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Modification of biomechanical properties of cornea with different UV corneal cross-linking protocols *ex vivo*

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Aim: Collagen cross-linking (CXL) with UV-A irradiation 370 nm and 0.1% riboflavin stabilizes the pathological process in the cornea. Improvement of the standard UV-A corneal cross-linking resulted in accelerated and pulsed-light accelerated UV-A cross-linking. It is necessary to compare these UV cross-linking techniques to assess its efficacy.

Methods: The experiments were carried out on 36 porcine eyes in 4 groups (8 porcine eyes each) *ex vivo*: 1st group – intact (control); 2nd group – standard UV-A corneal cross-linking (S-CXL) – 3 mW/cm^2, 30 min; 3rd group – accelerated UV-A corneal cross-linking (A-CXL) – 18 mW/cm^2, 5 min; 4th group – pulsed-light accelerated UV-A corneal cross-linking (Pl-A-CXL) – 18 mW/cm^2, 10 min, pulsed exposure (1 sec on/1 sec off). In all experimental groups Epi-Off, UV-A light 370 nm and 0.1% Riboflavin + 20% Dextran was used. The flaps from the cornea were stretched until they were completely ruptured using a universal tensile testing machine. Biomechanical properties were assessed by the force at rupture and the Young's modulus.

Results: All investigated methods of UV-A cross-linking led to an increase in the force at rupture and the Young's modulus of the porcine corneas. Young's modulus increased: S-CXL by 98±12.1%, A-CXL–86±9.4% and Pl-A-CXL–89±10.2%. Ultimate tensile strength increased: S-CXL by 67.8±9.5%, A-CXL-55.3±7.2%, Pl-A-CXL-58±8.1%. The maximum results of biomechanical strength were obtained in the S-CXL group. However, statistically significant difference between standard, accelerated and pulsed-light accelerated UV-A corneal cross-linking was not obtained.

Conclusions: Standard, accelerated and pulsed-light accelerated UV-A corneal cross linking increased the biomechanical properties of porcine corneas *ex vivo* and Young's modulus. Standard UV-A corneal cross-linking had slight advantage.

Biography

Azat R. Khalimov, B.Sc.D., Head of Research and Production Department of Ufa Eye Research Institute, The author of 1 monography, 170 research papers, 30 patents of the Russian Federation and 2 innovation proposals. More than 10 years, conducts research on UV corneal cross-linking. Is a developer of devices and medicines for UV corneal cross-linking. Research interests: ophthalmology, UV corneal cross-linking, pathological physiology, biophysics, biochemistry.

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