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Long-term safety, high-resolution imaging, and tissue temperature modeling of subvisible diode micropulse photocoagulation for retinovascular macular edema.

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Abstract

PURPOSE: To determine the **long-term safety** of high-density subvisible diode micropulse photocoagulation (810 nm), compare the clinical findings with computational modeling of tissue hyperthermia and to report results for a subset of eyes treated for diabetic macular edema (ME) documented pre- and postoperatively by spectral-domain optical coherence tomography.

METHOD: All eyes treated for ME from diabetic retinopathy (diabetic ME) and branch retinal vein occlusion between April 2000 and January 2010 were reviewed for subvisible diode micropulse laser-induced retinal damage. Therapeutic outcomes were reviewed for a subgroup treated for diabetic ME with pre- and postoperative spectral-domain optical coherence tomography. Laser-induced retinal thermal effects were modeled computationally using Arrhenius formalism.

RESULTS: A total of 252 eyes (212 diabetic ME, 40 branch retinal vein occlusion) of 181 patients qualified. None of the 168 eyes treated at irradiance <350 W/cm2 and 7 of 84 eyes at ≥ 590 W/cm2 had retinal damage (P = 0.0001) (follow-up 3-120 months, median, 47). Sixty-two eyes of 48 patients treated for diabetic ME with pre- and postoperative spectral-domain optical coherence tomography with median 12 months follow-up had no retinal injury by infrared, red-free, or fundus autofluorescence photos; fluorescein angiography or indocyanine green angiography; or spectral-domain optical coherence tomography. Central foveal thickness (P = 0.04) and maximum macular thickness decreased (P < 0.0001). Modeling of retinal hyperthermia demonstrates that the sublethal clinical regimen corresponds to Arrhenius integral >0.05, while damage is likely to occur if it exceeds 1.

CONCLUSION: Subvisible diode micropulse can effectively treat retinovascular ME without laser-induced retinal damage, consistent with Arrhenius modeling of pulsed hyperthermia.

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MeSH Terms

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