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Composite curing temperatures achieved with Halogen, laser and plasma light sources

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The purpose was to compare the pulpal temperatures curing composite resin in vitro using: a Demetron Optilux 401 Halogen light, a Lasermed Accucure 3000 Argon laser, and an Apollo 95E plasma light. An Ivory cube was cut and a hole drilled through its centre. Three pieces of Ivory were machined to have identical dimensions, but with 1, 2 & 4 mm thicknesses, enabling different depths of tissue to be present beneath the composite which was cured within the hole in the main cube. Kerr 'Herculite-XRV' Composite of 2 mm and 4 mm depth was cured with each light source, using the three different thicknesses of base piece.
The temperatures at the 'pulpal' face were measured by infra-red thermography. Results showed highest temperatures were achieved curing 2 mm of composite when only 1 mm of tissue was present between the base of the composite and the pulp. A 40s cure with an 8 mm diameter tip using the Optilux produced a maximum temperature rise of 5.4°C, and the laser an identical maximum rise, but after 15s curing time. Temperatures achieved with the plasma light were all lower.
In conclusion, all three light sources produced temperature rises which should not lead to irreversible pulpal damage in clinical use.

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Sem Observation of Irradiation with the Er,Cr: YSGG Laser after Coating by 38% $Ag(NH_3)_2F$ Solution

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Purpose: The purpose of this study was to evaluate the morphological changes of the dentine surface irradiated by the Er,Cr:YSGG laser in conbination with or without 38% $Ag(NH_3)_2$ F solution with SEM, SEM-EDX.
Material and Methods: Ten extracted human molar teeth were used in this study. They were vertically bisected, and one side of cut surfaces was coated with 38% $Ag(NH_3)_2F$ solution and the other side was irradiated by the Er,Cr:YSGG laser (Millennium, BioLase Technology, San Clemente, CA, USA) at the parameter of 2W and 20 HZ after coating with 38% $Ag(NH_3)_2F$ solution. The specimens were examined by SEM, SEM-EDX.
Results: The teeth surfaces of the laser irradiation group showed much deposition of silver compounds in comparision with only 38% $Ag(NH_3)_2F$ solution-coated group. The dentinal tubules of the laser-irradiated group were closed with the melted silver compounds.
Conclusions: We could conclude that the method of Er,Cr:YSGG laser irradiation after coating with 38% $Ag(NH_3)_2$ F solution on dentine surfaces showed the more effective treatment about prevention of caries and teeth fracture comparing with the method of coating only 38% $Ag(NH_3)_2$ F solution only.

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Effects of Holmium Laser on Dental Structure in vivo

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Previous in vitro studies has demonstrated that Ho:YLF laser is capable of inducing physical and chemical changes on dental surfaces for caries prevention. The temperature changes in the pulpal chamber was firstly evaluated in vitro to determine safe energy irradiation conditions range. The purpose of this work is to verify the occurrence of pulp inflammation under those irradiation conditions in rabbits. Ten rabbits (NZB) were divided in 5 groups according to the sacrifice period (control, immediately after irradiation, 6, 24 and 72 hours after irradiation). The rabbits posterior upper region teeth of each animal were irradiated with 10 pulses of a Ho:YLF prototype operating at 0.5 Hz and 300mJ/pulse on the left side and 500mJ on the right side. Sacrifices were obtained through transcardiac perfusion and the samples were prepared for pathological analysis. The in vitro temperature monitoring revealed an increase of 1°C to the 300mJ energy and 4.5°C for the 500mJ energy. SEM observations showed the occurrence of melting and resolidification. From the in vivo analysis it can be concluded that there was low degree of inflammation for the highest energy used and no pulpal alterations for the lowest one.

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Carieslike Lesion Initiation in Sound Enamel following CW CO_2 Laser Irradiation: an In-Vitro Study

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Purpose : This study aimed to asses the caries - preventive potential of various CW CO_2 laser parameters, and to explore the effect of the laser power density, and the exposure time on the caries inhibition activity.
Materials and Methods: Extracted human premolar teeth were irradiated with three different power densities (7.95, 15.9 and 31.8) W/cm^2 for three different exposure times (0.2, 0.4 and 0.8) sec of 10.6 mm CW CO_2 laser. All teeth were subjected to carieslike lesion formation by 3.5 pH lactic acid for 21 days. The teeth after that were sectioned into ground cross sections and the lesion depths were measured using a gratitude under polarizing microscope.
Results: CW CO_2 laser preventive treatments inhibit carieslike lesion progression upto 44%. This effect was improved with: (1) increased power density for each of the three exposure times. (2) decreased exposure time for each of the three power densities within the limits of the previously listed laser parameters.
Conclusion: (1) Short exposure time of CW CO_2 laser results in a significant inhibition of the enamel carieslike lesion formation. (2) The inhibitory effect depends upon the power density and the exposure time of the laser beam. (3) The optimal CW CO_2 laser parameters used for caries inhibition purpose is achieved with approximately 30 W/cm^2 power density and 0.2 sec exposure time.

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In Vitro Study of Hydroxyapatite and Enamel Powder Fused in human Enamel by Nd:YAG Laser

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This study had the aim of evaluating the effects of pulsed Nd:YAG (1064nm) laser irradiation on hydroxyapatite and enamel powder fusion. This laser beam is not well absorbed by these two compounds and for that reason they were mixed with vegetal coal in order to increase the absorption of the laser beam. Fifteen enamel flat surfaces were covered with three different substances: 1) hydroxyapatite mixed with vegetal coal (3:1 in weight); 2) enamel powder mixed with vegetal coal (3:1 in weight); 3) vegetal coal. Flat surfaces were used to determine the fusion of hydroxyapatite and enamel powder. All samples were irradiated with Nd:YAG laser with the following parameters: 80mJ; 15 Hz; 1,2 W; 100ms pulse-width, 131,1J/cm^2. The