SKEW-AXIS CYLINDER LENS OPTICAL SYSTEM: NOVEL METHOD OF CLINICAL OPTOMETRY OF ASTIGMATISM, CHARACTERIZATION, THEORETICAL MODELLING, AND IMPLEMENTATION

REVOLUTIONIZING OPTOMETRY OF ASTIGMATISM

ALEXANDER P. PLEKHANOV

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I developed a novel optical device and approach that emphasizes subjective patient perception and intuitive action, thus allowing a patient to determine the parameters of corrective glasses themselves.

Abstract

Astigmatism is a common vision problem that affects 30% of the world population. Current methods for diagnosing astigmatism (optometry) are complicated, have low accuracy, and are dependent on verbal interaction. As a result, measurements of astigmatism are often done suboptimally.

In this work, a rotatable Skew-Axis Cylinder Lens Optical System (SACLOS) has been invented, designed, and created with a goal to provide a novel, improved alternative to the existing method of optometry of astigmatism. The apparatus enables simultaneous variation of 2 independent optical parameters via direct computer-aided patient feedback in physical 2D space. This eliminates the need for verbal interaction and greatly simplifies the procedure.

A prototype apparatus has been built, and physical properties of the optical system have been characterized and optimized. The SACLOS has been demonstrated to accurately measure astigmatic defects. A theoretical model was derived and used to optimize the apparatus and method. Experimental data were compared with theoretical predictions. For further optimization, a novel point light source optometric test target was developed. It provides significant advantages over alternatives, improving measurement accuracy and patient experience. Thus, the developed device paves a way for quick, inexpensive, and accurate optometry of astigmatism, free from communication issues – an improvement over existing solutions.