The influence of corneal parameters on intraocular pressure readings of normal eyes using the Goldmann applanation tonometer, Tono-Pen XL and ocular response analyzer

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Purpose: To analyze the correlation between central corneal thickness (CCT), corneal hysteresis (CH), and corneal resistance factor (CRF) on intraocular pressure (IOP) readings of normal eyes using the Goldmann GAT, Tono-Pen XL and ocular response analyzer (ORA, Reichert).

Setting: The Tun Hussein Onn National Eye Hospital, Selangor, Malaysia.

Methods: This study comprised 120 eyes from 60 patients. Corneal hysteresis and corneal resistance factor were provided by the ORA device. CCT was measured using the Galilei Dual Scheimpflug Analyzer. IOP was measured using the Goldmann Applanation Tonometer (GAT), Tono-pen XL and ORA for every single patient. Corrected IOP values from GAT were also calculated based on a formula by Chihara [1]. The study population was recruited during a public glaucoma screening programme with patients having no prior ocular pathology. Multiple regression analysis was performed using SPSS.

Results: ORA is useful to measure the biomechanical properties of the cornea and can be useful in glaucoma, corneal pathologies, and refractive surgery. It is the most affected by corneal parameters with adjusted R square values of 0.988 for IOPg and 0.893 for IOPcc. This is followed by the Tono-pen XL (0.338), and GAT (0.204). CRF is the most influential corneal parameter in all IOP readings. IOP calculated based on the Chihara formula takes into account CCT, corneal curvature, and corneal shear modulus and the results revealed an adjusted R square value of 0.197.

Conclusion: Corneal parameters influence IOP readings of all commercially available tonometers to a certain extent but CRF appears to be the most significant. CRF is thought to be a better indicator of the cornea’s total viscoelastic response to the air pulse. The Chihara formula has allowed us to obtain the IOP with the least amount of influence from the corneal parameters.