Ability of Spectral-Domain Optical Coherence Tomography to Predict Humphrey Visual Field Defects in Patients With Open-Angle Glaucoma

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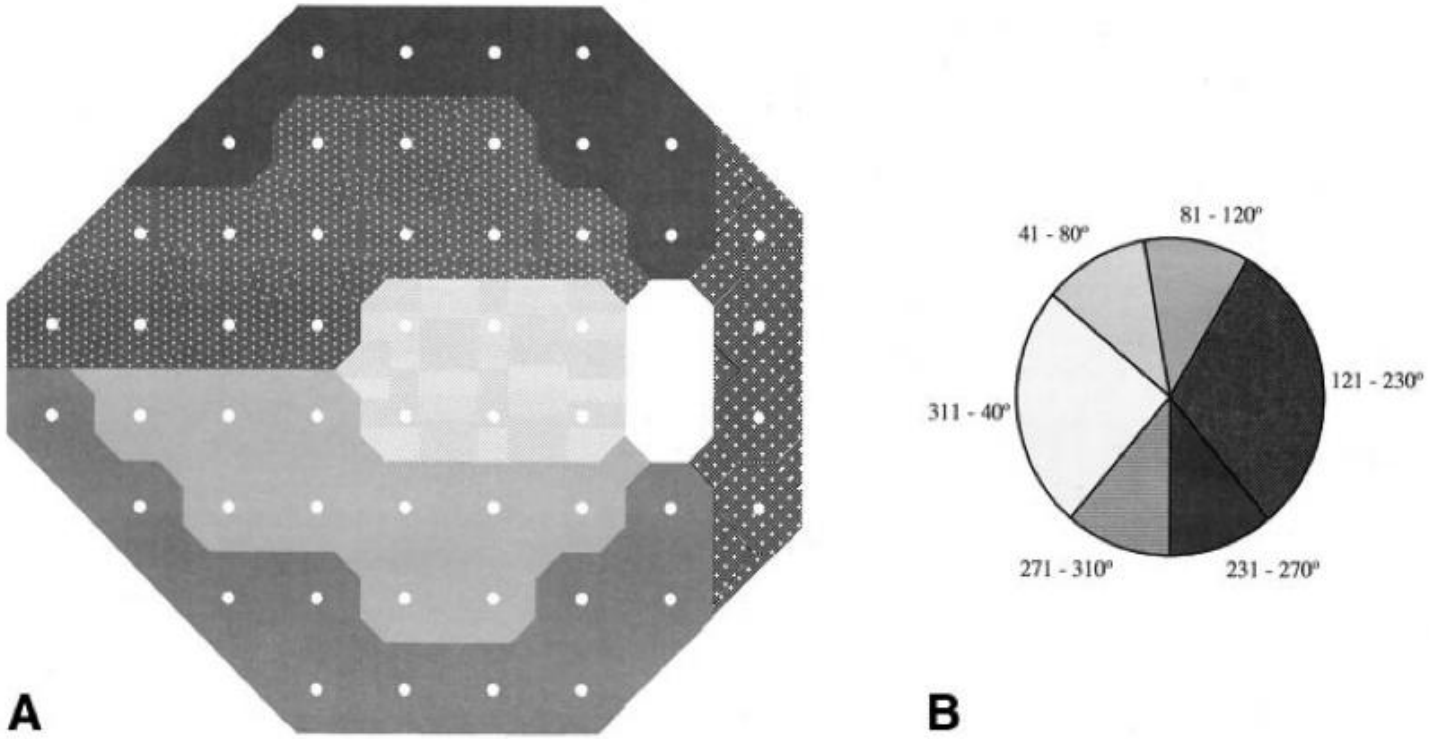
Background

- Diagnosis and assessment of progression of glaucoma—**No single examination method** is adequate
- Clinical decision are based on identification of typical **structural** and **functional** evidence of damage
- Functional Loss: **Automated perimetry→** gold standard
- **Limitations of Automated Perimetry:**
    - Subjective test: short and long term fluctuations
    - No clear criteria for glaucoma progression
    - Time consuming
    - Highly dependent on baseline
    - Large number of tests are needed to confirm progression event
    - Structural damage precedes functional damage

Background

- Time Domain OCT→ Spectral Domain OCT (2007)
  - SD-OCT: faster speed, higher axial resolution, more reliable, more info
- Recent literature has examined SD-OCT parameters regarding reproducibility, diagnostic ability, and ability to detect glaucoma progression.
- However, **no studies** have attempted to correlate visual field defects with sectorial neuroretinal rim measurements (quadrant and clock hour).
- **Clinical Question:** Can a specific visual field defect be predicted based on SD-OCT parameters? (NRR measurements at certain clock hours)



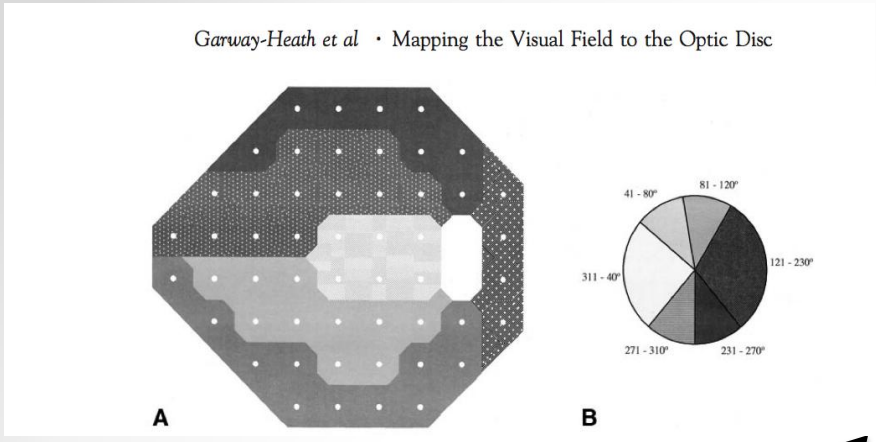
Garway-Heath DF, Poinoosawmy D, Fitzke FW, Hitchings RA. Ophthalmology 2000;107:1809 –15.

Methods

- Retrospective, Single Center, Single MD
- Glaucoma patients from Sep 2011 - March 2013 who had HVF and OCT RNFL within 3 months
- Inclusion Criteria:
  - BCVA >20/40, SE between -10 and +6, normal anterior segment on SLE, Open angle on gonioscopy, ONH with glaucomatous changes (increased C/D Radio and NRR narrowing),
- Exclusion Criteria
  - +concurrent retinal disease (e.g. ARMD, vascular disorder), optic nerve disease other than glaucoma, a brain disorder than could influence VF results, OCT Signal strength <6
- VF: only reliable tests (false positives <15%, FN <15%, fixation loss <20%), **minimum of two tests**
- **Define defects**: (i.e. Superior vs. Inferior, Arcuate, Nasal Step, etc.)
- "Controls": Glaucoma suspects with reliable, full HVF
- **Hypothesis**: Patients with visual field defects in a specific region will have NRR thinning at the corresponding clock hours

Results

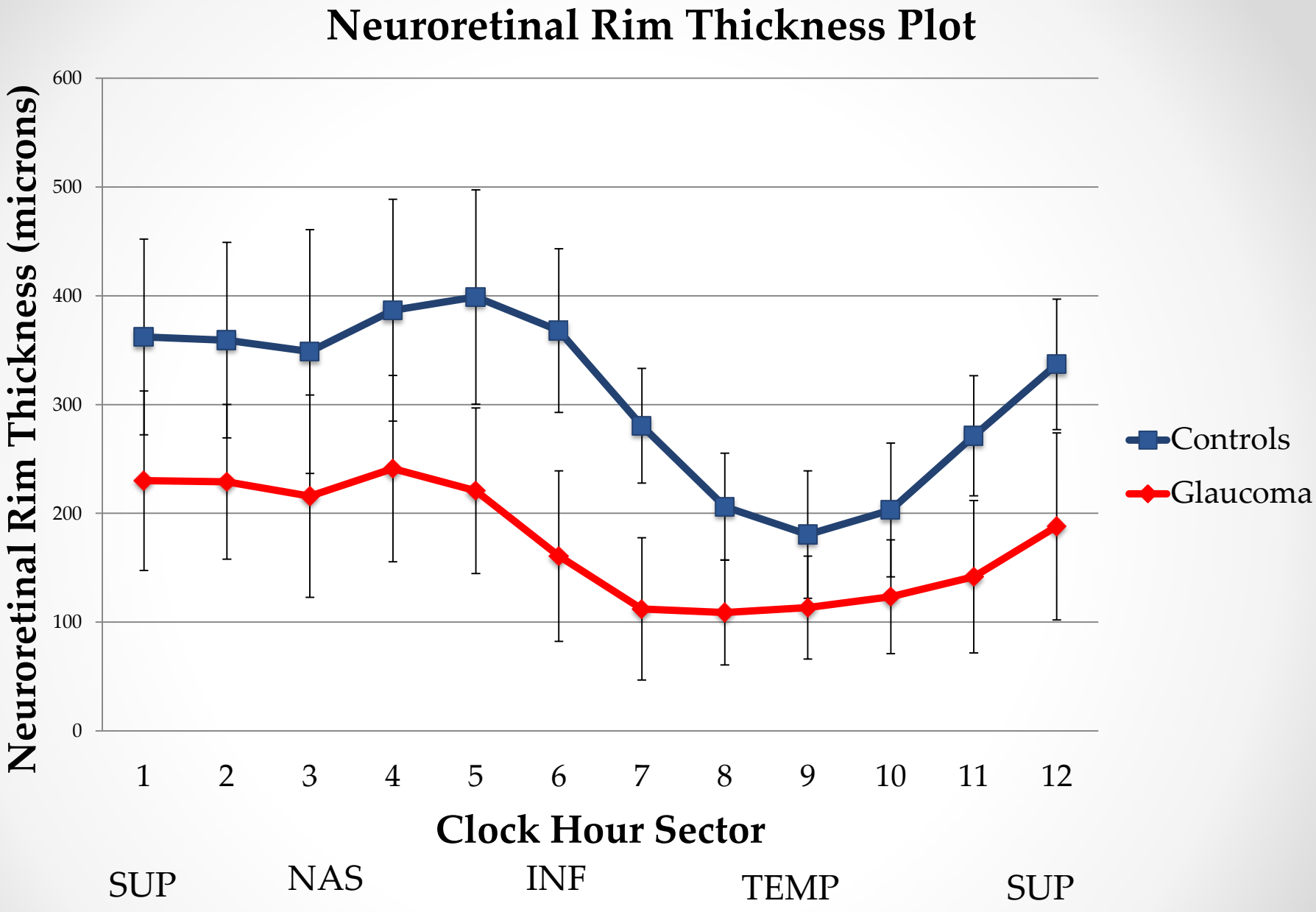
	Control (n=30)	All Glaucoma (n=33)	P
Age (years)	55.58 ± 12.57	67.48 ± 11.32	0.0002**
IOP (mm Hg)	17.1 ± 3.25	16.6 ± 4.76	0.61
MD (dB)	(-)0.203 ± 1.54	(-)8.23 ± 5.73	<0.0001**
PSD (dB)	1.775 ± 0.434	6.34 ± 2.37	<0.0001**
Disc Area (mm^2)	2.13 ± 0.43	1.96 ± 0.40	0.103
Average C/D	0.61 ± 0.10	0.75 ± 0.13	<0.0001**
Vertical C/D	0.57 ± 0.11	0.76 ± 0.13	<0.0001**
Total NRR area (mm^2)	1.28 ± 0.24	0.73 ± 0.22	<0.0001**
Average RNFL	91.38 ± 10.87	66.33 ± 13.01	<0.0001**



Glaucoma Group

- Superior VF Defects only
- Inferior VF Defects only
- Miscellaneous VF Defects (e.g. Paracentral scotomas Mixed scotomas)

	Control (n=30)	Superior Defects (n=18)	Inferior Defects (n=6)	P1 (Control vs. Sup)	P2 (Control vs. Inf)
Age (years)	55.58 ± 12.57	66.44 ± 9.23	76.67 ± 8.88	0.005**	0.0005**
IOP (mm Hg)	17.1 ± 3.25	15.44± 4.10	18.17 ± 6.08	0.124	0.552
MD (dB)	(-)0.20 ± 1.54	(-)8.71 ± 5.06	(-)6.16 ± 3.84	<0.0001**	<0.0001**
PSD (dB)	1.77 ± 0.43	7.39 ± 2.91	5.48 ± 3.34	<0.0001**	<0.0001**
Disc Area (mm^2)	2.13 ± 0.43	2.06 ± 0.38	1.62 ± 0.37	0.57	0.103
Average C/D	0.61 ± 0.10	0.78 ± 0.08	0.63 ± 0.23	<0.0001**	0.7752
Vertical C/D	0.57 ± 0.11	0.78 ± 0.09	0.62 ± 0.22	<0.0001**	0.3516
Total NRR area (mm^2)	1.28 ± 0.24	0.70 ± 0.19	0.82 ± 0.26	<0.0001**	0.0002**
Average RNFL	91.38 ± 10.87	63.67 ± 10.95	70.83 ± 13.14	<0.0001**	0.0003**


Neuroretinal Rim Thickness Plot
Neuroretinal Rim Thickness (microns)
600
500
400
300
200
100
0
1
2
3
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11
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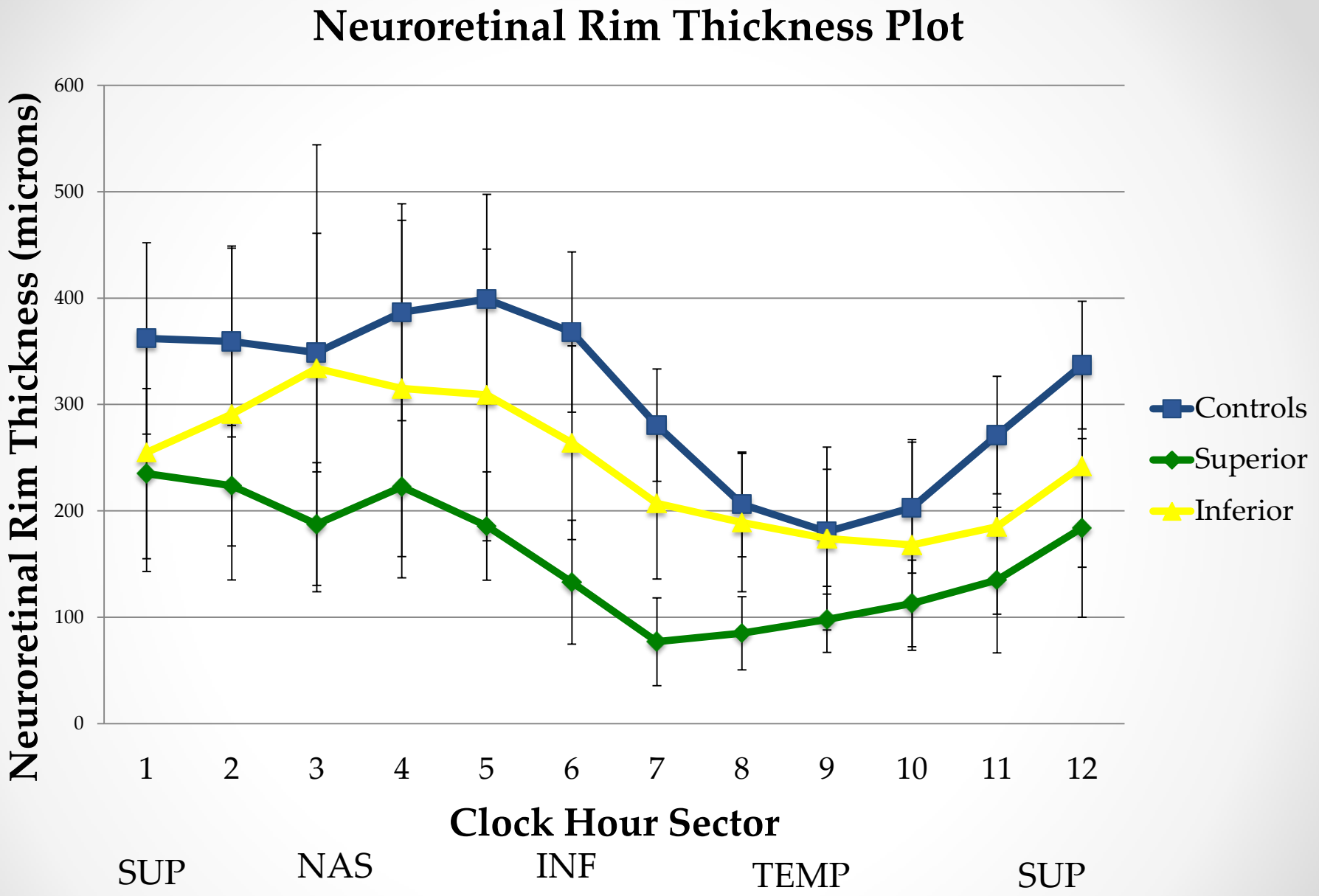
Clock Hour Sector
SUP
NAS
INF
TEMP
SUP
Controls
Glaucoma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11
12
Clock Hour Sector
SUP
NAS
INF
TEMP
SUP
Controls
Superior
Inferior

Discussion

- OAG Patients with VF defects have statistically significant NRR thinning **at all clock hours** vs. controls
- In patients with localized VF defects (e.g. superior vs. inferior), **no statistically significant focal NRR thinning in corresponding area of Disc** compared to non-corresponding areas.
- **Conclusion:** NRR clock-hour measurements are helpful in predicting whether or not a glaucoma patient will have a visual field defect, but they do not appear to reliably predict the type of defect.
- **Limitations:** Retrospective study, Low statistical power, small sample size, Studies indicate at least 3 HVF's needed to confirm a true defect, "Controls" not a true control group, Structural damage precedes functional, NRR Clock hour measurements only represent a single point

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