser has been reported, and its application to caries removal and cavity preparation has been recently approved [Keller and Hibst 1997, Keller et al. 1998, Dostalova et al. 1996]. In fact, the 2.94 µm wavelength of the Er:YAG laser falls in an area of the spectrum where both enamel and dentin have absorption peaks (high absorbability in water and hydroxyapatite). Keller and Hibst have first studied the application of pulsed Er:YAG laser radiation *in vitro* on extracted teeth to remove enamel, dentin, and carious lesions [Hibst and keller 1989, Keller and Hibst 1989]. Hoke et al. [1990] have investigated physical and thermal damage to surrounding tissue during removal of enamel and dentin. They concluded that the Er:YAG laser may be an effective method for tooth ablation when used with a water mist. Further studies have demonstrated the importance of a water spray for cooling laser-ablated tissues and limiting the temperature rises induced in the tissue to less than 5℃ [Paghdiwala et al. 1993, Visuri et al. 1996]. Cavity preparations with the Er:YAG laser, followed by adhesive resin composite restoration, were tested.

The use of the Er:YAG laser for cavity preparation results in a surface with a significantly different morphology to that achieved by conventional means. The enamel and dentin surfaces are free of debris and smear layer. The irradiated enamel shows a very irregular surface where the characteristic prismatic structure of this tissue is not visible [Dostalova et al. 1996, Tokonabe et al. 1999, Curti et al. 2004]. Preferential removing of the intertubular dentin creates micro-irregularities. The surface of Er:YAG laser irradiated dentin has open dentinal tubules [Dostalova et al. 1996, Armengol et al. 1999, Bertrand et al. 2004]. When acid etching is performed on the Er:YAG laser irradiated dentin surface before bonding, the orthophosphoric acid partially removes the highly mineralized peritubular dentin, decalcifies the underlying dentinal structures and enlarges the dentinal tubule orifices. The surface irregularities are erased but the surface demineralization allows a hybridation process and an increased bonding surface at the base of the resin tags. Thanks to the hybridation process, the bonding agents should effectively seal the dentinal surface and the dentinal tubule orifices to prevent microleakage and protect the pulp [Bertrand et al. 2004].

Different adhesive systems are currently available to bond composite resin in direct technique: total-etch adhesive systems in three or two steps and self-etch adhesive systems in two or one steps [Powers et al. 2003]. Previous in vitro studies assessed the performances of total-etch and self-etch adhesive systems by investigating the microleakage of class V composite resin restorations (Betti and Terzitta 2005, Bertrand et al. 2006,). No difference was observed between Er:YAG laser and bur-prepared cavities. The aim of this study was to assess the microleakage of composite resin restorations bonded in Er:YAG laser prepared cavities using a semi-direct technique, in comparison with diamond bur-prepared cavities.