Why Corneal Hysteresis is so important for Glaucoma

Glaucoma is the second leading cause of irreversible blindness in the world. The disease is **progressive** in nature, meaning that there is no definitive "beginning" and the condition will continually worsen over time. There is no cure for glaucoma but its progress can be slowed by treatment. Diagnosing glaucoma can be challenging because there are many risk factors and none of them are a silver bullet. The major risk factors are:

- IOP (which is a POOR prognosticator of glaucoma, but the only modifiable / treatable risk factor)
- Corneal Thickness (CCT)
- Age
- Family history of glaucoma
- Optic nerve characteristics (cup to disc ratio, notching, excavations, RNFL analysis, etc)
- PSD (Visual field pattern standard deviation - how bad are the visual field exam results)

Diagnosis can be especially difficult in Normal Tension Glaucoma "NTG", which is thought to make up 25-50% of glaucoma (IOP below 21 mmHg but patient has glaucoma). These patients slip through the cracks for years and years because they have normal or low IOP. A number of papers, including a very recent one, show that CH is the most significant correlate to presence of glaucoma in patients with NTG.

Doctors do not want to initiate medical treatment, due to expense and side effects, if it is not necessary. So it is common for patients to be monitored every 6 months or every year, sometimes for years or decades, before a doctor decides they have glaucoma. How do they decide? Unless one or two of the risk factors are extremely obvious (IOP of 40, for example) it usually comes down to seeing actual progression (ie: vision loss related to glaucoma). Of course, this is too late! Once you have the vision loss, you cannot get it back.

Once the diagnosis is made, the challenge is to determine how fast the patient will progress. Two glaucoma patients could be essentially identical from every point of view (IOP, CCT, age, etc) and one will progress rapidly while the other progresses slowly. This is a major concern for patients and physicians alike because the goal is to prescribe the lest aggressive, least invasive treatment required in order to maintain good vision for the life of the patient. More aggressive treatment (different drops, more drops, multiple drops, laser surgery, valves, trabeculectomy) is only explored if progression is rapid and / or does not seem to be slowing down.

How is rate of progression determined? By monitoring visual field examination results over time and extrapolating a progression rate from the data. So they are literally watching the patient go blind in order to see how fast they are going blind in order to determine if they need to get more aggressive with the treatment. It takes about 5-6 reliable visual field examinations in order to determine progression rate. These are usually done every 3-6 months. The word *reliable* is important because VF exam results are terribly noisy. Patients hate them because they take a long time and require intense concentration. Elderly patients do not demonstrate good repeatability on VF exams. As such, it is quite a challenge for physicians to properly identify progression rates. It takes a lot time and effort from both doctor and patient to figure out if patients are actually getting worse, and that will, *by definition,* require the patient to lose some vision in the process. This is why Corneal Hysteresis is so important. Studies show that it is associated with **progression**. More importantly, the prospective studies show that it is **PREDICTIVE** of **RATE** of **progression**.

So now, finally, we have a risk factor that can help doctors determine earlier which eyes will be more likely to progress more rapidly. So that diagnosis can be made earlier. So that treatment decisions can be made (or delayed) in a more timely manner. This is all about accuracy of diagnosis and treatment decision making earlier in the process to PRESERVE patient vision.

No other glaucoma risk factor has been shown to be related to rate of progression, that I am aware of.

So in summary, CH is predictive of progression. This will help diagnose patients early OR give a doctor more confidence not to treat. Once a patient is diagnosed, the CH measurement will help the doctor determine the course of treatment. Both of these facts will help preserve patient vision because glaucoma is progressive by nature and the earlier the intervention, the better the treatment outcomes.

And don't forget, along with the CH measurement ORA users get IOPcc as well. IOP of course is another key risk factor. As mentioned above, it is a poor prognosticator of glaucoma, but it is the ONLY modifiable risk factor. That is to say, it is all they can treat (lower the IOP with drops or surgery). After treatment is initiated, IOP is monitored closely to determine if the treatment is effective. IOPcc has been shown to be more associated with glaucoma than any other tonometer measurement. So IOPcc can also be very helpful in the diagnosis and management of glaucoma. This is especially important in patients who have had LASIK or other corneal surgeries (or pathologies) that modify the corneal biomechanical properties. In these eyes, Goldmann and other forms of tonometry can be wildly inaccurate (as much as 20 mmHg off from true pressure!). AND Corneal Hysteresis is not useful in these eyes as a predictive factor for glaucoma progression, since the biomechanics of the cornea have been altered. IOPcc should not be forgotten as a valuable tool for glaucoma risk evaluation.

So ORA really is a 1-2 punch for glaucoma diagnosis and monitoring!!