CORNEAL THICKNESS MEASUREMENT IN THE MANAGEMENT OF PRIMARY OPEN-ANGLE GLAUCOMA: A REPORT BY THE AMERICAN ACADEMY OF OPHTHALMOLOGY

Dueker DK, Singh K, Lin SC, Fechtner RD, Minckler DS, Samples JR, and Schuman JS. Ophthalmology. 2007;114:1779–1787.

Research Objective

To evaluate published literature to assess whether central corneal thickness (CCT) is a risk factor for the presence, development, or progression of glaucomatous optic nerve damage related to primary open-angle glaucoma (POAG).

Study Design

Literature analysis.

Funding Source

None listed.

Relevant Methodology

A PubMed literature search limited to English language articles conducted on November 15, 2004 retrieved 195 articles. These abstracts were reviewed and 57 were selected to review in full text to determine relevance to the assessment questions. A further 24 studies of interest were identified from periodic updates to the literature search, surveillance of the literature, and reference lists of reviewed articles. The articles were rated according to the strength of evidence by the panel methodologist. A level I rating was assigned to well-designed properly conducted randomized clinical trials or similar quality-validated cohort studies with appropriate reference standards. A level II rating was assigned to well-designed case-control studies, exploratory cohort studies, and other nonrandomized clinical studies lacking consistently applied reference standards. Each study was also graded as positive if it supported a statistical association of CCT with the risk of having or developing glaucomatous optic nerve damage or as negative if no such association was found.

Results

There is strong and consistent levels I and II evidence that CCT is a risk factor for progression from ocular hypertension to POAG. Studies that were rated as providing the highest quality of evidence revealed mixed results with respect to glaucoma prevalence. One population-based study (level II) showed a positive association, another larger study (level I) revealed an association of marginal significance, and 3 studies (all level I) found no association of CCT with POAG prevalence.

Conclusions

There is strong evidence that measuring CCT is an important component of a complete ocular examination, particularly for patients being evaluated for the risk of developing POAG. CCT measurement should be included in the examination of all patients with ocular hypertension. Although the evidence supporting the necessity of measuring CCT as part of screening for POAG or as a risk factor for glaucoma progression is not as strong, intraocular pressure (IOP) is the only modifiable risk factor in the treatment of glaucoma, and CCT has the potential to significantly impact IOP measurement by applanation tonometry in all patients.

Comment

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This technology assessment of the AAO is one of the strongest evidence-based findings in all of ophthalmology; the measurement of CCT is the standard of care for patients at risk for developing POAG, especially ocular hypertensives. The methodology, timing, and measurement of CCT should be carefully integrated into all practices that deal with glaucoma and the physician must ensure its reliability and accuracy. Even though the evidence is not as strong, measuring corneal thickness is also useful in established and new glaucoma patients, and refractive surgery cases. This practice may prevent excessive therapy in patients with a thick cornea, or under treatment in patients with a thin one.

In a perfect applanation world, there would be no correlation between CCT and IOP for the innate resistance to applane the cornea (that falsely elevates IOP) would always be cancelled by capillary attraction (that falsely lowers IOP). In the real world, corneal biomechanics and thickness vary more than Goldmann and Schmidt imagined and thus true IOP is not always known. Therefore, the thoughtful physician measures CCT and categorizes as thin, normal, or thick. The number is documented in the chart; the clinical plan altered as necessary and significance explained to the patient.

Because the biomechanical properties of the cornea vary and are difficult to measure, the IOP adjustment factor is unknown. Realize that the adjusted IOP is not written in stone and should only serve as a guide and is a gross oversimplification, albeit useful until technology improves.[1] [One estimate is to add or subtract 1 mm Hg for every 20 µm under or over 540 µm, eg, an IOP of 14 mm Hg in a 440 µm cornea is adjusted to 19 mm Hg, and noted on the chart as T_A 14 (19)].

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From a public health glaucoma detection viewpoint, the prevalence of thin corneas may lead to falsely low estimates of IOP especially in African Americans and Hispanics.[2]

The job of the OTA group is to define, clarify, and ultimately emphasize what is considered as solid ophthalmic care. The reports of the OTA are scrutinized by not only ophthalmologists, but by insurers, government agencies, and related healthcare providers. The evidence is overwhelming, thickness matters!

References

1. Brandt JD, Beiser JA, Kass MA, et al. Central corneal thickness in the Ocular Hypertension Treatment Study (OHTS). *Ophthalmology.* 2001; 108:1779–1788.
2. LaRosa FA, Gross RL, Orengo-Nania S. Central corneal thickness of Caucasians and African Americans in glaucoma and nonglaucomatous populations. *Arch Ophthalmol.* 2001;119: 23–27.