OptiSkew: A Biophysical Approach for Self Assessment Eye Refractive Disorders (Year II)

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Uncorrected refractive error is the leading cause of vision impairment particularly in low-income regions, due to limited access to diagnostic systems. Current assessment tools including phoropters are constrained by their reliance on patient feedback, specialized equipment, and trained optometrists. To address this issue, the researcher developed the OptiSkew System, an automated self-assessment optical device to compensate for astigmatism, myopia and hyperopia eye errors, removing the manual swapping of lenses. Optical distortions were characterized using second-order Fourier decomposition and converted to clinical parameters to determine corrective lenses: ±0.25 D cylindrical for astigmatism and ±1.00 D spherical errors: myopia and hyperopia. The device was tested with high resolution optical tests and modulation transfer function (MTF) metrics to determine how lenses affected optical performance over time. Based on MTF50 measurements before blur, after induced blur and after correction, the OptiSkew device significantly restored spatial resolution, achieving an optical accuracy of 92.4% for cylindrical aberrations and exceeding baseline performance for spherical aberrations. Further validating the robustness of this device, the researcher tested the machine against clinical eye errors associated with a real-life clinical dataset. In addition to a precise eye refractive error tool, the researcher employed fluidic lens dynamics to create an initial prototype dynamically controlling fluidic resin-based lenses for noninvasive correction. Ultimately, the OptiSkew machine met all initial criteria and constraints allowing any individual to operate the device independently, enabling complete self-assessment and helping prevent progression of vision impairment.

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