

Nanosecond laser cataract surgery: Contralateral endothelial cell study. ARVO 2016

Jordan Datseris¹, Ivan Tanev, MD³, George Asimellis, PhD¹, A. John Kanellopoulos, MD¹⁻²

1: Laservision.gr Eye Institute, Athens, Greece 2: NYU Langone Medical School, New York, NY 3; Tanev center Sofia, Bulgaria

Purpose An alternative ultrasound phacoemulsification surgical technique for cataract surgery is evaluated. This technique utilizes novel coaxial nanosecond laser-assisted phacoemulsification. The purpose of this study was to **contralaterally** evaluate corneal endothelium cell density and morphology after coaxial ultrasound vs nano-second laser assisted phacoemulsification.

Methods: 82 eyes subjected to uneventful cataract surgery with implantation of acrylic IOL. Each patient received ultrasound phacoemulsification (US) on one eye and coaxial nanosecond laser assisted (NL) on the other eye. Nuclear sclerosis was graded from NO3NC3 to NO4NC4 (Lens Opacities Classification System III).

Parameters analyzed pre-operatively and 2-years postoperatively: effective phacoemulsification time (EPT) for the US group and the number of laser pulses and total energy dissipated for cataract removal for the NL group. Endothelial cell density (ECD) and endothelial cell size variability were determined preoperatively and two years postoperatively.

Endothelial structure was evaluated by measuring the central endothelial cell density (cells/mm²), coefficient of variation (CV) in cell size (an objective measure of polymegethism), and percentage of hexagonal cells (CV6), an index of pleomorphism (%HC).

Results: Mean EPT in the US group was 7.26±44 seconds. In the NL laser group average number of laser pulses was 243±188. Each laser pulse released 7.5 mJ (14 ns duration). The mean amount of energy dissipated into the anterior chamber was 1.83 J.

Mean ECD in the US group was preoperatively 2517±137 cells/mm² and 2-years postoperatively 2287±155 cells/mm² (p<0.001). In the NL group preoperatively 2521±233 cells/mm² and 2-years postoperatively 2420±292 (p<0.001).

Mean CV in the US group was preoperatively 27.6±2.4 and 2-years postoperatively 30.6±2.4 (p<0.001). In the NL group, preoperatively 27.9±2.8 and 2-years postoperatively 27.2±2.0 (p<0.001).

Mean %HC in the US group was preoperatively 42.3±3.6 and 2-years postoperatively 37.74±3.54 (p<0.001). In the NL group, preoperatively 42.8±3.2 and 2-years postoperatively 43.00±2.68 (p<0.001).

Discussion: The number of cataract operations is continuously increasing starting from approximately 20 million surgeries in 2010, and expecting to reach 32 million procedures globally by 2020. Ultrasonic phacoemulsification, used since the early 1970s, has been progressively refined and is now the standard reference for effective cataract surgery.

Modern cataract surgery is one of the most successful types of surgery when considering the improving of the patient's quality of life. The expected outcomes today include reduced surgical trauma, smaller incisions, improved intraoperative ocular stability, advanced performance capabilities of intraocular lenses.

Ophthalmic surgeons are in constant search of refined techniques and instrumentation (tools, devices) in order to improve safety and patient's outcome

Ultrasound (US) energy may affect ocular structures and has been implicated in the pathogenesis of endothelial cell loss and cystoid macular edema. Corneal edema is one of the most frequent early postoperative complications of phacoemulsification. This complication may sometimes lead to permanent and serious visual disturbances. Post-operative corneal swelling and endothelial cell loss are related to many factors, including phacoemulsification time and energy, cataract density, corneal pathology, anterior chamber depth, axial length, ocular trauma, free radical development, mechanical and heat injury, phacoemulsification technique, experience of the surgeon, and use of viscoelastic material.

Conclusions Data in this study indicate that nanosecond laser-assisted cataract surgery phacoemulsification presents some advantages in comparison to ultrasound phacoemulsification in relation to endothelial cell structure preservation.

