

Glaucoma Advances and Updates

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Disclosures

Has a relevant financial relationship with
Sanofi - Speaker
EyePromise- Employee

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Glaucoma Overview

- Group of ocular disease- Progression
 - Can damage optic nerve and lead to vision loss if left untreated^[a]
 - Leading cause of irreversible vision loss
 - Second leading cause of preventable blindness, after cataracts^[b]
- Asymptomatic until later stages, when significant and irreversible visual impairment has already taken place^[c]
- Up to 50% of all glaucoma cases remain undiagnosed^[c]



a. CDC. [Vision Health Initiative](#). Reviewed November 24, 2020. Accessed May 15, 2023; b. Pereira IC, et al. Eye. 2021;35:3202-3221; c. Tappay L, et al. Patient Prefer Adher. 2021;15:1477-1489. Image by Philippin N, et al. Community Eye Health Journal. 2012;25:52.

3

Glaucoma Prevalence and Risk Factors

- > 70 million people worldwide have glaucoma^[a]
- Includes ~3 million Americans^[b]

Glaucoma can affect anyone, but certain groups are at higher risk!

Patients at higher risk for glaucoma^[a]

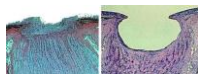
- All people aged > 60 yr
- Black people aged > 40 yr
 - 6 to 8 times higher risk vs White counterparts
- People with a family history of glaucoma
- People with diabetes
 - Risk doubled vs individuals without diabetes

a. Pereira IC, et al. Eye. 2021;35:3202-3221; b. CDC. [Vision Health Initiative](#). Reviewed November 24, 2020. Accessed May 15, 2023.

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Glaucoma an epidemic/ endemic

- Glaucoma in USA more than **3 million**;
- Ocular hypertensive 4.5% of population >40 age
- Glaucoma suspects 4 times more than glaucoma
- worldwide 76 million 2020 ; 111.8 by 2040



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Diagnosis

- 50% undiagnosed
- Over diagnosed in clinics
- How can it be both?

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Intraocular pressure

-  Diagnosis- not helpful
-  Treatment- only proven method
-  Progression- very closely associated with IOP
-  Risk factor- without a doubt most important risk factor
-  In fact, the only alterable risk factor!

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Ocular Response Analyzer

- ▶ IOPG - Goldmann Correlated IOP
- ▶ IOPCC - Corneal Compensated IOP
- ▶ CH - Corneal Hysteresis



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Ocular response analyzer

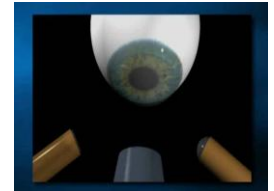
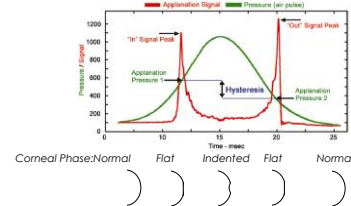


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Applanation Signal Plot



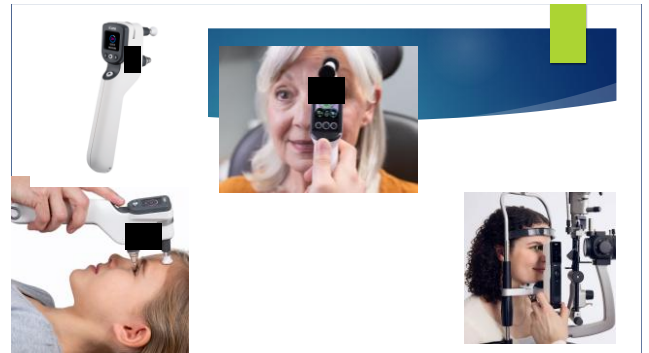
"Dynamic bi-directional applanation"



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Rebound tonometers

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A Comparative Study of the Hand-held IC200 and Slit Lamp-mounted ST500 rebound tonometers with Goldmann Applanation Tonometry

Ryo Tomita MD,¹ Glen P. Sharpe MSc,¹ Devin Betsch MD,¹ Rodolfo Boratti MD,¹ Belwanray C. Chauhan PhD,¹ A. B.

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<https://doi.org/10.1016/j.ogla.2024.10.008>

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Excellent intraclass correlations

- 156 participants
- Age 45-72 years
- Average CCT 553 microns
- IOP range GAT 8.5-53 mmHg
- Median IOP 17.1

Conclusions: The ST500 shows **good agreement** with **GAT over a large range of IOP** and significantly higher repeatability compared to the IC200 and GAT, suggesting it may be advantageous in clinical settings where topical anesthesia or skilled staff are unavailable.

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> Ophthalmol Glaucoma. 2024 Nov 30;5(2589-4196):400215-1. doi: 10.1016/j.ogla.2024.11.008. Online ahead of print.

Agreement between the Icare HOME tonometer and the Goldmann Applanation Tonometry in the assessment of the Peak Intraocular Pressure in the Water-Drinking Test

Carolina N. Suzanna,¹ Fernando N. Suzanna,² Laura Goldfarb Cyrino,² Renato Antonio Schiavo Gernero,² Remy Suzanna Jr.,² Pradheep Y. Ramulu,² Marcelo Hatanaka,²

Affiliations: + expand

PMID: 39622413 DOI: 10.1016/j.ogla.2024.11.008

Results: The agreement between Icare and Goldmann Applanation Tonometry was high during the WDT: the intraclass correlation coefficient (i) between the two methods from basal to 45 min: 0.94 (p < 0.001), at basal: 0.91 (p < 0.001), at 15 min: 0.94 (p < 0.001), at 30 min: 0.94 (p < 0.001), at 45 min: 0.95 (p < 0.001) and for peak IOP: 0.94 (p < 0.001). There was no significant difference between peak IOP with GAT and Icare: 18.3 ± 4.6 (10-33) and 18.5 ± 5.0 (0-33) (p = 0.533), nor between the delta of fluctuation between basal and peak IOP with GAT and Icare: 3.96 ± 3.22 and 4.54 ± 3.92 (p = 0.054).

Conclusion: Our study demonstrated a **high agreement between Icare HOME and Goldmann Applanation Tonometer during the WDT** in a clinical environment with supervision.

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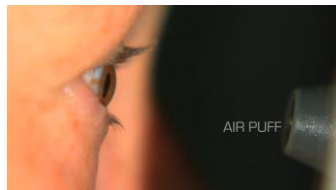
Rebound tonometer

- ▶ When to use? - Screenings
- ▶ Why?
- ▶ When not to use? Glaucoma patients except for childhood glaucoma
- ▶ Concerns ?
 - ▶ Can't be used when wearing contact lenses

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Disinfection of tonometers

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NCT

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RESEARCH ARTICLE

Increased microbial loading in aerosols produced by non-contact air-puff tonometer and relative suggestions for the prevention of coronavirus disease 2019 (COVID-19)

Hui Guo¹, Wei Li¹, Yingying Huang¹, Xinyan Li¹, Zhi Li¹, Hongqin Zhou², Enhua Guo¹, Li Li¹, Jiahong Li^{1,3*}

doi: 10.1016/j.ogla.2024.11.008

ORIGINAL RESEARCH

Quantitative Evaluation of Aerosol Generation from Non-contact Tonometry and its Correlation with Tear Film Characteristics

Wenling Huo¹, Jiafeng Wu¹, Xinyang Zhao¹, Dandan Long¹, Jinghui Yu¹, Haosheng Cao¹, Yan Wang²

Quantitative High-speed Assessment of Droplet and Aerosol From an Eye After Impact With an Air-puff Amid COVID-19 Scenario

Rohit Sharma¹, MD, PhD, FRCN¹, Nabil Beldarsham¹, MD¹, Susan Sheriff¹, MD¹, Naveen Sharma¹, MD¹, Praveen Kulkarni¹, PhD¹, Dharshini Res¹, MSc¹, Nisha M. Joseph¹, MSc¹, Pooja Khanna¹, MD, PhD¹, Sagarika Bora¹, PhD¹ and Abhishek Sharma¹, PhD¹

Effect of Intraocular Pressure on Aerosol Density Generated by Noncontact Tonometry Measurement

Yuan Tang, MS¹, Chunchun Li, MS¹, Yanyan Chen, MS¹,
Zhangyuan Chen, MS¹, Peihua Zhang, BS¹, Aimin Wang, BS¹,
Xiaoqiong Huang, PhD¹, Jia Qu, OD, PhD¹, Mengchen Li, MS¹,
Siyen Ma, MS¹ and Balaramani Vasudevan, PhD²

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Summary

Author	device	results	Main results
Gua H, PloS one (2020)	Nidek NCT	Aerosols produced	Alcohol and air disinfection UV
Hao W Adv Ther (2021)	-	Aerosols produced	Aerosols coagulate as they spread; 50 cms safe distance <1.0 micron; PPE recommended
Shetty R J of Glaucoma (2020)	Shin-Nippon NCT 200	No droplet in natural setting; Large droplets 100-500 micron considered	When excess tears (artificially induced droplets seen)
Tang Y J of Glaucoma (2020)	Canon NCT	≤ 2.5 micron, <10 micron; Aerosols produced	IOP level can determine aerosolization; next to air jet concentration highest

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Disposable tips- Goldmann tonometer

- ▶ 10% Bleach soak 5-minutes and wash with water and let dry...effective against most microbes
- ▶ No disinfectant technique works against prions.



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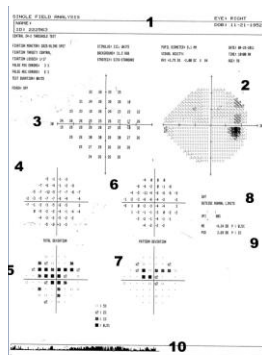
Visual fields

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Criteria for glaucomatous damage

- 1) GHT outside normal limits
- 2) PSD < 5% of normal individuals
- 3) A cluster of three or more **non-edge** points (pattern deviation plot) all of which are depressed at a $p < 5\%$ and one of which is depressed at a $p < 1\%$ on two occasions (respecting horizontal meridian)
 - ▶ This criterion was written for 30-2, if 24-2 field is analyzed edge points are included.
 - ▶ Criteria should be met on 2/3 issues mentioned above
 - ▶ Confirmed on two occasions!

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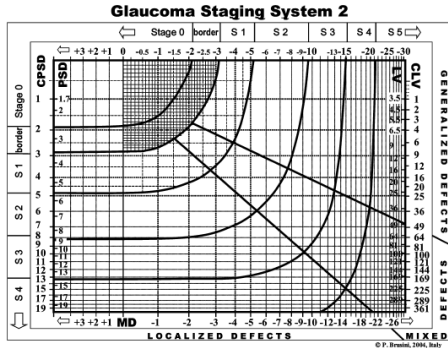


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Staging based on MD

- ▶ Better than -6 db- Mild
- ▶ Worse than -6.0 dB but better than -12 dB – Moderate
- ▶ Worse than -12.0 dB severe

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Staging POAG

Stage/Severity	Symptoms/Signs
1 - Suspected	✓ IOP ≥ 22 mm Hg ✓ Asymmetry of vertical C/D ratio (> 0.2 between the 2 eyes) ✓ Suspect appearance of the optic disc ✓ Suspected central-field defect
2 - Mild (early)	✓ Slight glaucomatous changes in the cup (C/D ratio ≤ 0.65 for an optic nerve of average diameter) ✓ Slight visual-field defect outside the central 10°
3 - Moderate	✓ Moderate glaucomatous changes in the cup (C/D ratio $0.7-0.85$) ✓ Moderate visual-field defect outside the central 10°
4 - Advanced	✓ Significant glaucomatous changes in the cup (C/D ratio ≥ 0.9) ✓ Visual-field defect within the central 10°

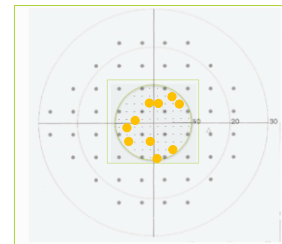
C/D, cup/disc.
Fontaine N, et al. [Scientific Reports](#). Published 2013. Accessed June 6, 2023.

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Advances in perimetry

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Resulting SITA Faster 24-2C Pattern on HFA3



The 24-2C test pattern combines all 24-2 points + ten selected 10-2 points (shown in OD orientation)

Large Gray	24-2 pattern
Large Orange	Ten additional 24-2C points
Small Gray	10-2 pattern

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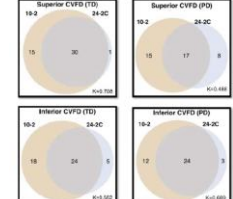
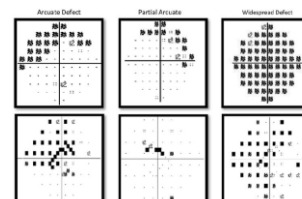
Thresholding requires time

- ▶ 62 points in 3 minutes or so.
- ▶ Is SITA Faster too fast?
- ▶ Can it threshold reliably?

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Agreement Between 10-2 and 24-2C Visual Field Test Protocols for Detecting Glaucomatous Central Visual Field Defects

Tatui Chakravarti, MD,*† Mohamad Moghadam, MD,*
James A. Pruss-Frost, MS,* Robert N. Weinreb, MD,*
Christopher Bowd, PhD,* and Linda M. Zangwill, PhD*



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Agreement Between 10-2 and 24-2C Visual Field Test Protocols for Detecting Glaucomatous Central Visual Field Defects

Tatui Chakravarti, MD*†, Mohamad Moghadam, MD*
James A. Proudfoot, MS*, Robert N. Weinreb, MD*
Christopher Bowd, PhD*, and Linda M. Zangwill, PhD*

Conclusion: Substantial agreement for identifying CVFDs using the 24-2C and 10-2 protocols suggests that combining tests by adding central test points to the 24-2 test grid may supplant the need for 2 perimetry regimens for detecting central and peripheral glaucomatous VF damage.

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New 24-2C SITA Faster protocol

- ▶ Free upgrade if you have HFA III
- ▶ Gives more macula points.
- ▶ Results comparable to 24-2 SITA FAST
- ▶ Thresholds are ± 3 dB
- ▶ Gives you some macula information
- ▶ You need 10-2 if damage is noticed in macula region

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Virtual reality
perimetry- Are
you ready for
prime time?

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How do I
correlate
structure and
function ?

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ARVO JOURNALS

From: The Structure and Function Relationship in Glaucoma: Implications for Detection of Progression and Measurement of Rates of Change
Invest. Ophthalmol. Vis. Sci., 2012;53(11):4939-4946. doi:10.1167/iovs.12-10345

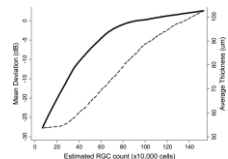


Figure Legend:

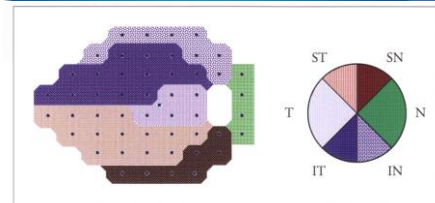
Relationship between MD, average RNFL thickness measurements, and estimated RGC counts. At early stages of damage (high RGC counts), changes in estimated RGC counts correspond to relatively smaller changes in MD (continuous line) and relatively larger changes in average RNFL thickness (dashed line). At advanced stages of damage (low RGC counts), changes in estimated RGC counts correspond to relatively large changes in MD, but only small changes in average RNFL thickness.

Date of download: 8/15/2016

The Association for Research in Vision and Ophthalmology. Copyright © 2016. All rights reserved.

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Structure function correlation



Perimetry Update 1998/1999, pp. 381-389

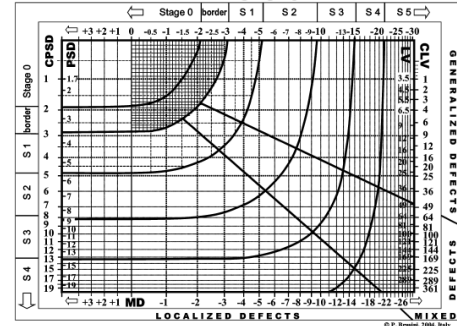
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Staging glaucoma

- Mean deviation – cataract not clinically significant (clinical judgement in dilated evaluation)
- MD
- Early < -6.00 dB
- Moderate > -6.00 to < -12.00 dB
- Severe ≥ 12.00 dB

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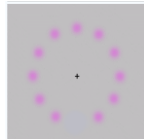
Glaucoma Staging System 2



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Points to remember during fields testing

- Same light levels as calibration
- Patch fellow eye well
- Pupil at least 3 mm; consistently do the same thing
- Explanation, explanation, explanation
- Mask will fog lens; tape the mask
- Breaks will save you repeat testing (@2 minutes)
- Ptosis, dermatochalasis –Tape and lubricate
- Lens close to eye but should not touch eyelashes



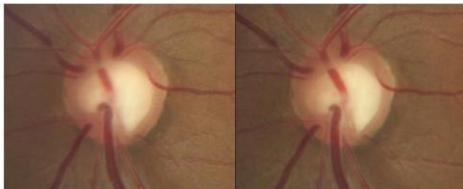
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Structure and OCT- 92133

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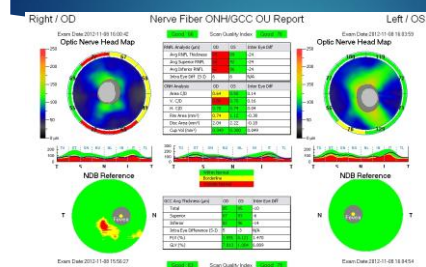
Gold standard

- Simultaneous stereo photography!
- Problems?



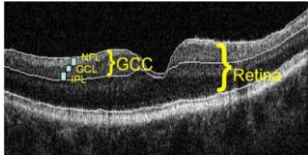
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Case



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Ganglion Cell Complex (GCC)- 92133

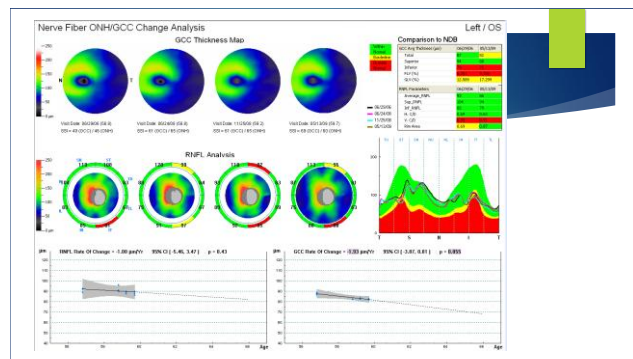


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Progression

- ▶ Consensus is limited
- ▶ Visual fields tend to fluctuate in early glaucoma
- ▶ Reliable and repeatable structural measurements is very valuable
 - ▶ Fourier domain OCT 5 microns accuracy.

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Slow progressors VS fast VS non glaucoma

- ▶ Progressing rapidly in monthno major spike in IOP...possibly not glaucoma or at least some thing more
- ▶ Look at nerve carefully signs of pallor... neurological testing, pupils, color
- ▶ If definitely glaucoma by criteria discussed before
- ▶ Then consider the following...
- ▶ 6-OCT scans in 2 years

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Six-Scans in 2 years

- ▶ Helps determine if this person is progressing (really glaucoma)
- ▶ Helps identify rate of progression (with much greater accuracy)
- ▶ Accuracy much more than once or twice a year
- ▶ Fast versus slow progressors....
- ▶ Determine if your treatment options are correct....

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Blood pressure and Glaucoma

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Independent risk factors

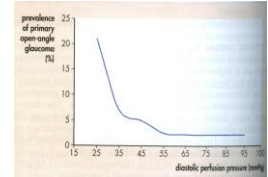
- ▶ Low Diastolic blood pressure
- ▶ Low Mean Ocular Perfusion Pressure
- ▶ Low Diastolic Perfusion Pressure
- ▶ Measure Blood pressure after 5 minutes being seated
- ▶ Measure BP twice, 5 minutes apart
- ▶ If SBP was 10 mmHg or DBP was 5mmHg different measure 3rd time
- ▶ Average two measurements that are the closest.

Zheng et al. IOVS 2010

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Systemic hypertension and glaucoma

- ▶ Blood pressure and pathogenesis of glaucoma
 - ▶ Hospital based study
 - ▶ Baltimore Eye Survey examined perfusion pressure
- ▶ Diastolic perfusion pressure= DBP-IOP



Tielsch et al Hypertension perfusion pressure and primary open angle glaucoma Arch ophthalmol 1995

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Mean Ocular perfusion pressure- Elevated IOP

- ▶ $MOPP = \frac{2}{3} [DBP + \frac{1}{3}(SBP - DBP)] - IOP$.

Blood pressure

IOP	120/80	120/70	120/60	110/70	110/60	100/60
22	40.2	35.7	31.3	33.5	29.1	26.8
24	38.2	33.7	29.3	31.5	27.1	24.8
26	36.2	31.7	27.3	29.5	25.1	22.8
28	34.2	29.7	25.3	27.5	23.1	20.8

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Mean Ocular perfusion pressure- "Normal IOP"

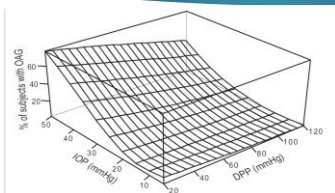
- ▶ $MOPP = \frac{2}{3} [DBP + \frac{1}{3}(SBP - DBP)] - IOP$.

Blood pressure

IOP	120/80	120/70	120/60	110/70	110/60	100/60
18	44.2	39.7	35.3	37.3	33.3	30.8
16	46.2	41.7	37.3	39.3	35.3	32.8
14	48.2	43.7	39.3	41.3	37.3	34.8
12	50.2	45.7	41.3	43.3	39.3	36.8

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Perfusion pressure and IOP



Zheng et al. IOVS 2010

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Summary perfusion pressure

Greater the IOP lower the blood flow

Elevated IOP with Lower blood pressure - Bad combination

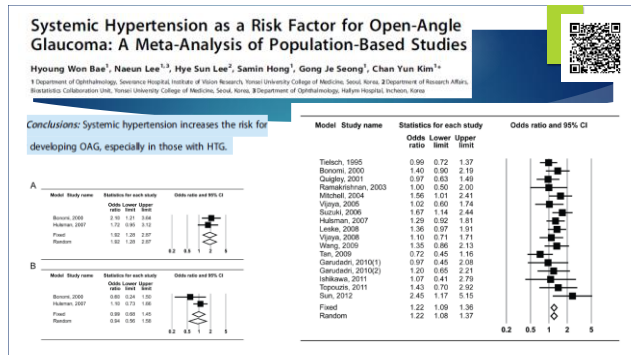
In terms of Perfusion pressure

Low IOP (12 mmHg) but with lower BP (100/60)

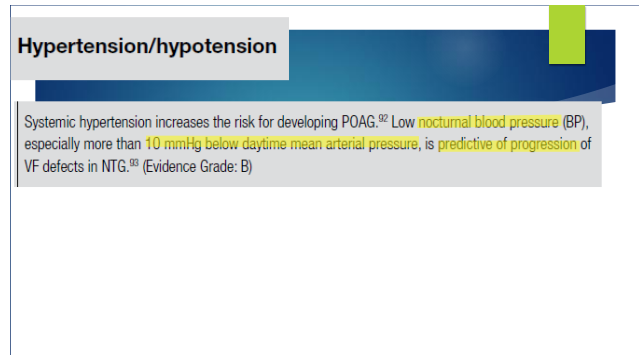
=

Elevated IOP (26 mmHg) at "normal BP" 120/80

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Clinical tip: Measure BP and Pulse rate on all glaucoma patients

Particularly in suspects that IOP is not high, but nerves appear suspicious

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Disc hemorrhages

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Disc hemorrhage

- Location- Infero temporal followed by superior temporal regions
- Does not mean glaucoma always
- Is not the only location of damage
- More likely to progress to POAG
- POAG progression is greater in eyes with DH

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Disc hemorrhages

- RNFL changes – Wedge shaped defects
- Associated notching of rim
- Vertical elongation of cupping after an episode

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Disc Hemorrhages Are Associated With Localized Three-Dimensional Neuroretinal Rim Thickness Progression in Open-Angle Glaucoma

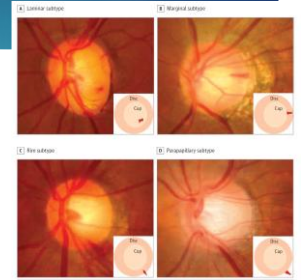
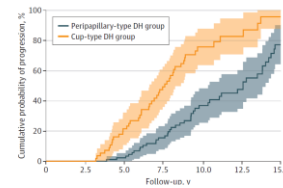
MILICA A. MARGETA, KITTYA RATANAWONGPHABUL, EDEM TSIKATA, MICHELE ZEMPLENY, COURTNEY L. ONDECK, JANICE KIM, ANNE L. COLEMAN, FEI YU, JOHANNES F. DE BOER, AND TERESA C. CHEN

124 OAG patients
5 year follow-up
19 showed hemorrhage (15.3%)

• CONCLUSIONS: Glaucoma progression detected by high-density 3D SD-OCT neuroretinal rim measurements preceded DH occurrence in the majority of patients. **These findings support the hypothesis that DHs are indicators of ongoing glaucoma progression rather than discrete events that cause subsequent progression** (Am J Ophthalmol 2022;234: 188–198; © 2021 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>))

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Types of disc hemorrhages



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Myopia-Glaucoma-OCT

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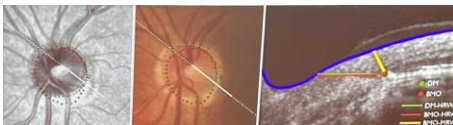
Stats and why should it be concerning

- ▶ 2050 – 5 billion people will have myopia (half the world's population)
- ▶ About 1/3 will have high myopia $\geq -6D$

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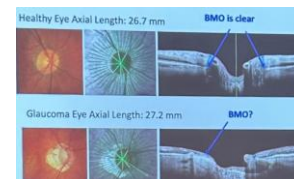
Issues with myopia and OCT

Clinical Disc versus disc margin identified by Bruchs membrane opening



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BMO is not clear in all patients

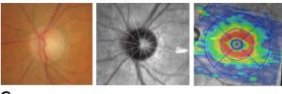


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A AL ≤ 24 mm



B 24 mm < AL ≤ 26 mm



C AL > 26 mm



Macula structural and vascular differences in glaucoma eyes with and without high axial myopia

Jasmin Rezapour,^{1,2} Christopher Bowd,¹ Jade Dohleman,¹ Akram Belghith,¹ James A Proudfoot,¹ Mark Christopher,¹ Leslie Hyman,¹ Jost B Jonas,^{1,2} Rafaelia C Pereira,¹ Susan Moghimi,¹ Huiyuan Hou,¹ Yuesen Wu (E-Norm), Eleonora Micheli,¹ Massimo A Fazio,¹ Robert N Weinreb,¹ Linda M Zangwill,¹

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Can OCT values be trusted in myopia?

- ▶ Axial length is not adjusted? Magnification is off so away from true value
- ▶ The disc analysis is off given the filled appearance and myopic type stretched disc
- ▶ Bruchs membrane opening is displaced
 - ▶ Thus clinically what is considered as an edge of disc is not the same
- ▶ Nerve fiber layer may be utilized
- ▶ Macula may be more sensitive to changes
- ▶ But macula can also be pathological !
- ▶ Visual field defects also seen in myopic eyes!
- ▶ Management of glaucoma in high myopes is a tough situation.

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Progression and glaucoma

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The Scoring Tool for Assessing Risk (S.T.A.R. II) calculator



- ▶ OHTs and EGPS data
- ▶ Intended for use only in untreated OHT patients
- ▶ Age (30-80)
- ▶ IOP 20-32 mmHg
- ▶ CCT 475 to 650 microns
- ▶ PSD 0.50 to 3.00 dB
- ▶ C/D ratio vertical 0.00 to 0.8

Probability of conversion in 5- years
<5% observe and monitor
5 to 15% consider treatment
>15% treat

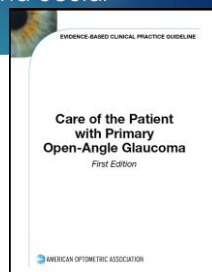
<https://ohts.wustl.edu/risk/>



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Open-angle glaucoma and ocular hypertension

- ▶ Primary open-angle glaucoma
- ▶ Normal tension glaucoma
- ▶ Ocular hypertension

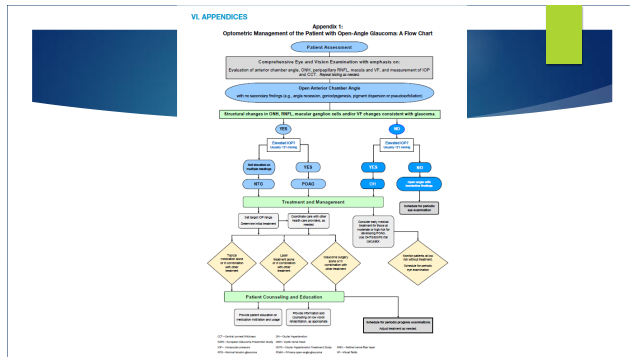


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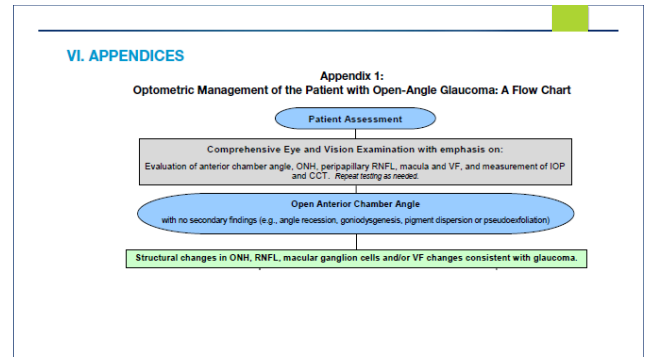
Evaluation and Examination

- The examination of a person suspected of having primary open-angle glaucoma (POAG) should include all aspects of a **comprehensive eye** and vision examination, with emphasis on the evaluation of the **anterior chamber angle**, optic nerve head (**ONH**), peripapillary retinal nerve fiber layer (**RNFL**), macula and visual fields (**VF**), and measurement of intraocular pressure (**IOP**) and central corneal thickness (**CCT**).^{11,17,179,185,188,227} (Evidence Grade: B, Recommendation)
- Eye doctors should be **persistent in providing education** and training to patients with primary open-angle glaucoma (POAG) to **improve adherence/compliance** with recommended therapy.^{419-418,424,425,431,432,451-453} (Evidence Grade: B, Recommendation)

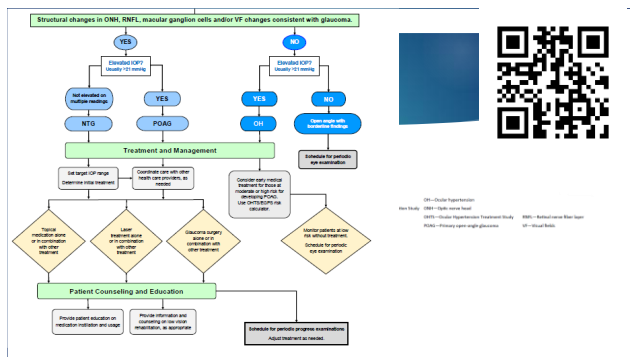
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Thank You!

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Cornea, Disc and Visual fields in Normal tension glaucoma

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Can IOP be underestimated in NTG?

- Yes, absolutely
- CCT is lower in NTG patients compared to POAG or OHT
- POAG vs NTG - 21 cut off
- An NTG patient can have lower than 21 pressure, borderline pressure and IOP > 21 with
 - ORA, DCT, 7CR, CORVIS ST (CCT independent measures)

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Corneal Stiffness and Modulus of Normal-Tension Glaucoma in Chinese

YUNZHI XU, YIMING YE, ZIDONG CHEN, JIANGANG XU, YANGFAN YANG, YANMEI FAN, PINGPING LIU, JOK TONG CHONG, KEMING YU, DAVID C. C. LAM, AND MINBIN YU

• **CONCLUSIONS:** The corneas of NTG patients were softer than those of HTG patients and controls, as assessed by CID, which were associated with thinner CCT. These might suggest different ocular biomechanical properties in NTG and HTG. (NOTE: Publication of this article is sponsored by the American Ophthalmological Society. Am J Ophthalmol 2022;242: 131–138. © 2022 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>))

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VF loss in NTG

- ▶ Progression of NTG tends to be slow
- ▶ Some people reported differences in location of defects of visual field.
- ▶ VF defects focal, deeper and central (closer to fixation)

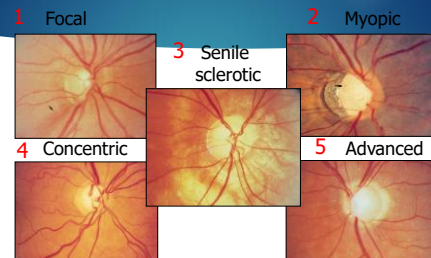
80

VF loss in NTG -2

- ▶ A dense paracentral scotoma encroaching on fixation is not an unusual finding as the initial defect
- ▶ The findings of visual field differences is supported by some researchers where as others failed to confirm them

81

Glaucomatous Disc Classifications



Broadway D.C, Nicotola M. T, Drance S.M., Survey of Ophthalmology 1999

82

Optic disc and NTG

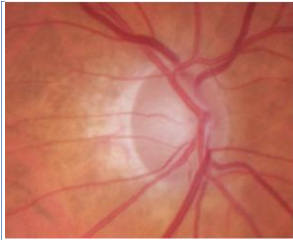
- ▶ NTG patients have a thinner rim inferiorly and inferotemporally when compared to other glaucoma with similar total VF loss

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Optic disc appearance-NTG

- ▶ Senile sclerotic group
 - ▶ Shallow, sloping of NRR
- ▶ Focal ischemic
 - ▶ Deep focal polar notching in the neuroretinal rim
 - ▶ Shallow saucerized cupping
- ▶ Senile sclerotic nerve
 - ▶ Commonly found hemorrhage- locations
 - ▶ Proximal constriction of retinal arteriole
 - ▶ Importance of large peri-papillary atrophy and its blood flow associations
 - ▶ Loss of superficial capillaries and delayed filling of the nerve head

84



85

Differential diagnosis

- ▶ Diurnal IOP is a useful in determining the peak IOP
- ▶ Also useful in establishing target IOP
- ▶ CCT and IOP issue

86

Microvasculature Dropout and Development of Normal Tension Glaucoma in Glaucoma Suspects: The Normal Tension Glaucoma Suspect Cohort Study

YOUNGHEA JUNG, HAE-YOUNG LOPILLY PARK, HEEJONG SHIN, SI EUN OH, SEONG AH KIM, JI-YOUNG LEE, DA YOUNG SHIN, SOO JI JEON, YONG-CHAN KIM, HYE-YOUNG SHIN, JIN A. CHOI, NA YOUNG LEE, AND CHAN KEE PARK

- **CONCLUSIONS:** NTG suspects with baseline MvD or a lower laminar deep VD on OCT-A had a higher risk of conversion. (Am J Ophthalmol 2022;243: 135–148. © 2022 Elsevier Inc. All rights reserved.)

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Vascular parameters and endothelin-1 measurements in glaucoma patients with low- and high-tension optic disc hemorrhages

Isabela N. F. Almeida¹, Elise Taniguchi², Cecilia Victoria Agapito Tito², Diego Torres Dias^{1,3}, Michele Ushida⁴, Syril Dorairaj¹, Robert Ritch¹, Sérgio H. Teixeira¹, Augusto Paranhos Jr¹, Carolina P. B. Gracitelli^{1,5}, Cristiane Kayser⁶ & Tiago Santos Prata^{1,5,6,7}

Patients developing DH and had low IOP (<16) have higher endothelin -1 and more peripheral vascular dysfunction

Compared to DH in higher IOP

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Selective laser trabeculopalsty

89

SLT and glaucoma

- ▶ Great first or second line option.
- ▶ Non-compliant individuals
- ▶ Individuals that fluctuation of IOP is a concern
- ▶ In theory can be repeated to lower IOP.
- ▶ Is the IOP lowering the same second attempt?

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Primary Selective Laser Trabeculoplasty for Open-Angle Glaucoma and Ocular Hypertension

Clinical Outcomes, Predictors of Success, and Safety from the Laser in Glaucoma and Ocular Hypertension Trial

- ▶ A total of 611 eyes (195 OHT and 416 OAG) of 355 patients received SLT, and 622 eyes (185 OHT and 437 OAG) of 362 patients received topical medication at baseline.
- ▶ Early absolute IOP-lowering after SLT was no different between OHT and OAG eyes
- ▶ No difference was noted in early absolute IOP-lowering between topical medication and primary SLT
- ▶ Early absolute IOP-lowering with primary SLT was positively associated with baseline IOP

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Primary Selective Laser Trabeculoplasty for Open-Angle Glaucoma and Ocular Hypertension

Clinical Outcomes, Predictors of Success, and Safety from the Laser in Glaucoma and Ocular Hypertension Trial

- ▶ At 36 months, 536 eyes (87.7% of 611 eyes) of 314 patients (88.5% of 355 patients) were available for analysis.
- ▶ Some **74.6% of eyes (400 eyes) treated with primary SLT achieved drop-free disease-control at 36 months; 58.2% (312 eyes) after single SLT.**
- ▶ Six eyes of 6 patients experienced immediate post-laser IOP spike (>5 mmHg from pretreatment IOP) with 1 eye requiring treatment.

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Primary Selective Laser Trabeculoplasty for Open-Angle Glaucoma and Ocular Hypertension

Clinical Outcomes, Predictors of Success, and Safety from the Laser in Glaucoma and Ocular Hypertension Trial

- ▶ Conclusions: Primary SLT achieved comparable early absolute IOP-lowering in OHT versus OAG eyes.
- ▶ Drop-free disease-control was achieved in approximately 75% eyes at 36 months after 1 or 2 SLTs, the majority of these after single SLT.
- ▶ These analyses are exploratory but support primary SLT to be effective and safe in treatment-naïve OAG and OHT eyes.

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Poll 5

- ▶ Would you be willing to get trained if required to obtain licensure to perform SLT?
- ▶ A) Yes
- ▶ B) No

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Narrow angle/acute attack/angle closure glaucoma

95

Gonioscopy- CPT 92020

A = Above Schwalbe line, totally occluded angle.
B = Behind the Schwalbe line, peripheral iris is in contact with TM.
C = Scleral spur Iris root at the level of scleral spur
D = Deep anterior ciliary body seen.
E = extremely deep



Iris insertion



Angle approach



Curvature of peripheral iris

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Indentation gonioscopy

- ▶ Angle narrow
- ▶ Angle appears closed
- ▶ Angle structures not visible in a quadrant
- ▶ Ruling out synechiae



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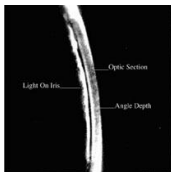
Angle Measurement with Quantification



Clinical tip: Angle 20 degree or less needs further evaluation

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Van Herrick angle estimation



- ▶ 1:1 – Open angle, VH grade 4
- ▶ 1:1/2 – Open angle, VH grade 3
- ▶ 1:1/4 – Narrow angle, VH grade 2 (Angle Closure Possible)
- ▶ 1: <1/4 – Angle closure likely, VH grade 1

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Treatment for narrow angles

Prophylactic laser iridotomy



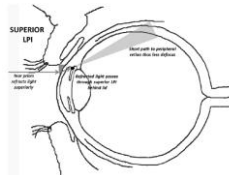
Laser iridoplasty- appositionally closed angle



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Dysphotopsia following Laser PI

- ▶ halos, shadows, crescents and commonly blurred line (sometimes colored)
- ▶ Conventionally LPI under the lid or fully covered
- ▶ Hypothesis decreases "ghost images"

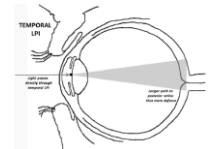


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Dysphotopsia after Temporal versus Superior Laser Peripheral Iridotomy: A Prospective Randomized Paired Eye Trial

VANESSA VERA, ABDULLA NAQI, GRAHAM W. BELOVAY, DEVESH K. VARMA, AND IQBAL IKK, AHMED

- ▶ Superior LPI 10.7% linear dysphotopsia
- ▶ Temporal LPI 2.4%
- ▶ Partially or completely covered LPI four times more likely to demonstrate new linear dysphotopsia



Am J Ophthalmol 2014;157:929-935.

102

Does LPI prevent angle closure? ZAP trial

103

Laser peripheral iridotomy for the prevention of angle closure: a single-centre, randomised controlled trial

Mingqiang He, Yuchun Jiang, Shengping Huang, Jialy C Zhang, Baolin Wu, Tingting, Paul Foster, David F Friedman

www.thelancet.com Vol 393 April 20, 2019

Zhongsan Angle Closure Prevention (ZAP) Trial

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ZAP

- ▶ 11,991 screened
- ▶ 889 enrolled
- ▶ 889 eyes treated fellow eye 889 not treated
- ▶ Primary outcome Angle closure by 72 months
- ▶ Incidence of angle closure
 - ▶ 4.19 per 1000 treated
 - ▶ 7.97 per 1000 untreated
- ▶ Small but significant protective effect of treatment
- ▶ Widespread prophylactic laser for angle closure suspects not recommended

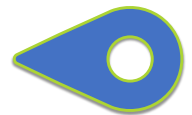
105

Effectiveness of early lens extraction for the treatment of primary angle-closure glaucoma (EAGLE): a randomised controlled trial

Argente-Alexandre Blouin, Jennifer Burr, Craig Manning, David Cooper, Paul Foster, David F Friedman, Graham Goodfellow, Mehdi Javabakh, Claire Cathrine Johnstone, for the EAGLE study group

www.thelancet.com Vol 388 October 1, 2016

EAGLE trial



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EAGLE trial

Hypothesis tested –

- ▶ clear lens extraction after primary angle closure glaucoma
- ▶ leads to **better quality of life, lowering of IOP and less need for glaucoma surgery** than standard care
- ▶ Standard care – Laser iridotomy and medications

Interpretation Clear-lens extraction showed greater efficacy and was more cost-effective than laser peripheral iridotomy, and should be considered as an option for first-line treatment.

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