Glaucoma Update: New Tools and Treatment Options

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Research Grants:
- Topcon, Heidelberg

Why talk about glaucoma?

Projections for Glaucoma (2030-2050)

From 2010 to 2050, the number of people in the U.S. with glaucoma is expected to increase by more than double, from 2.7 million to **6.3 million**.

Disclosures

Optometry must be involved:

POAG incidence is expected to more than double by 2050, likely related to the aging Baby Boomer generation

- The projected increase in incidence of POAG from 2011 to 2050 cannot be attributed for by an overall increase in population

- Increase in POAG incidence from 2011 to 2050

- Increase in POAG incidence from 2011 to 2050

Topics

- New IOP Monitoring and Measuring:
  - iCare Home
  - Ocular Response Analyzer
  - Corneal Hysteresis

- New Medications:
  - Vyzulta
  - Rhopressa
  - Rocklatan

- Drug Delivery:
  - Bitmatoprost Ring
  - Travoprost

- Visual Fields

- Progression Analysis

- Perimetry
What do we know about IOP?

- 2 minutes from 6 IOP measures in one yr
- Out of 525,600 min in one year

IOP is Highest in the Nocturnal/Sleep Period

Out of Office IOP Fluctuation Increases Risk of VF Progression

<table>
<thead>
<tr>
<th>Relative Risk of Disease Progression</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diurnal IOP Range 3.11 mm Hg</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Diurnal IOP Range 5.4 mm Hg</td>
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</tbody>
</table>

5-6x Greater Risk


What is it?

- The iCare® HOME tonometer is a handheld, battery operated device that measures intraocular pressure (IOP) without the need for topical anesthetic.
- The device is intended as an adjunct for monitoring IOP of adult patients (self-use). The HOME tonometer is designed for use at home or on the go.

iCare HOME

- IOP, date, time, eye recognition (right/left) and measurement quality are all stored in the internal memory.
- Patient cannot view IOP readings.
- Data is transferred to a PC for further analysis by the prescribing physician.
New features: positioning light, automatic eye recognition system, series or single measurements, new user interface panel.

Rebound Technology

- Measurements take place in 0.1 seconds
- To be repeated 6 times in order to minimize deviation and to produce a calculated measurement value
- Whole procedure (6 eyes) takes about one minute
- Literature shows under measurement range of 0 to 3.4 mmHg

Rebound Tonometry is Safe

- No significant safety issues reported for the Icare® TA01 or ic100 tonometers with a large number sold worldwide (40,000+) and in the United States (11,000+)
  - In use by healthcare personnel with varying degrees of tonometer experience and some of which have little or no ophthalmic training.
- No significant safety issues reported for the Icare® HOME tonometer or its predecessor, Icare ONE: over 2,000 tonometers in use worldwide
  - Majority in Europe after Icare ONE received CE mark in late 2009 and was introduced in 2010.

Icare HOME Study:

- 171 patients
  - 10 (6%) stopped b/c of difficulty in using the device
  - 27 (16%) unable to achieve certification
- HOME and GAT were within 5 mmHg
  - 116 of 127 patients (91%)
  - MD of -0.33 mmHg (0-3 mmHg)
- No corneal abrasions or adverse events

+/- 5 mmHg Difference to GAT

Within Patient Reliability
Probes

**Patient Example: Stable IOP**

**VF Progression OD>OS, Single Med only**

**New Report:**

**Candidates for iCare HOME**

Asrani “Suggested” Guidelines:

- **Mild Glaucoma:**
  - Less than 5 mmHg
- **Moderate Glaucoma:**
  - Less than 4 mmHg
- **Severe Glaucoma:**
  - Less than 3 mmHg

- Glaucoma suspects and ocular hypertensives prior to initiating treatment
- Glaucoma patients disease progression and in office IOP that is at or near target IOP goals
- Stable glaucoma patients with high risk factors for progression
- Patients with poor compliance where additional IOP information may demonstrate critical need for laser or surgical procedure
- Patients who would benefit from having additional IOP information

No true Evidence Based Guidelines currently exist. Individual patient findings and risk factors must be considered.
How to put this into play:

- **iCare Home is available for purchase now**
  - There is no CPT code (not reimbursable)
  - Fee is charged to patient for use of device over a three (3) day period
- Practitioner and Staff are trained and “Certified”
- Patient is selected and is trained in office.
  - Approximately 10-20 minutes

Questions to still Answer:

Data Interpretation:
- Highest Peak IOP out of office?
- Higher Mean IOP?
- Highest Fluctuation of IOP?

Are there good clinical indicators for this test?
- What about “environmental” factors?
- Will it improve medication compliance?

Taking Glaucoma risk assessment to the next level:

**THE ROLE OF CORNEAL HYSTERESIS**

Ocular Response Analyzer
(Reichert)

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Section 1: Introduction to Corneal Hysteresis
Bioengineering of the Eye: Emerging Concepts

- Viscelastic tissue with complex, interconnected microstructure
- Geometrical attributes are not a surrogate for biomechanical properties
  - eg: CCT does not describe viscoelasticity
- The eye appears to be a mechanical structural continuum
  - Tissue properties may provide additional diagnostic information

Measure IOP at two different applanation points

Section 1: Introduction to Corneal Hysteresis

Hysteresis: Not a New Concept

- A measurement that characterizes response to application and removal of force (load/unload)
  - Found in materials or systems that do not instantly follow forces applied to them but react slowly, or dissipate a portion of the applied energy
- More than 7500 papers published on hysteresis in a variety of medical fields
  - Various tissues and structures (tendon, lung, arteries, etc)
  - The importance of corneal visco-elasticity had been discussed and explored (in-vivo) prior to the ORA

**Classic “Hysteresis Loop”**

- Sir James Alfred Ewing identified the phenomenon of hysteresis and coined the term in 1890
- Hysteresis Property: “More like a Shock Absorber and NOT just a Coil Spring”

CH: Average Values in Normal Subjects

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>CH (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>105</td>
<td>10.1 ± 1.8</td>
</tr>
<tr>
<td>UK</td>
<td>272</td>
<td>10.2 ± 1.2</td>
</tr>
<tr>
<td>China</td>
<td>125</td>
<td>10.8 ± 1.5</td>
</tr>
<tr>
<td>Japan</td>
<td>204</td>
<td>10.2 ± 1.3</td>
</tr>
<tr>
<td>Spain</td>
<td>88</td>
<td>10.8 ± 1.5</td>
</tr>
<tr>
<td>USA</td>
<td>44</td>
<td>10.5 ± 1.2</td>
</tr>
</tbody>
</table>

*CH units are mmHg

**CH: Risk Factor for Glaucoma**

- Low CH (<9 mmHg) = Higher Risk
- High CH (>12 mmHg) = Lower Risk
- Less significant RF contribution: CH 9-12 mmHg
- As with any RF, CH alone cannot be considered a definitive indicator of glaucoma, though it may be an indicator for further evaluation particularly in presence of other glaucoma risk factors

**Other Related Findings**

- Corneal hysteresis has been shown to be lower in various types of glaucomatous eyes in comparison to normal eyes; these include POAG, PACG, NTG, and pseudoexfoliative glaucoma.
- Low Hysteresis Associated with OAG and Visual Field Asymmetry
  - More sensitive than CCT or IOP
- Low-baseline corneal hysteresis is associated with a greater magnitude of IOP reduction following various glaucoma therapies including topical prostaglandin therapy and SLT.

**Corneal Hysteresis Studies:**

- CH is repeatable, typically with good correlation R/L
- No diurnal variation in normal eyes
- Small decrease with age (as with CCT)
- Appears to be valuable to repeat procedure
- CH is low with high (>30) IOP
  - And may rise after hypotensive therapy
- CH is low following LASIK (use IOP cc measure)
- CH is low in corneal pathology (Keratoconus)
- Neither of these suggest increased risk of glaucoma
**Why is CH relevant in Glaucoma?**

(Low) CH has been consistently shown to be independently and strongly associated with or predictive of glaucoma progression.

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**Corneal Hysteresis as a Risk Factor for Glaucoma Progression:**

**Conclusions:**

The CH measurements were significantly associated with risk of glaucoma progression. Eyes with lower CH had faster rates of visual field loss than those with higher CH.

The prospective longitudinal design of this study supports the role of CH as an important factor to be considered in the assessment of the risk of progression in patients with glaucoma.

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**Corneal Hysteresis and Progressive Retinal Nerve Fiber Layer Loss in Glaucoma**

**Conclusions:**

Lower CH was significantly associated with faster rates of RNFL loss over time.

The prospective longitudinal design of this study provides further evidence that CH is an important factor to be considered in the assessment of the risk of progression in patients with glaucoma.

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**CH Predicts the Development of Glaucoma**

**Conclusions:**

Baseline lower CH measurements were significantly associated with increased risk of developing glaucomatous visual field defects over time. The prospective longitudinal design of this study supports the role of CH as a risk factor for developing glaucoma.

200 Glaucoma Suspects followed for 4 years.

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**Ocular Response Analyzer Technology**

- 2002: Clinical research with ORA commences
- 2005: The 1st generation ORA was made commercially available
- 2012: Generation II ORA was launched
- 3rd Generation “ORA G3” introduced September 2015

**Measures:**

- Corneal Hysteresis (CH)
- Goldmann-correlated IOP (IOP<sub>g</sub>)
- Corneal compensated IOP (IOP<sub>cc</sub>)

**Interpretation of measurement values**

- Becomes a second tonometer for the office.
- Can be used on all patients.

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**Section 4: Ocular Response Analyzer Technology**

**Interpretation of measurement values**

- **Right:** 16.7 mmHg
- **Left:** 16.5 mmHg
- Waveform score: 9, which indicates a good measurement.
Glaucoma Update: New Tools

### IOPcc = Corneal Compensated IOP

- An IOP measurement that is less influenced by corneal properties than Goldmann or other tonometers.
- This value is closer to the “true pressure” and has been shown to be a better indicator of glaucoma than Goldmann.
- Matches GAT on average, so numerical “Scale” is the same
- Excellent for patients who have had LASIK

### ORA: Report Example

- IOPcc: 27.2
- IOPg: 26.8
- WS: 5.2
- CH: 9.0
- CRF: 12.6

### Special considerations:

In post-LASIK/refractive surgery and in Corneal Pathology (KC, Fuchs')
- CH is NOT a reliable indicator of glaucoma risk due to modified biomechanics
  - In these situations there is increased importance of IOPcc

There a need to educate ORA users for correct interpretation of CH values:
- Children have significantly higher CH values than adults, which should be taken into consideration when determining glaucoma risk
- CH values are artificially low with very high IOP (30+)

### Implementing ORA in Clinical Practice:

- ORA will NOT replace Goldmann tonometry
  - Advantageous to have different tonometric devices
- Evidenced based guidelines needed for low/medium/high CH values

### QUESTIONS:

- How often to repeat?
- How does the ORA best fit into practice workflow?
  - Screening room (eg, like an auto-refractor)
  - Or only on select patients?
- Where does ORA fit into the measurement process?
  - Prior to the patient getting into the chair

### How am I using ORA and Corneal Hysteresis?

- Obtaining CH on new glaucoma and glaucoma suspects
- Using IOPcc on LASIK patients
- Obtaining on progressing patients and other potentially high risk patients
- Adjusting therapy and management for patients with low CH

### CASE Example w/ CH
CASE BR

46 yo, Good Health
Negative Family History, Neg. Past Ocular History
Referred for High IOP OD
Slit Lamp + Gonioscopy = open to CB, No recession, light pigment, No PAS
GAT = 32 mmHg OD; 15 OS
CCT = 555 OD 564 OS

Corneal Hysteresis:
with IOP of 32 OD, will repeat when IOP is lower

Discussion and Management

• Initiated Treatment with Vyzulta OU
  • RTC 3 weeks
  • IOP 17 OD and 15

• RTC 2-3 months
• IOP is the same
• Good compliance no other issues
• Will f/u in another 2-3 months with VF test
Glaucoma Update: New Tools

6 months

- Timoptic
- Betagan
- Trusopt (1995)
- Alphagan 0.2%
- Pilocarpine
- Argon Laser

Glaucoma Care circa ______

- No OCT
- Fundus Cameras
- Polaroid or 35mm slide
- Encouraged “drawing” ONH
- Humphrey Perimeter
- STAPRECAT but No True Progression Analysis
- No Randomized Clinical Trial data had been published
- OHTS, EMGT, AGIS, CNTGSG

New Combinations/ Formulations

- Cosopt
- Lumigan 0.03%; 0.01%
- Travatan; Travatan Z
- Alphagan P 0.1%
- Azopt

- Combigan
- Simbrinza
- Zioptan (preservative free PGA)
- Cosopt PF

No new mechanism of action (MOA)*

*Rescula (unoprostone) 2000 and 2012. Likely activity on BK channels in TM

New Therapies for OHTN/Glaucoma

- **Vyzulta™**
  - Latanoprostene bunod
  - FDA Approved, Available NOW
- **Rhopressa™**
  - Netarsudil
  - FDA Approved, Available NOW
- **Rocklatan™**
  - Netarsudil + latanoprost
  - Files to FDA early 2018, expected Spring 2019

Vyzulta™ (latanoprostene bunod)

- Latanoprostene bunod is a dual mechanism, dual pathway molecule, consisting of latanoprost acid, linked to an **Nitric Oxide-donating moiety**, which enhances trabecular meshwork/Schlemm’s canal (conventional) outflow by inducing cytoskeletal relaxation.

- Latanoprost plus nitric oxide (NO)

Latanoprostene Bunod (LBN):

**MOA**

- **Latanoprostene**
  - latentropost
  - Increases uveocleral outflow

- **Bunod** donates Nitric Oxide (NO)
  - Effects its effect in trabecular smooth muscle
  - Resulting in trabecular relaxation and increased conventional outflow

Nitric Oxide may have other therapeutic roles in the eye and optic nerve
Latanoprostene Bunod (LBN):
Mechanism of Action

- Latanoprostene = latanoprost
- Increases uveoscleral outflow
- Bunod donates Nitric Oxide (NO)
- Exerts its effect in trabecular smooth muscle
- Resulting in trabecular relaxation and increased conventional outflow
- NO is normal produced by the TM
- Glaucoma Patients have decreased levels of NO.

Study Design: APOLLO Study¹,²

Phase 3, randomized, multicenter, double-masked, parallel-group study in patients with open-angle glaucoma or ocular hypertension

Primary Objective:
- Evaluate noninferiority of VYZULTA 0.024% OD in the evening vs timolol maleate 0.5% BID in patients with open-angle glaucoma or ocular hypertension

Primary Endpoint:
- IOP measured at 9 assessment time points in study eye

Secondary Endpoints:
- CFB in IOP at 9 assessment time points
- CFB in diurnal IOP at Week 2, Week 6, and Month 3

Vyzulta Superior to Timolol

Mean IOP Reduction of 7.5 to 9.1 mmHg from Baseline³

Adverse Reactions in APOLLO and LUNAR

- Low rate of discontinuation due to ocular AR ¹,²

Most Common Ocular Adverse Reactions in the APOLLO and LUNAR Studies

- Vyzulta 3.9%
- Timolol 8.6%

- Vyzulta:
  - 2.8% ocular hypertension
  - 2.6% eye pain
  - 1.3% ocular irritation

- Timolol:
  - 2.8% ocular hypertension
  - 2.2% eye pain
  - 1.3% ocular irritation

Glaucoma Update: New Tools

**VOYAGER:** Phase 2 Study of LBN vs Latanoprost

- Nocturnal IOP with latanoprostenebunod treatment was 2.5 mmHg lower than baseline (Liu J et al. Am J Ophthalmol 2016;)

**Jupiter Study:** Japan (normal tension)

In the long term JUPITER study, treatment with VYZULTA resulted in a reduced mean IOP of 14.4 mmHg at 12 months

**LBN provides nocturnal IOP lowering**
- Nocturnal IOP with latanoprostenebunod treatment was 2.5 mmHg lower than baseline (Liu J et al. Am J Ophthalmol 2016;)

**24 Hour Supine Ocular Perfusion Pressure**

**Vyzulta 0.024% once daily for OHT/OAG**
- Latanoprost with New MOA with Nitric Oxide of improving TM outflow
- More effective (~1.23 mmHg) than latanoprost
- 7.5-9.1 mmHg lower IOP
- Side Effects
  - Conj. Hyperemia= 6%

**Potential Roles of Vyzulta:**
- **First Line Therapy**
  - Alternate/Replacement for latanoprost/PGA
  - Good for all? Better for those with more advanced disease? Better for those with lower IOP?
- **Switch/Adjunctive Therapy**
  - When small additional IOP is needed, advantage of maintaining single bottle therapy
  - PGA w/ adjunctive med and not @ target
  - Switch to LBN w/ adjunctive
- No data on adjunctive therapy role
CASE LP

- 43 year old male
- Referred for Open Angle Glaucoma
- Without Elevated IOP
- Positive Family History

Clinical Background:

- IOP
  - First Visit: 21 OD and 21 OS
  - Second Visit (AM appt) 22 OD and 22 OS
- CCT / Pachymetry
  - 481 OD and 487 OS
- Corneal Hysteresis:

Low CH: 7.9 / 8.6

Treatment:

- Started Vyzulta, one drop bedtime, both eyes
- First follow up @ 2 weeks:
  - 14 mmHg OD and 14 mmHg OS (from 22)
    - -36%
  - No side effects, doing well
  - 8 week follow up next
Rhpressa: netarsudil 0.02%

**INDICATION**

RHOPRESSA® (netarsudil ophthalmic solution) 0.02% is a Rho kinase inhibitor indicated for the reduction of elevated intraocular pressure in patients with open-angle glaucoma or ocular hypertension.

**Dosage and Administration:** The recommended dosage is one drop in the affected eye(s) once daily in the evening.

RhoKinase Inhibitors (ROCK)

- **Netarsudil - MOA:**
  1. ROCK causes alteration of cellular components of the trabecular meshwork and Schlemm’s canal; rho kinase inhibitors decrease resistance in the trabecular meshwork outflow pathway and promote reduction of IOP.
  2. ROCK inhibition lowers EVP
  3. NET inhibition lowers AH production

Rho Kinase Inhibitors Improves Trabecular Meshwork Outflow

Lowers Episcleral Venous Pressure (EVP)

Rhpressa 3-Month Safety Profile

- The most common ocular AEs observed in controlled clinical studies with Rhopressa® was conjunctival hyperemia, which was reported in 53% of patients.
- Other ocular adverse reactions (~20%) in these clinical studies included cornea verticillata, instillation site pain, and conjunctival hemorrhage

<table>
<thead>
<tr>
<th>Adverse event</th>
<th>Rhopressa® (0.02%)</th>
<th>Comparator (0.5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Discomforts</td>
<td>100 (67%)</td>
<td>33 (22%)</td>
</tr>
<tr>
<td>Cornea Verticillata</td>
<td>66 (24.5%)</td>
<td>3 (0.9%)</td>
</tr>
<tr>
<td>Corneal Hemorrhage</td>
<td>58 (10.5%)</td>
<td>11 (3.2%)</td>
</tr>
<tr>
<td>Uveitis</td>
<td>26 (0.4%)</td>
<td>51 (1.4%)</td>
</tr>
<tr>
<td>Felon</td>
<td>12 (0.3%)</td>
<td>10 (0.3%)</td>
</tr>
<tr>
<td>Other Store Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infection Site</td>
<td>63 (25.5%)</td>
<td>12 (2.5%)</td>
</tr>
<tr>
<td>Infection Site Uveitis</td>
<td>52 (21.5%)</td>
<td>10 (2.1%)</td>
</tr>
<tr>
<td>Administration Site Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infection Site</td>
<td>30 (13.3%)</td>
<td>10 (2.1%)</td>
</tr>
</tbody>
</table>

The corneal verticillata seen in RHOPRESSA®-treated patients were first noted at 4 weeks of daily dosing. The reaction did not result in any apparent visual functional changes in patients. Most corneal verticillata resolved upon discontinuation of treatment.

Conjunctival hyperemia

was either not reported or reported as mild in about 9 out of 10 patients

Corneal verticillata

was seen under biomicroscopy, did not result in an apparent change in functional vision, and resolved in many patients upon treatment discontinuation

Conjunctival hemorrhage

was graded as mild in more than 90% of cases
**Rhopressa: none to mild hyperemia 89%**

**Potential drug of choice as adjunctive therapy to PGAs when additional IOP lowering is desired**

*Adjunctive studies have NOT been completed*

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**Rhopressa’s Role in Glaucoma**

**Rhopressa™ Advantages**

- Efficacy vs. other adjunctive therapies
- QD PM dose
- Lack of serious and systemic drug-related AE’s

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**Mercury 1 = Netarsudil + Latanoprost**

- According to the study,
  - 82% of Roclatan patients achieved an IOP of 18 mm Hg or less compared with...
  - 57% of patients who received netarsudil and
  - 68% of patients who received latanoprost.
- Data from Mercury 1 show Roclatan to have a consistent safety profile over 12 months of treatment

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**Corneal Verticillata and Conj. Hemorrhage**

- Does not affect vision, Resolves when d/c
- Transient

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**What’s Next? Rocklatan**

- Netarsudil and Latanoprost 0.02%/0.0005%
- Fixed Dose Combination
- PDFUFA date March 14, 2019

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**Emerging Glaucoma Drug Delivery Options:**

- Long duration of medication delivery
- 3 to 6 months or more
- Obviously compliance benefits
- Good safety profiles thus far
- Good efficacy compared to drop therapy
- Retention for some devices may be a challenge
- Injection delivery for other devices is a hurdle
The Bitmatoprost Ring Insert

- Large silicon ring that sits in the fornix
- Visible at medial canthus
- Helps identify ring
- Sustained drug delivery for 6 months
- 20% IOP reduction at all time points in clinical trials
- Slightly less than timolol BID
- PGA continuous dose effect

Bitmatoprost Ring

- High Retention Rate
  - 93% @ 3 months
  - 88% @ 6 months
- Minimal Discomfort

Side Effects:
- Ring:
  - Increased mucous in AM
- Medication:
  - Hyperemia, etc.

Phase 3 Trials continue

Bitmatoprost SR (Sustained Release)

- Phase II Clinical Trial Results
  - January 2018
  - ~10% IOP lower for 12 months

Phase 3 Trials now

iDose: travoprost 12m delivery system

Ocular Therapeutix: Travoprost Intra-canicular Insert

Visual Field Testing

Remains an essential exam component.
In fact, indications for more frequent testing on patients.
Humphrey Matrix 800

Standard W‐on‐W

Pulsar for Early Glaucoma

Oculus Easyfield

Small, compact and portable.

Humphrey® Field Analyzer (HFA)

HFA 3

- A long term favorite for perimetry
- SITAFAST™ proprietary computerized analysis tool to simplify visual field interpretation
- Decades of validation
- Enhancements to the gold standard platform to further improve patient care:
  - Glaucoma Progression Analysis (GPA) expert tool to improve decision making
  - SITA Faster

SITA‐FASTER™:

- SITA Faster testing takes about two‐thirds of the time required by SITA Fast and about half the time required by SITA Standard.
- Test time reductions are largest in eyes with severe field loss and by about one‐third compared to SITA Fast.
- Many patients are able to complete SITA Faster 24‐2 testing in about 2 minutes.
- (SITA Faster is only available for 24‐2).
- Clinical testing has shown that SITA Faster produces results that are clinically equivalent to SITA Fast with no loss of repeatability.
Central Visual Fields and Glaucoma
- Recent papers have suggested that the 24-2 test pattern has limited ability to detect central field defects
- 50% of retinal ganglion cells are found within 4.5mm of fovea
- Macula region comprises only 10% of overall visual field area though it is responsible for 60% of area of visual cortex
- Damage to central 10° associated with diminished contrast sensitivity, reduced reading ability

Macular Zone Vulnerability

24-2 Pattern on Retinal Surface
VF testing under samples the macula. Possibility of small defects going undetected

Central Field Testing: 10-2 vs 24-2

The Central Field in Glaucoma: Q's
- Does the 24-2 detect functional vision loss in the central 100 in all cases?
- Points in test grid are 60 apart in a grid pattern
- Is there a role for a complementary test such as the 10-2 in which 55 points are placed in a 100 area that are 20 apart?
- Will this detect small scotomas that fall between the cracks?
- Is glaucoma a disease that involves the macula region early in the condition?
Are 10-2 VFs Really Helpful??

- Not so Fast!
- Two Recent Studies suggest similar detection rate 10-2 vs 24-2
- 82% central defects identified on the 24-2

How and when use 10-2 VFs

- Good Test Takers, Younger patients
- Minimal to no defects on 24-2
- OCT Macula/Ganglion Cell scan is abnormal
- High Risk Patients
- Be Selective for High Risk Patients

CASE MW

56 yo Asian F
Referred in for “Large Cupping”
IOP = 18 mmHg OD, OS
CCT = 591, 601

Referral Notes

- OCT Macula/Ganglion Cell scan is abnormal
- High Risk Patients
- Be Selective for High Risk Patients
Glaucoma Update: New Tools 2019

Michael Chaglasian, OD

What diagnoses do clinical findings suggest?

How do you evaluate large discs?

How to you manage OCT abnormalities without visual field defects?

How important is Corneal Hysteresis?

Would additional IOP information be helpful?

Structure Function

Corneal Hysteresis:
normal/average ~10 mmHg

OCT

Discussion

THOUGHTS?
Glaucoma Update: New Tools

IOP over 20 mmHg Not Detected

Is my patient getting worse? How can I tell for certain?

Variability in perimetric testing Challenges of structural assessment

Newer Question: What is the rate of progression? Can we quantify this?

Baseline exams. Establishes initial visual field status.

VFI Rate of Progression Analysis. Trend analysis of patients overall visual field history

Today's Visual Field. Complete report of current visual field exam including PD, VFI, progression analysis and GPA Alert.

Detecting progression remains one of the most difficult tasks in glaucoma Mx

One Example: It can be hard to distinguish disease progression from exam variability and/or aging changes

There is no consensus on the best technique or criteria to detect progression, or what amount would be clinically significant.

Research and Literature does not easily translate into daily clinical care.

Progression may be measured by:

- Functional change in visual field; structural change in the optic disc or retinal nerve fiber layer; or combined functional and structural change.

Accomplished through clinical examination, ophthalmoscopy, threshold perimetry, and imaging.

“Nuance” of Glaucoma

Michael Chaglasian, OD
**Variability in Visual Field Progression Rates: EMGT**

- **Avg. rate** = -1.0 db/yr
- **HighTG** = -1.31 db/yr
- **NormalTG** = -0.36 db/yr
- **ExfoliativeG** = -3.13 db/yr

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**Detecting Visual Field Progression in Glaucoma**

Factors Impacting Progression Measure

- Long Term Fluctuation
- Reliability
- Confirmatory Testing
- Ability to Efficiently Review the Data

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**Key Points:**

- Some rates of progression put patient at risk of visual disability
- Most do not follow this path
- Estimated ~ 17% of patient (even under care)

**Fast Rates of Progression**

- > 0.5 - 1.0 dB per year or higher (varies w/ age)

However, slower rates in younger patients are still at risk due to longer life with disease.


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**Event analysis**—compares baseline to most recent data; change as dictated by criteria has occurred or not.

**Trend analysis**—looks at the significance of rate of change over time. Identifies progression by looking at patient behavior over time. Uses all data points and a linear regression formula. Weakness—progression is not necessarily linear.

**Event analysis and trend analysis are complementary.**

- Without event analysis, we have no early detection of glaucoma or early detection of progression in patients having glaucoma diagnoses.
- Without rate analysis, we have no ability to decide if detected changes are clinically significant.
What Rate of Loss is Significant?

Greater than: \( \sim 1 - 1.5\% / \text{yr} \) (vary w/ age, loss at Dx, etc.)

-0.1%

-1.4%

Point By Point Progression Analysis
- Shows which points have progressed from baseline

Event Progression Analysis
- Highlights test points deteriorating by more than the random variability typically found in perimetrically experienced glaucoma patients.

GPA Summary Report:
- Trend Line looks okay,
- Event Analysis is NOT!

Thanks

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