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Retinochoroidal Electrothermoadhesion Using Microinvasive (25-G) High-Frequency Electric Welding: An Experimental Study

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Objective: To evaluate the effectiveness of high-frequency electric welding (HFEW) for retinopexy using a monopolar 25-G welding probe in rabbits via histology after estimating threshold voltage parameters by mathematical modeling and an experiment with following optical coherence tomography (OCT) imaging.

Methods: Threshold voltage parameters were estimated experimentally in 3 rabbits (6 eyes) after finite element modeling of electric heating of the retinal tissues based on vitreous cavity content (2 eyes with vitreous body, 2 eyes with air, 2 eyes with perfluorodecaline). HFEW was used to form retinochoroidal adhesion spots with the monopolar 25-G welding probe, which were assessed by OCT and ophthalmoscopy. In another group of rabbits (5 rabbits, 10 eyes), this retinochoroidal electrothermoadhesion was evaluated by histology on postoperative days 1, 3, 7, 14, and 30 (2 eyes per each time point).

Results: Experimental and mathematical modeling–based estimated voltage parameters for microinvasive (25-G) HFEW were closely similar depending on the vitreous cavity content (11.3 V for vitreous body, 12 V for air, and 12.5 V for perfluorodecaline), forming retinochoroidal adhesion spots with minimally-to-moderately disrupted retinal architecture and edema in the inner retinal layers. Histology showed moderate disruption of the inner retina with preserved tissue architecture of the outer retina after electric welding at all time points. Prominent retinochoroidal adhesion was achieved early postoperatively, starting from day 7.

Conclusion: Mathematical modeling accurately estimated threshold voltage parameters for HFEW, which were approved in the experiment. Microinvasive (25-G) HFEW achieves prominent retinochoroidal electrothermoadhesion in rabbit eyes with minimally-to-moderately disrupted retinal architecture.

Disclosure of Interest: None Declared