

STRESZCZENIE

The phenomenon of birefringence has been known since 1669, but the phenomenon of corneal birefringence was described in 1861. In 1871 attempts were made to combine the structure of the cornea with its anisotropic properties. Currently cornea is treated as a linear birefringent medium. Some of the researchers claim that it is an uniaxial medium, others that it is a biaxial one, there are also some others which describe corneal nature depending on its observed area.

The aim of this study was to propose a new, polarimetric method for measuring the anisotropic media (mainly corneas). To these measurements, a Mueller-type double-path polarimeter was used, testing it on optical elements and next on people (in two age groups). The character of the distribution of the azimuth angle, retardance, as well as birefringence was determined. The geometrical parameters of the corneal polarization-interference figures were also described using the results of the double-path polarimeter, as well as of the proposed biomicroscope with a slit lamp and circular polarizer.

The characteristic geometrical properties of the corneal conoscopic figures were used to propose a system and a measurement method for measuring torsional eye movements. An attempt was also made to create a numerical model describing the birefringent properties of the cornea of the human eye. The results presented in the dissertation may also have influence on the ophthalmological diagnostic procedures, the surgical procedures, as well as development of the corneal transplantology which uses corneas grown in laboratories. The conclusions from the experiments described in this dissertation provide information that complements the existing knowledge about structure of the human cornea and its birefringent properties tested by the proposed *in vivo* methods.