

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

Park SJ, Ang GS, Nicholas S, Wells AP.

Eye Department, Wellington Hospital, Capital and Coast District Health Board, Wellington, New Zealand.

**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 (IOP<sub>g</sub>), corneal-compensated IOP (IOP<sub>cc</sub>), and adjusted IOP using CCT-based correction formulae.

**RESULTS:** Average PDCT IOP values were higher than GAT, IOP<sub>g</sub>, IOP<sub>cc</sub>, and CCT-adjusted IOP. The GAT IOP readings demonstrated poor agreement with PDCT IOP (95% limits of agreement,  $\pm 4.7$  mmHg); however, IOP<sub>g</sub>, IOP<sub>cc</sub>, and adjustment of GAT IOP with CCT-based formulae resulted in even poorer agreement (range of 95% limits of agreement,  $\pm 5.1$  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,  $\geq 568$   $\mu\text{m}$ ).

**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.

Ophthalmology. 2012 Mar;119(3):443-9. Epub 2011 Oct 27.

PMID: 22035576 <http://www.ncbi.nlm.nih.gov/pubmed/22035576>