Shining a new light on the macula: its emerging role in glaucoma

No financial conflicts to report

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Clinical assessment of optic nerve and VF

And accumulating evidence indicates that both structural & functional macular involvement is present throughout the spectrum of glaucoma

Evolution to OCT-RNFL

Recently, new focus on the macula

Case Example

So why might the macula be involved in early glaucoma?

The macula contains 50-60% of all retinal ganglion cells
The central 8 degrees contains one third of all ganglion cells

Research support for macular involvement in glaucoma

1. Disturbed visual function in early glaucoma
2. Strong structure/function relationships
3. Excellent diagnostic precision for glaucoma

Visual Dysfunction Evidence

Acquired B-Y color vision defects occur in early glaucomatous process -- likely represents macular ganglion cell dysfunction

Visual adaptation to changing contrast is altered in glaucoma

Recent studies show that CENTRAL VISUAL FIELD LOSS is common even in early glaucoma

Structure/function relationship

Macular structure and central visual function are better correlated than RNFL thickness and 24-2 visual function

Specifically....

- Several studies have shown that partial/inner macular thickness parameters carry similar diagnostic capability compared to RNFL thickness parameters
- Total macular thickness underperforms versus RNFL with one exception
  - Macular thickness asymmetry parameters compare favorably with RNFL diagnostic capability
1. Macular compromise is associated with central visual field loss and central vision loss is closely related to QOL
2. Measurement of macular thickness with SD-OCT is fast, precise, reproducible
3. Current 24-2 pattern poorly samples central field

Anatomic, Structural, and Functional evidence all support the premise that the macula is involved in ALL stages of glaucoma

When should MT be utilized?
1. Diagnostic uncertainty
   - Early stages/suspects
   - Anomalous optic nerves
   - Differential diagnosis efforts
2. Examine structure/function relationship in more detail
3. Enhance risk assessment
4. Corroboration of other dx findings

When should macular thickness measurement be considered?

When should macular thickness measurement be considered?
Corroborating other dx findings
- Confirm structure/function relationship

Enhance risk assessment

Prevalence and nature of early glaucomatous defects in the central 10° of visual field

Examined 100 eyes
1. Glaucomatous optic neuropathy
2. 24-2 Mean Defect better than −6dB
10-2 visual fields performed
1. Classified abnormal by hemifield cluster criterion
   - at least 3 contiguous pts at 5,5,1% or 5,2,2%
2. Pattern of abnormality also investigated

Central visual field defects in glaucoma (Traynis et al)

RESULTS

Of 100 eyes with glaucomatous optic neuropathy:
Abnormal 10-2 hemifields: 53%
Abnormal 24-2 hemifields: 59%
16% of eyes with normal 24-2 were classified abnormal on 10-2
Superior defects more common, deeper, and closer to fixation

Initial arcuate defects within the central 10 degrees in glaucoma.

Examined 12 eyes with arcuate visual field defects on 10-2 testing but ...
NO visual field loss on 24-2 testing
Examined structure/function relationships using SD-OCT maps and 10-2 VF tests

Mean db loss all subjects

Structure/function map

Mean db loss all subjects

The 24-2 only samples the central 10° field with the inner 4 to 12 points.
**Examples of 10-2 glaucomatous visual field loss**

**Examples of 10-2 glaucomatous visual field loss**

**Who is at risk for central visual field loss?**

Exchanged 69 eyes with isolated initial parafoveal scotoma (IPS)

Exchanged 53 eyes with isolated initial nasal step (INS)

Clinical characteristics and systemic factors compared between groups

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**RESULTS**

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Parafoveal scotoma progression in glaucoma: 10-2 versus 24-2 analysis


Included 50 eyes with isolated initial parafoveal scotoma (IPS)

Evaluated progressive changes on 24-2 and 10-2 (at least 5 of each tests)

**RESULTS**

Mean follow-up period/number of tests similar for 10-2 and 24-2 (5.7 years, 7.7 tests)

10-2 detected 24 eyes with progression (48%)

-- 17 of the 24 missed on 24-2 (71%)

24-2 detected 11 eyes with progression (22%)

-- 4 of the 11 missed on 10-2 (36%)

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10-2 vs 24-2 progression in eyes with IPS

(Park SC et al. Ophthalmology 2013)

**RESULTS**

These results suggest 10-2 has greater utility than 24-2 in patients with IPS

May or may not extrapolate to eyes with parafoveal scotoma that is not initial finding

Results suggest that BOTH tests are needed

-- versus a revised testing algorithm that allows simultaneous testing of central and peripheral visual field

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Clinical Implementation of 10-2

When should this test be considered?

- Diagnostic uncertainty
- Early stages of disease/glaucoma suspects ("pre-perimetric")

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Clinical Implementation of 10-2

When should this test be considered?

- Compromise of MVZ
**Clinical Implementation of 10-2**

**When should this test be considered?**

- Profile c/w "normal-tension glaucoma"
- Disc hemorrhage

**Advantages of 10-2**

1. Increases diagnostic confidence
2. Enhances risk assessment
3. More robust structure/function correlation
4. Better reproducibility than 24-2
5. Better sampling of central field than 24-2
6. Faster/easier test to perform than 24-2
7. May detect progression better than 24-2 when central visual field is involved
8. Better correlation with symptoms

10-2 disadvantages

- Logistics: when and how often to use
- No commercially available progression software

**Clinical Implementation of 10-2**

**When should this test be considered?**

- Corroborate other findings

**Summary....macular thickness for glaucoma**

- **MT Advantages:**
  - Better reproducibility than RNFL parameters
  - Less anatomic variability
  - Better correlation with symptoms
  - Better structure/function correlation

- **MT disadvantages**
  - Samples only 50% of RGC's
  - Similar diagnostic capability to RNFL
  - Progression tools not well developed yet

**MT provides great complementary value....but doesn’t replace other structural measures**
Summary......10-2 for glaucoma

**10-2 Advantages:**
- Better sampling of central field than 24-2
- Faster/easier test to perform than 24-2
- Good structure/fxn relationship with MT
- May detect progression better than 24-2 when central visual field is involved

**10-2 disadvantages**
- Logistics: when and how often to use
- No commercially available progression software

10-2 provides unique information that can be very valuable for glaucoma diagnosis, monitoring, and risk assessment.

CONCLUSION

- Macular structure and central visual function are involved in **ALL STAGES** of glaucoma

10-2 provides unique information that can be invaluable for glaucoma diagnosis, monitoring, and risk assessment.

THANK YOU