Viability of External Reading of a Flexible Sphere's Internal Fluid Pressure and Its Application in Measuring Intraocular Pressure

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Glaucoma is the second leading cause of blindness, affecting 1 in 100 people worldwide. Unfortunately, due to its asymptomatic nature, it often goes undetected leading to permanent vision loss . A major risk factor for glaucoma is high intraocular pressure(IOP). An affordable and accessible tonometric device that provides early screening of elevated eye pressure would have significant global impact. The purpose of the research was to test the viability of a novel method using external force sensors to measure IOP. The feasibility of incorporating this sensor into a fingertip-based, self-monitoring device was also investigated. A new method for internal fluid pressure measurement was developed based on the unique sensor transfer curve of a thin-film circular force sensitive resistor(FSR). Several biomechanical models of eye were built, incorporating corneal thickness & eyelid. An Arduino-based measurement setup integrating the eye model and FSR was constructed. The sensor transfer curve was measured and validated against the model. Building on successful findings, a fingertip-based prototype was built. An algorithm was developed to measure pressure with a gentle touch on the eye model. The proposed method accurately measured the internal fluid pressure with a sensitivity of approximately 1.4mmHg in the 17-21mmHg pressure range. The promising results demonstrate the capability of the device to monitor elevated IOP levels.The finger-tip sensor prototype (approximate cost-$18), was able to automatically measure the pressure and display it in real time.Further testing with realistic eye models and FSRs with improved sensitivity would potentially enable a game-changing tonometer in the fight against glaucoma.

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