A comparative study of 337 and 532 nm laser irradiation on Thrombi Formation in vivo

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Aim: In vivo thermal effects of laser-induced endothelial damage were investigated comparatively with pulse UV- laser of 337 nm and continuous diode laser of 532 nm.

Methods: Mesenteric venules of anesthetized Wistar rats, (d=20-30 μm) were irradiated with pulse laser light (LGI-21, Russia, λ=337 nm, 3 mW, pulse duration 10-8s, period 0,02s) and continuous one(DPSS Laser, λ=532 nm, 34 mW, South Korea). Laser- induced microvascular disturbances were analyzed using time-lapse video-microscopy. Local intravascular temperature rise was calculated on the basis relatively simple heat transfer model.

Results: Heat effects within irradiated microvessels are determined by direct absorption of laser radiation by blood and heat losses by lateral conduction (tdif=D²/6ρ) and by longitudinal convection(tcon=L/v). Calculated peak temperature rise during one pulse was about 50°C. The irreversible primary damages of endothelium which gave rise to thrombus growth followed by pronounced thromboembolic reaction were observed in experiment after a series (at least 10) pulses. The diode laser irradiation (1 s) resulted in formation of stable thrombus with minimal thromboembolic process. The calculated temperature rise inside the irradiated volume of microvessel did not exceed 31°C.

Conclusions: Both numerical and experimental studies of laser-induced thrombus growth indicate wide possibilities in modeling of well-controlled endothelium damage in mesenteric microvessels.