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Numerical modeling of refractive changes in diabetic subjects

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The aim of the study was to reconstruct the optical conditions inside the diabetic crystalline lens. Optical parameters of the crystalline lens were affected by homeostasis disorders associated with diabetes. The changes of optical parameters in subjects with diabetes are usually described with statistical methods (1) and the results of these statistical analyses rarely provide clear and unequivocal results. In the case of parameters that require high sensitivity measurements, the results often turn out to be located at the borderline of statistical significance. Thus, in such cases it is necessary to use more stable and predictable equivalents of these structures. For numerical simulations, a model of crystalline lens was constructed. The model was based on geometric parameters (2), physiological data (3) with gradient index (GRIN) of optical medium of the lens (4). The GRIN was modified according to our knowledge about changes of crystalline lens in diabetic patient (1). We examined refractive power and spherical aberration and their changes for possible disturbances. The present study has shown that the changes of gradient profile have the influence on the optical power of the lens and the value of spherical aberration as well. Furthermore, the study has proved the possible reduction of changes of optical parameters of the lens due to swelling by GRIN. When the lens swells, the focal length becomes shortened and spherical aberration is bigger. The results from simulation are clear because the mathematical model proves the relationship between the geometry of the lens and GRIN and image reproduction.

Biography

Robert Szuba has done Bachelor and Master of Science in Physics and he is a PhD student of Biophysics. He is also a Faculty of Physics in Adam Mickiewicz University.

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