The effect of thin, thick, and normal corneas on Goldmann intraocular pressure measurements and correction formulae in individual eyes

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OBJECTIVE: To evaluate the usefulness of the central corneal thickness (CCT)-based correction formulae for stratified CCT groups, with intraocular pressure (IOP) from the Pascal dynamic contour tonometer (PDCT) as the reference standard.

DESIGN: Retrospective case series.

PARTICIPANTS: Two hundred eighty-nine patients attending a specialist glaucoma practice and a mixture of normal subjects and subjects with confirmed glaucomatous optic neuropathy.

METHODS: Intraocular pressure was measured using PDCT, Goldmann applanation tonometry (GAT), and the Ocular Response Analyzer (ORA; Reichert Corp, Buffalo, NY). The GAT readings were obtained before automated readings and were adjusted for CCT using 4 different correction formulae. Discrepancies between GAT and CCT-corrected GAT readings were evaluated after stratification into thin, intermediate, and thick CCT groups. The IOP measurements from GAT, the ORA, and CCT-adjusted IOP were compared against PDCT IOP measurements using Bland-Altman analysis.

MAIN OUTCOME MEASURES: Mean, 95% limits of agreement, and proportion of patients with IOP difference of 20% or more between PDCT IOP and each of GAT IOP, Goldmann-correlated IOP (IOPg), corneal-compensated IOP (IOPcc), and adjusted IOP using CCT-based correction formulae.

RESULTS: Average PDCT IOP values were higher than GAT, IOPg, IOPcc, and CCT-adjusted IOP. The GAT IOP readings demonstrated poor agreement with PDCT IOP (95% limits of agreement, ± 4.7 mmHg); however, IOPg, IOPcc, and adjustment of GAT IOP with CCT-based formulae resulted in even poorer agreement (range of 95% limits of agreement, ± 5.1 to 6.7 mmHg). If PDCT was used as the reference standard, there was a 26% to 39% risk of making an erroneous IOP adjustment of magnitude of 20% or more at all levels of CCT. This risk was greatest in the patients with thicker corneas (CCT, ≥568 μm).

CONCLUSIONS: Adjusting IOP using CCT-based formulae resulted in poorer agreement with PDCT IOP when compared with unadjusted GAT IOP. If PDCT is the closest measure we have to intracameral IOP, there is a risk of creating clinically significant error after adjustment of GAT IOP with CCT-based correction formulae, especially in thicker corneas. This study suggests that although CCT may be useful in population analyses, CCT-based correction formulae should not be applied to individuals.
