



CHAIR-SIDE REFERENCE: STRUCTURE-FUNCTION RELATIONSHIP IN GLAUCOMA

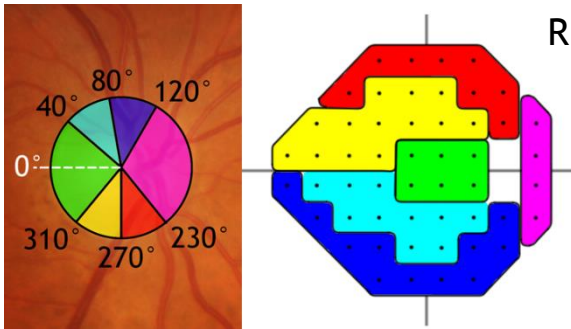
Glaucoma is an optic neuropathy presenting with characteristic loss of the neuroretinal rim, retinal nerve fibre and retinal ganglion cells. These structural findings are frequently observed with corresponding defects on visual field testing, and therefore in conjunction with other clinical signs and examination findings, structure-function concordance should herald high suspicion of glaucoma. This reference provides considerations for evaluating the presence of structure-function concordance in clinical settings. While the focus of this chairside reference is glaucoma, principles may be applied in other optic nerve and inner retinal pathologies resulting in visual field defects.

STRUCTURE-FUNCTION RELATIONSHIP USING THE 24-2 VISUAL FIELD GRID

The 24-2 visual field test grid evaluates the central 54 degrees of the visual field, extending to 30 degrees from fixation nasally, and is the mainstay technique for assessing the visual field in glaucoma.

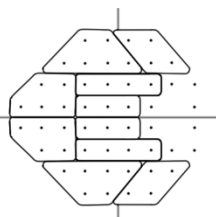
Garway-Heath Model

This model was developed from retinal nerve fibre layer projections based on retinal photography and is frequently utilised to match both neuroretinal rim and retinal nerve fibre layer (RNFL) from OCT to visual field results. For more information, see Garway-Heath et al. 2000 Ophthalmology.



Neuroretinal rim sectors corresponding to locations in the 24-2 visual field. Sectors can also be applied to RNFL thicknesses.

Note that while the demarcated zones resemble those in the Glaucoma Hemifield Test (GHT), these are not identical. It is therefore the GHT is not considered an accurate measure of structure-function concordance.

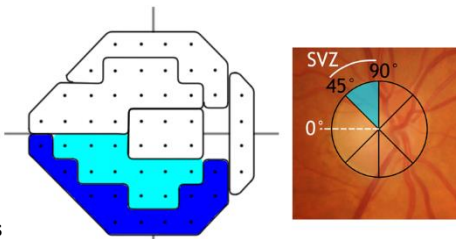


Map of GHT Zones (Asman & Heijl 1992 Arch Ophthalmol)

Locations Vulnerable to Glaucomatous Damage

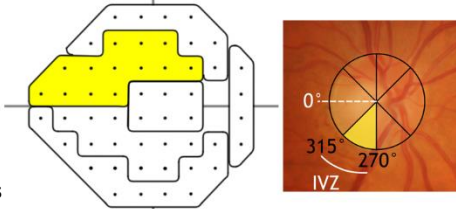
Superior vulnerability zone (SVZ): superior structural loss results in inferior visual field defects

- Inferior nasal step
- Inferior arcuate loss



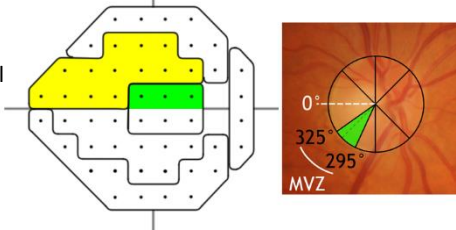
Inferior vulnerability zone (IVZ): inferior structural loss results in superior visual field defects

- Superior nasal step
- Superior arcuate loss



Macular vulnerability zone (MVZ): inferotemporal structural loss results in superior paracentral visual field defects

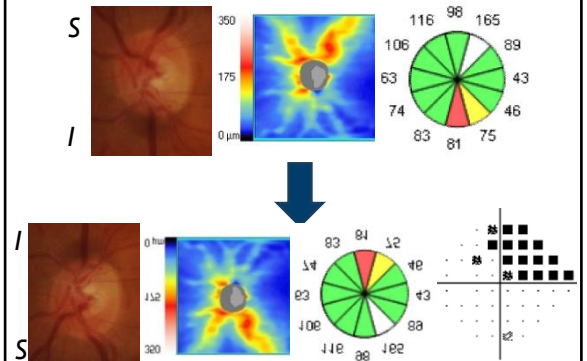
- Superior nasal step less common



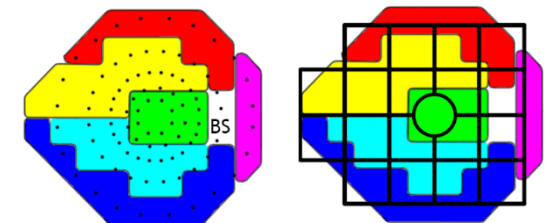
The above are adapted from Hood et al. (2013 IOVS) and Hood (2017 PRER)

Tips on Interpretation

Vertically flip fundus photos and OCTs before matching to visual field results



Principles can be loosely applied to other visual field test grids



Medmont glaucoma test (points within central 44° only, adjusted for scale)

Matrix



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FACTORS CONTRIBUTING TO VARIATION IN THE STRUCTURE-FUNCTION RELATIONSHIP

Inappropriate Sampling Density of Visual Field Test Points

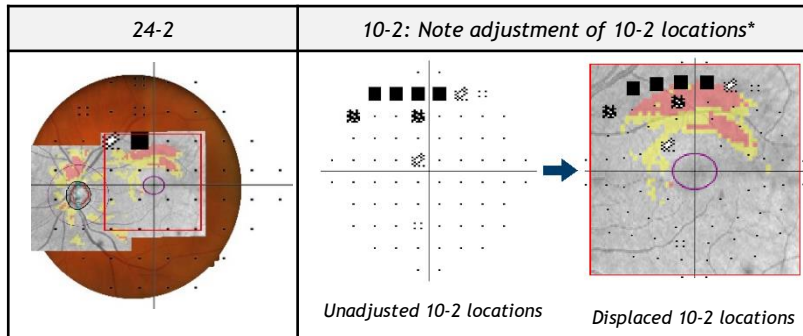
a. Macula

Macular OCT analyses e.g. ganglion cell analysis (GCA) and ganglion cell complex (GCC) and central visual fields testing e.g. 10-2 are helpful in determining concordance between structure and function centrally. Paracentral visual field defects do not always appear to match structural loss with other tests due to:

- Excessive spacing between test locations
- Difficulty visualising associated RNFL loss due to the small MVZ

Due to the shift in ganglion cells secondary to Henle's fibres forming the foveal pit, central visual field locations need to be adjusted to match corresponding structural locations. * Note that peripheral 10-2 locations are not covered by macular OCT analyses due to differences in testing area.

In this example, macular ganglion cell loss appears as a borderline visual field defect on 24-2 and a corresponding superior visual field defect on 10-2.

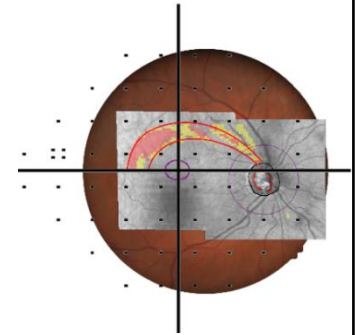


* Adjustment of visual field locations only applies for inner retinal diseases

b. Slit RNFL Defects

Very thin or slit RNFL defects may fall between visual field test locations. Structure and function may not match in these circumstances, but this does not mean there is no corresponding functional loss.

In cases of slit RNFL defects visible within the macular region, central visual fields testing (e.g. 10-2) may be helpful to confirm whether there is associated functional damage.



ANATOMICAL VARIATIONS RESULTING IN ALTERED RNFL TRAJECTORY

Atypical disc insertions, locations and sizes, frequently observed in high myopia, often present with alterations in RNFL trajectory which will affect the corresponding visual field location. Examples include temporal shift of RNFL bundles and rotation of RNFL trajectory in relation to the foveal location.

