An Evaluation of the Occluding Effects of Er;Cr:YSGG, Nd:YAG, CO2 and Diode Lasers on Dentinal Tubules: A Scanning Electron Microscope In Vitro Study

Author(s): Gholami, GA (Gholami, Gholam Ali); Fekrazad, R (Fekrazad, Reza); Esmaiel-Nejad, A (Esmaiel-Nejad, Azadeh); Kalhori, KAM (Kalhori, Katayoun A. M.)

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Abstract: Objective and Background: Dentin hypersensitivity (DH) is one of the most frequent problems causing patients' complaints following stimulation of cervically exposed dentin. Studies have shown that different lasers have various occluding effects on dentinal tubules. This study is aimed at evaluating the occluding effects of Er; Cr:YSGG (P:0.25W, F:20Hz, Pd:140 μS), Nd:YAG (P:1W, F:20Hz), CO2 (P:1W, Pd:50 μs), and 810-nm diode (P:2 W, Pd:30ms) lasers on dentinal tubules. Methods: Fifteen human third molars were collected and ground-sectioned vertically on the buccal and lingual surfaces to yield two dentin disks of 2-mm thickness. Then, four sites for laser irradiation and one control site were marked in the cervical areas of the dentin disks. Before laser application, specimens were exposed to a 14% EDTA solution to expose dentinal tubules and were then evaluated by scanning electron microscopy (SEM). The tubules' entrance diameters were determined by "scale-bar" software (Phillips Scale-Bar, Phillips, Amsterdam, The Netherlands), which is specifically designed for SEM. The mean diameters for the tubules were then estimated for each site and analyzed statistically. Results: The mean dentinal tubule entrance diameters for Er:Cr:YSGG, 810-nm diode, CO2, and Nd:YAG, were 1.73, 3.27, 2.10, and 1.64 microns, respectively, compared with 3.52 microns before laser irradiation. Overall, the furthest reduction in mean tubule diameter resulted from the Nd: YAG laser (53%). However, tubular diameter reduction in all laser groups (p<0.05) was found to be statistically significant. In all laser groups, melting of the peritubular dentin was the dominant observed phenomenon. Conclusion: Our results indicate that Nd: YAG, Er; Cr: YSGG, and CO2 lasers, through their ability to melt peritubular dentin, can occlude dentinal tubules partially or totally, and therefore reduce patients' hypersensitivity symptoms. The 810-nm diode laser sealed tubules to a far lesser degree, with negligible effects on desensitization.