

NOT YOUR GRANDMA'S PUFF TEST



A review of corneal hysteresis.

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Many patients likely recall the days of the dreaded puff test, the form of pneumatic tonometry that had them stressing over their eye appointments. Today, another form of puff test has become relevant: the measurement of corneal hysteresis (CH). Recently, the importance of CH in determining the risk of glaucomatous progression has been a hot topic of discussion. As with all diagnostic information, CH has prompted ophthalmologists to question how this new puff test can facilitate clinical decision-making and, more importantly, whether the modality should be adopted in routine practice. This article provides a closer look at the use and utility of CH.

WHAT IS CH?

CH is a biomechanical parameter produced by the Ocular Response Analyzer (ORA; Reichert Technologies) and measured by a puff of air. CH is often described as a measurement of tissue elasticity but may more accurately be thought of as a measurement of tissue compliance.^{1,2} Using a puff of air, the ORA records two pressures: the pressure at which the cornea bends in and the pressure at which it returns to normal positioning. The measured change in pressure is called *corneal hysteresis*.^{1,3}

The cornea has a natural viscoelasticity that dissipates some of the energy from the pressure changes, which factors into the CH reading. Stiffer eyes are less able to dissipate this energy, which results in lower CH readings. This may be seen in patients

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with certain corneal diagnoses as well as in patients with high IOPs. Low CH is therefore associated with a diagnosis of glaucoma and faster disease progression.^{1,2}

It is important to note that, as with the introduction of any new diagnostic modality, there is some skepticism about the use of CH. Some studies suggest that CH may be only a weak surrogate marker for other biomechanical properties farther back in the eye that have yet to be clarified.⁴ Others maintain that CH may be associated with abnormal optic nerve head anatomy and that, because central corneal thickness (CCT) may have a more direct association with glaucoma development than CH, CCT should take priority.⁴

IS CH IMPORTANT?

Numerous studies have shown that CH is a useful and statistically relevant biomechanical risk factor for the progression of glaucoma. In a prospective study by Aoki et al, CH was found to be the most sensitive biomechanical factor in glaucomatous progression in patients with primary open-angle glaucoma (POAG).⁵ This finding has been repeated in various studies, further supporting the use of CH in

the risk stratification of patients with glaucoma. In addition, one study estimated that, for every 1 mm Hg reduction in CH, the risk of developing glaucoma increased by 21%.⁶ Based on these findings, CH should be a factor considered in glaucoma risk stratification and should be considered equally as important to risk stratification as CCT.

HOW CAN CH BE APPLIED TO PRACTICE?

Two large studies found the average CH of normal eyes to be between 10.24 and 10.70 mm Hg.^{7,8} Although there is no consensus on what qualifies as a low CH value, several studies suggest that a value of less than 10 mm Hg should raise concern regarding the development and progression of glaucoma.^{1,2,5,6}

A CH measurement may also help guide glaucoma treatment because patients with low CH tend to respond better to prostaglandin analogues and selective laser trabeculoplasty and because CH typically rises with effective treatment.² Additionally, CH readings may function as a tie-breaker when deciding whether to initiate therapy or continue to observe a patient who is suspected to have POAG.

CONCLUSION

The ORA ranges in price from \$8,500 to \$15,000, whereas a pachymeter costs only about \$2,500.³ Many institutions have not decided whether adding CH to their existing risk-stratification algorithm is worth the expense. However, knowledge of a patient's CH value may directly affect the treatment of their glaucoma, especially if the appropriate management strategy is unclear. Providers with access to the ORA may find its incorporation into POAG workups worthwhile. ■

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