

Glaucoma Update  
and Grand Rounds  
2026



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### Financial Disclosures Ben Gaddie 12/4/2025

\*\*\*\*All relevant relationships have been mitigated\*\*\*\*

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- Balance Ophthalmics-Consultant
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### Updates on Diagnosis

- Genetic testing
- How to use your OCT
- The macula in glaucoma
- Optic nerve changes
- Futures with AI

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### Glaucoma: Which Genes Do We Already Know

- Genes associated with Adult Onset Glaucoma (Autosomal Dominant/Monogenic)
  - MYOC
    - Autosomal Dominant inherited POAG as well as JOAG
  - LOKY1
    - Exfoliation syndrome/glaucoma
    - Encodes enzyme that crosslinks elastin and collagen
  - PMEL
    - Premelanosome protein in pigmentary dispersion syndrome/glaucoma
  - OPTN
    - Optineurin, involved in neuroprotection
  - WDR36
  - TBK1
    - Tank binding kinase 1
    - NTG primarily
- All one of these genes account for less than 5% of all cases of adult onset glaucoma
  - Note-No genetic associations for steroid-induced glaucoma

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### Multitrait analysis of glaucoma identifies new risk loci and enables polygenic prediction of disease susceptibility and progression

Jamie E. Craig<sup>1</sup>, Xibin Han<sup>1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100,101,102,103,104,105,106,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138,139,140,141,142,143,144,145,146,147,148,149,150,151,152,153,154,155,156,157,158,159,160,161,162,163,164,165,166,167,168,169,170,171,172,173,174,175,176,177,178,179,180,181,182,183,184,185,186,187,188,189,190,191,192,193,194,195,196,197,198,199,200,201,202,203,204,205,206,207,208,209,210,211,212,213,214,215,216,217,218,219,220,221,222,223,224,225,226,227,228,229,230,231,232,233,234,235,236,237,238,239,240,241,242,243,244,245,246,247,248,249,250,251,252,253,254,255,256,257,258,259,260,261,262,263,264,265,266,267,268,269,270,271,272,273,274,275,276,277,278,279,280,281,282,283,284,285,286,287,288,289,290,291,292,293,294,295,296,297,298,299,300,301,302,303,304,305,306,307,308,309,310,311,312,313,314,315,316,317,318,319,320,321,322,323,324,325,326,327,328,329,330,331,332,333,334,335,336,337,338,339,340,341,342,343,344,345,346,347,348,349,350,351,352,353,354,355,356,357,358,359,360,361,362,363,364,365,366,367,368,369,370,371,372,373,374,375,376,377,378,379,380,381,382,383,384,385,386,387,388,389,390,391,392,393,394,395,396,397,398,399,400,401,402,403,404,405,406,407,408,409,410,411,412,413,414,415,416,417,418,419,420,421,422,423,424,425,426,427,428,429,430,431,432,433,434,435,436,437,438,439,440,441,442,443,444,445,446,447,448,449,450,451,452,453,454,455,456,457,458,459,460,461,462,463,464,465,466,467,468,469,470,471,472,473,474,475,476,477,478,479,480,481,482,483,484,485,486,487,488,489,490,491,492,493,494,495,496,497,498,499,500,501,502,503,504,505,506,507,508,509,510,511,512,513,514,515,516,517,518,519,520,521,522,523,524,525,526,527,528,529,530,531,532,533,534,535,536,537,538,539,540,541,542,543,544,545,546,547,548,549,550,551,552,553,554,555,556,557,558,559,560,561,562,563,564,565,566,567,568,569,570,571,572,573,574,575,576,577,578,579,580,581,582,583,584,585,586,587,588,589,590,591,592,593,594,595,596,597,598,599,600,601,602,603,604,605,606,607,608,609,610,611,612,613,614,615,616,617,618,619,620,621,622,623,624,625,626,627,628,629,630,631,632,633,634,635,636,637,638,639,640,641,642,643,644,645,646,647,648,649,650,651,652,653,654,655,656,657,658,659,660,661,662,663,664,665,666,667,668,669,670,671,672,673,674,675,676,677,678,679,680,681,682,683,684,685,686,687,688,689,690,691,692,693,694,695,696,697,698,699,700,701,702,703,704,705,706,707,708,709,710,711,712,713,714,715,716,717,718,719,720,721,722,723,724,725,726,727,728,729,730,731,732,733,734,735,736,737,738,739,740,741,742,743,744,745,746,747,748,749,750,751,752,753,754,755,756,757,758,759,760,761,762,763,764,765,766,767,768,769,770,771,772,773,774,775,776,777,778,779,780,781,782,783,784,785,786,787,788,789,790,791,792,793,794,795,796,797,798,799,800,801,802,803,804,805,806,807,808,809,810,811,812,813,814,815,816,817,818,819,820,821,822,823,824,825,826,827,828,829,830,831,832,833,834,835,836,837,838,839,840,841,842,843,844,845,846,847,848,849,850,851,852,853,854,855,856,857,858,859,860,861,862,863,864,865,866,867,868,869,870,871,872,873,874,875,876,877,878,879,880,881,882,883,884,885,886,887,888,889,890,891,892,893,894,895,896,897,898,899,900,901,902,903,904,905,906,907,908,909,910,911,912,913,914,915,916,917,918,919,920,921,922,923,924,925,926,927,928,929,930,931,932,933,934,935,936,937,938,939,940,941,942,943,944,945,946,947,948,949,950,951,952,953,954,955,956,957,958,959,960,961,962,963,964,965,966,967,968,969,970,971,972,973,974,975,976,977,978,979,980,981,982,983,984,985,986,987,988,989,990,991,992,993,994,995,996,997,998,999,1000</sup>

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### Most Glaucoma is not voiced by monogenic programming

- More commonly, POAG is a complex inherited trait with:
  - Multiple genes with small effect combining to form "risk"
  - Environmental triggers or "turning on" the gene
  - Proximity to a given Loci
- All necessary for "Disease" development
- These genes are not the common ones described on the previous slides
- Over 127 loci have been identified by Genome Wide Association Studies (GWAS)
  - 16 of which are targeted by current existing glaucoma drugs

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**Inheritance of Glaucoma is both Monogenic and Polygenic.**  
Polygenic Disease e.g. POAG has Complex Phenotype and Risk Profiles

**Monogenic disease**  
High-risk variant is rare

**Polygenic disease**  
Numerous variants are common

**A Definitive Diagnosis**  
A single gene mutation directly correlates with disease phenotype

**A Spectrum of Risk**  
Multiple genes have high correlation with single disease trait. A single variant cannot indicate disease risk. Disease risk is a continuous variable. Pattern of variants determines disease risk.

Adapted from Weinreb et al., JAMA Ophthalmol 2017; doi:10.1001/jamaophth.135.0533

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### Genome Wide Association Studies

#### GWAS

- Several large population based GWAS are in existence and used in this study
  - UKB
    - Population based study in UK of 500,000 participants
    - 7800 POAG vs. 119,000 controls
  - ANZAG
    - 3100 cases of European ancestry POAG along with 6750 controls
  - Neighborhood GWAS
    - Meta analysis from 8 independent datasets of European Ancestry in US
    - 3900 POAG vs. 35,000 controls
  - BMEES
    - Population based cohort study of common ocular diseases in people over 50 in Australia
  - Progressa-prospective longitudinal study of genetic risk factors in 388 patients with early glaucoma

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### GWAS

- Allows pathway analysis for POAG associated risk loci
  - Some of these genes have been associated with mechanisms for POAG development
  - Pathways**
    - Endoplasmic reticulum stress response
    - Extracellular matrix
    - Cell adhesion
    - TGF alpha and beta signaling
    - Vascular development
    - Lipid metabolism
    - Endogenous Nitric Oxide Synthetase
    - Mitochondrial Function
- However none of them on their own would lead to development of disease

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### Methods

- Develop a glaucoma Polygenic Risk Score (PRS)
- Characterize 67,000 Optic Nerve Photographs of UK Biobank participants
  - Used vertical C/D ratio (VCDR) as an endophenotype for glaucoma
  - Also used genetic data from large genetic study using IOP as endophenotype
  - Combined with multitrait analysis of GWAS to identify new genetic loci
    - MTAG

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### Results

- In addition to the already established 127 gene loci, this study identified another 176 loci from VCDR/IOP/GWAS MTAG
- Optimized the prediction of glaucoma risk by combining correlated or associated traits
- Outcome of a Polygenic Risk Score (PRS)
- This PRS had a better prediction ability than any of the input traits alone (IOP, VCDR, GWAS)

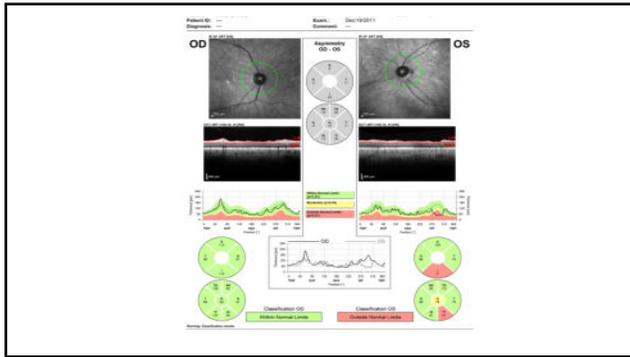
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### Main Outcomes

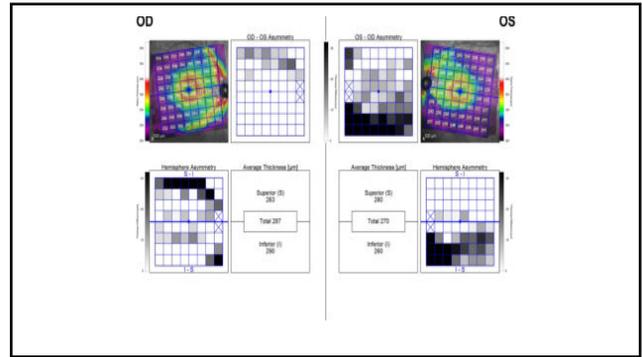
- PRS Prediction
  - Individuals in the top PRS decile reach an absolute risk of glaucoma **10 years earlier** than those in the bottom decile (**6.34 x higher likelihood of having POAG**)
  - These same individuals in the top PRS decile are at a **15-fold increased risk of developing advanced glaucoma**
  - PRS predicts glaucoma progression in prospectively monitored, early manifest glaucoma cases
  - PRS predicts need for surgical intervention in advanced glaucoma cases
  - PRS will facilitate a personalized approach for earlier treatment of high-risk individuals with less intensive monitoring and treatment for lower-risk patients

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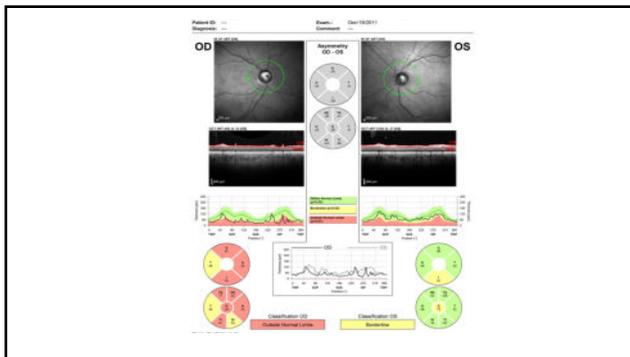




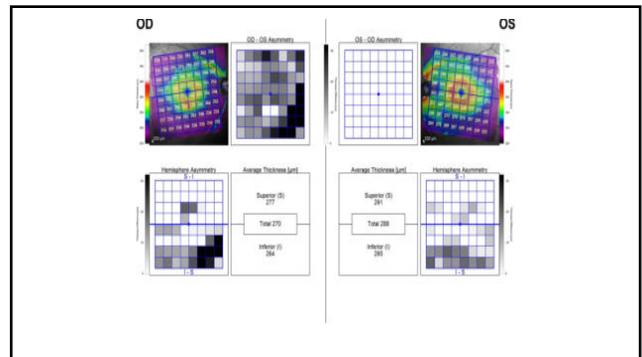
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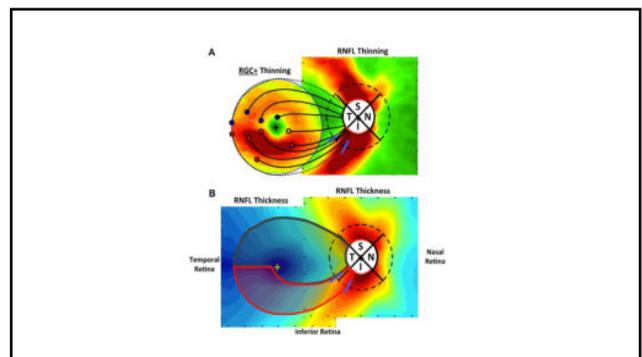
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### Macular Vulnerability Zone

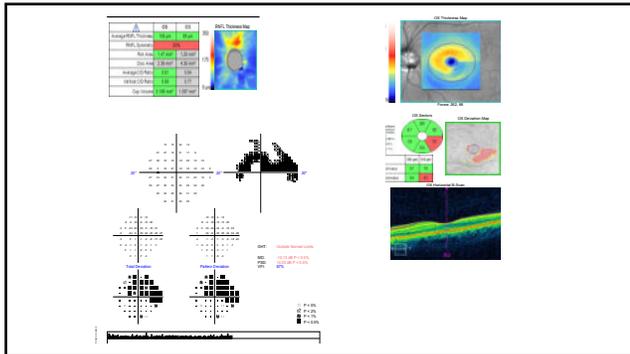
Prog Vision Eye Res. 2013 January ; 102 : 1-21. doi:10.1016/j.provis.2012.08.001.

**Glaucomatous damage of the macula**  
 Donald C. Hood<sup>1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100,101,102,103,104,105,106,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138,139,140,141,142,143,144,145,146,147,148,149,150,151,152,153,154,155,156,157,158,159,160,161,162,163,164,165,166,167,168,169,170,171,172,173,174,175,176,177,178,179,180,181,182,183,184,185,186,187,188,189,190,191,192,193,194,195,196,197,198,199,200,201,202,203,204,205,206,207,208,209,210,211,212,213,214,215,216,217,218,219,220,221,222,223,224,225,226,227,228,229,230,231,232,233,234,235,236,237,238,239,240,241,242,243,244,245,246,247,248,249,250,251,252,253,254,255,256,257,258,259,260,261,262,263,264,265,266,267,268,269,270,271,272,273,274,275,276,277,278,279,280,281,282,283,284,285,286,287,288,289,290,291,292,293,294,295,296,297,298,299,300,301,302,303,304,305,306,307,308,309,310,311,312,313,314,315,316,317,318,319,320,321,322,323,324,325,326,327,328,329,330,331,332,333,334,335,336,337,338,339,340,341,342,343,344,345,346,347,348,349,350,351,352,353,354,355,356,357,358,359,360,361,362,363,364,365,366,367,368,369,370,371,372,373,374,375,376,377,378,379,380,381,382,383,384,385,386,387,388,389,390,391,392,393,394,395,396,397,398,399,400,401,402,403,404,405,406,407,408,409,410,411,412,413,414,415,416,417,418,419,420,421,422,423,424,425,426,427,428,429,430,431,432,433,434,435,436,437,438,439,440,441,442,443,444,445,446,447,448,449,450,451,452,453,454,455,456,457,458,459,460,461,462,463,464,465,466,467,468,469,470,471,472,473,474,475,476,477,478,479,480,481,482,483,484,485,486,487,488,489,490,491,492,493,494,495,496,497,498,499,500,501,502,503,504,505,506,507,508,509,510,511,512,513,514,515,516,517,518,519,520,521,522,523,524,525,526,527,528,529,530,531,532,533,534,535,536,537,538,539,540,541,542,543,544,545,546,547,548,549,550,551,552,553,554,555,556,557,558,559,560,561,562,563,564,565,566,567,568,569,570,571,572,573,574,575,576,577,578,579,580,581,582,583,584,585,586,587,588,589,590,591,592,593,594,595,596,597,598,599,600,601,602,603,604,605,606,607,608,609,610,611,612,613,614,615,616,617,618,619,620,621,622,623,624,625,626,627,628,629,630,631,632,633,634,635,636,637,638,639,640,641,642,643,644,645,646,647,648,649,650,651,652,653,654,655,656,657,658,659,660,661,662,663,664,665,666,667,668,669,670,671,672,673,674,675,676,677,678,679,680,681,682,683,684,685,686,687,688,689,690,691,692,693,694,695,696,697,698,699,700,701,702,703,704,705,706,707,708,709,710,711,712,713,714,715,716,717,718,719,720,721,722,723,724,725,726,727,728,729,730,731,732,733,734,735,736,737,738,739,740,741,742,743,744,745,746,747,748,749,750,751,752,753,754,755,756,757,758,759,760,761,762,763,764,765,766,767,768,769,770,771,772,773,774,775,776,777,778,779,780,781,782,783,784,785,786,787,788,789,790,791,792,793,794,795,796,797,798,799,800,801,802,803,804,805,806,807,808,809,810,811,812,813,814,815,816,817,818,819,820,821,822,823,824,825,826,827,828,829,830,831,832,833,834,835,836,837,838,839,840,841,842,843,844,845,846,847,848,849,850,851,852,853,854,855,856,857,858,859,860,861,862,863,864,865,866,867,868,869,870,871,872,873,874,875,876,877,878,879,880,881,882,883,884,885,886,887,888,889,890,891,892,893,894,895,896,897,898,899,900,901,902,903,904,905,906,907,908,909,910,911,912,913,914,915,916,917,918,919,920,921,922,923,924,925,926,927,928,929,930,931,932,933,934,935,936,937,938,939,940,941,942,943,944,945,946,947,948,949,950,951,952,953,954,955,956,957,958,959,960,961,962,963,964,965,966,967,968,969,970,971,972,973,974,975,976,977,978,979,980,981,982,983,984,985,986,987,988,989,990,991,992,993,994,995,996,997,998,999,1000</sup>

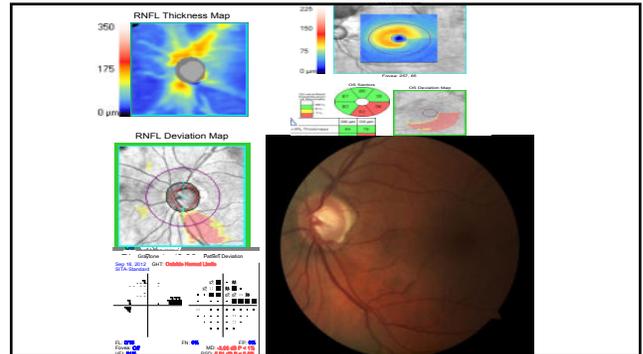
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- 53 YO WM
- Father with glaucoma
- Pach 531/601 (OD lasik)
- CH 6.8 OD and 9.1 OS
- IOP 21/23 highest

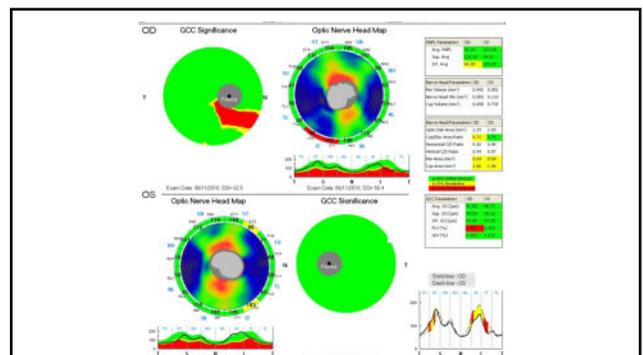
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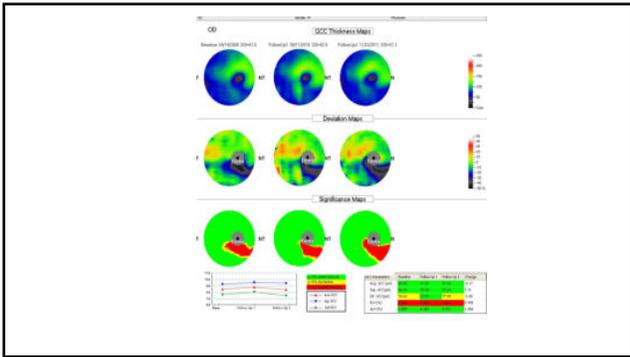
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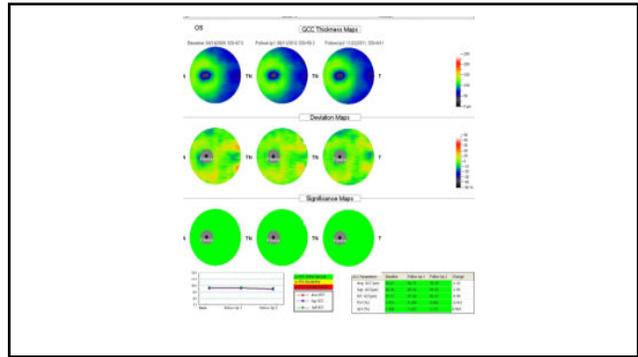
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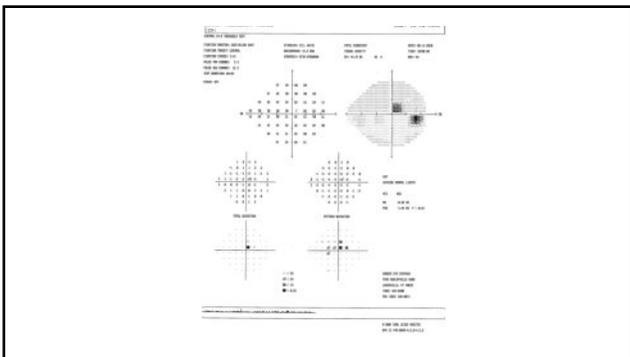
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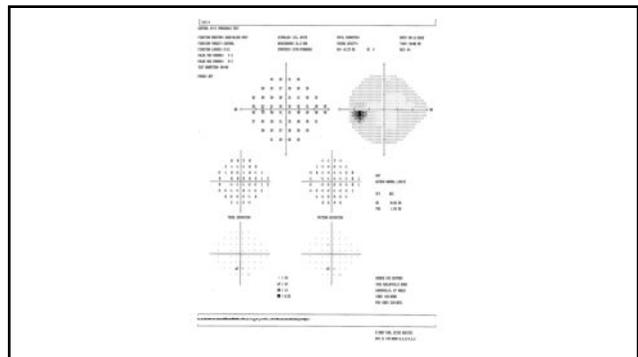
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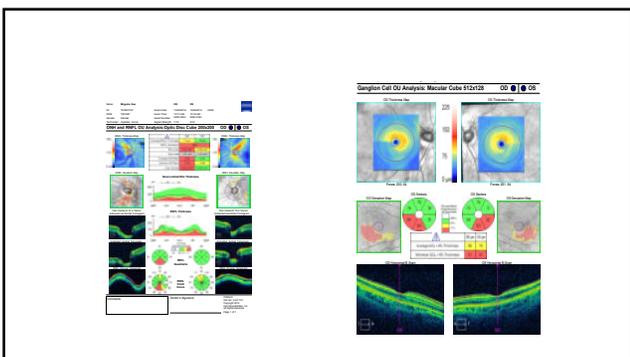
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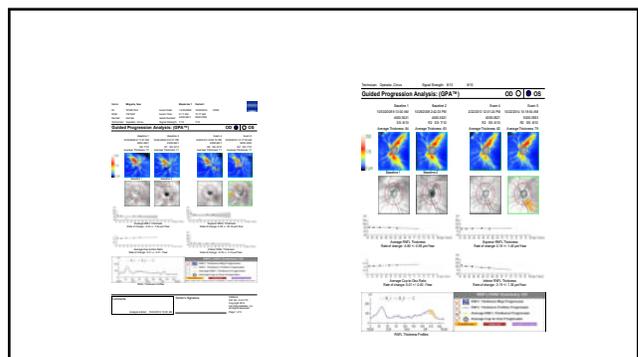
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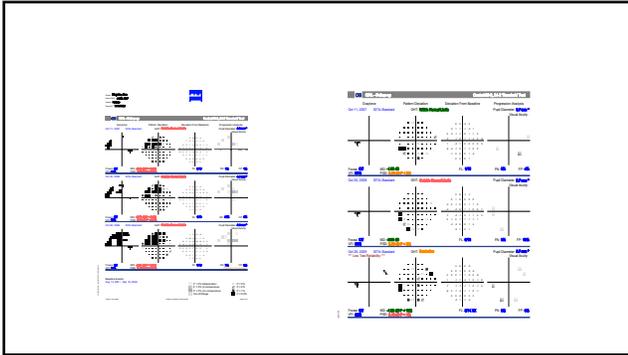
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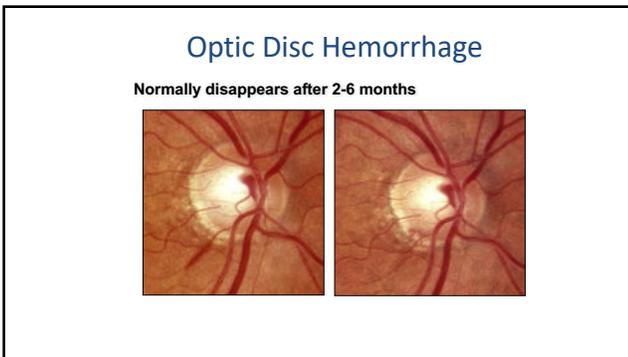
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Are Optic Nerve Hemorrhages Pathognomic For Glaucoma?

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- Optic Disc Hemorrhages
- Optic Disc Hemorrhages in a Population with and without Signs of Glaucoma
    - Healey PR, Mitchell IP, et al Ophthalmology 1998 (Blue Mountains Eye Study)
  - Overall prevalence in either or both eyes 1.4% of general population
    - More common in women
    - Prevalence increased with age
  - Prevalence in individuals with OAG 13.8%
    - 8% High Tension
    - 25% Low Tension
    - 1.5% OHTN

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**Optic Disc Hemorrhages in a Population with and without Signs of Glaucoma**

Paul R. Healey, BMedSc, MBBS,<sup>1</sup> Paul Mitchell, MD, FRACP(AH),<sup>1</sup> Wayne Smith, BMed, MPH,<sup>1</sup> Ju Jin Wong, MMed (Clin Ep)<sup>1</sup>

**Objective:** This study aimed to determine the prevalence and associations of optic disc hemorrhage in a well-defined older Australian population.

**Design:** The study design was a population-based, cross-sectional study.

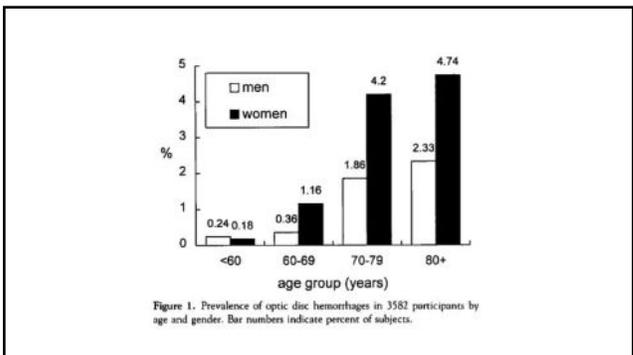
**Participants:** A total of 3584 persons 49 years of age or older, representing 88% of permanent residents from an area west of Sydney, participated in the study.

**Main Outcome Measures:** Participants underwent a detailed eye examination. The diagnosis of optic disc hemorrhage was made from masked photographic grading; disc hemorrhages were subclassified as flame or blot in shape. Open-angle glaucoma was diagnosed from matching visual field loss and optic disc rim thinning.

**Results:** The overall prevalence of disc hemorrhage in either or both eyes was 1.4%. Disc hemorrhage prevalence was higher in women (odds ratios [OR], 1.9; confidence interval [CI], 1.0–3.5) and increased with age (OR, 2.2 per decade; CI, 1.7–2.9 per decade). The overall prevalence in subjects with open-angle glaucoma was 13.8% (8% in high-pressure glaucoma and 25% in low-pressure glaucoma) and 1.8% in subjects with ocular hypertension. Disc hemorrhages were associated with increasing intraocular pressure (OR, 1.7 per 5 mmHg; CI, 1.3–2.3 per 5 mmHg), pseudoexfoliation (OR, 3.5; CI, 1.1–11.8), diabetes (OR, 2.9; CI, 1.4–6.0), and increasing systolic blood pressure (OR, 1.1 per 10 mmHg; CI, 1.0–1.3) after adjusting for age and gender. Among subjects without open-angle glaucoma, disc hemorrhages were more frequent in eyes with larger vertical cup–disc ratios and in subjects with a history of typical migraine headache (OR, 2.2; CI, 1.1–4.6). No associations were found among subjects with a history of vascular events, smoking, regular aspirin use, or myopia.

**Conclusions:** Disc hemorrhage prevalence in this population is higher than that in the two previous population-based reports. Although the strong association of disc hemorrhage with open-angle glaucoma was confirmed (particularly low-pressure glaucoma), most disc hemorrhages (70%) were found in participants without definite signs of glaucoma. *Ophthalmology* 1998;105:216–223

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### Best Method to Detect ONH Hemorrhages is Inspection of Disc Photographs

Budenz Ophthalmology 2006

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### Detection and Prognostic Significance of Optic Disc Hemorrhages during the Ocular Hypertension Treatment Study

Donald L. Budenz, MD, MPH,<sup>1</sup> Douglas B. Anderson, MD,<sup>2</sup> William J. Feuer, MD,<sup>3</sup> Julia A. Balar, MD,<sup>4</sup> Jason Schiffman, MD,<sup>5</sup> Richard E. Farnik II, MD,<sup>6</sup> Josh E. Rhee-Scooter, MD,<sup>7</sup> Marc O. Cosman, PhD,<sup>8</sup> Michael A. Kass, MD,<sup>9</sup> Ocular Hypertension Treatment Study Group

**Purpose:** To compare the rates of detection of optic disc hemorrhages by clinical examination and by review of optic disc photographs of the Ocular Hypertension Treatment Study (OHTS), to assess the incidence of and the predictive factors for disc hemorrhages in the annual disc photographs of the Ocular Hypertension Treatment Study (OHTS), and to determine whether optic disc hemorrhages predict the development of primary open-angle glaucoma (POAG) in the OHTS.

**Design:** Cohort study.

**Participants:** Three thousand two hundred thirty-six eyes of 1618 participants.

**Methods:** Both eyes of participants were examined for optic disc hemorrhages every 6 months by clinical examination, with dilated fundus examinations every 12 months, and by annual review of stereoscopic disc photographs of the OHTS.

**Main Outcome Measures:** Incidence of optic disc hemorrhages and POAG and points.

**Results:** Median follow-up was 66.3 months. Stereophotography-confirmed glaucomatous optic disc hemorrhages were detected in 128 eyes of 128 participants before the POAG end point. Twenty-one cases (16%) were detected by both clinical examination and review of photographs, and 107 cases (84%) were detected only by review of photographs ( $P < 0.0001$ ). Disc hemorrhages associated with disc hemorrhages were older age, thinner cornea, larger vertical cup-to-disc ratio, larger pattern standard deviation index on perimetry, family history of glaucoma, and smoking status. The occurrence of a disc hemorrhage increased the risk of developing POAG 3-fold in univariate analysis ( $P < 0.001$ ; 95% confidence interval, 2.0–10.1) and 2.7-fold in multivariate analysis that included covariate factors predictive of POAG ( $P < 0.001$ ; 95% confidence interval, 2.1–4.0). The all-cause cumulative incidence of POAG in the eyes without optic disc hemorrhage was 8.2%, compared with 13.8% in the eyes with optic disc hemorrhage. In eyes with a disc hemorrhage in which a POAG end point developed, the median time between the 2 events was 13 months.

**Conclusions:** Review of stereophotographs was more sensitive at detecting optic disc hemorrhage than clinical examination. The occurrence of an optic disc hemorrhage was associated with an increased risk of developing a POAG end point in participants in the OHTS; however, most eyes (86.7%) in which a disc hemorrhage developed have not experienced a POAG end point to date. Ophthalmology 2006;115:1008–1016 © 2006 by the American Academy of Ophthalmology.

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### Update on Primary Care Management of Glaucoma

- Lasers in Glaucoma
  - First line SLT
  - Direct SLT
  - Low Energy Annual SLT
- Managing Adverse Events with Medications
- Pipeline laser technologies

45

### Identifying and managing allergies and sensitivities to glaucoma medications

46

### Alpha Agonists (Alpha-2 selective)

- This sensitivity has been called many things
  - Allergy
  - Follicular Conjunctivitis
  - Atopic reaction
- ~20 % rate of reaction with .2%
  - When on branded .1% it is suspected to be less than 5% rate
  - When combined in branded combigan drops to about 10% but still 1 in 10 will get the allergy, usually 6-12 mos after starting

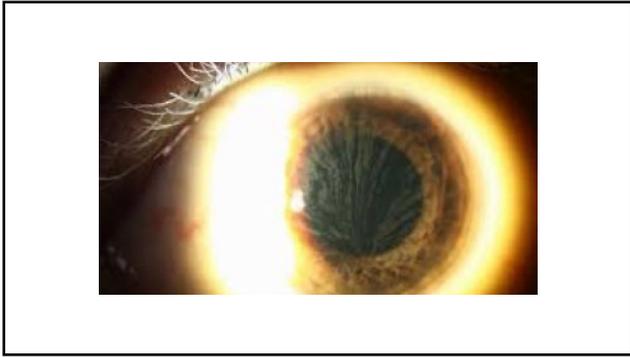
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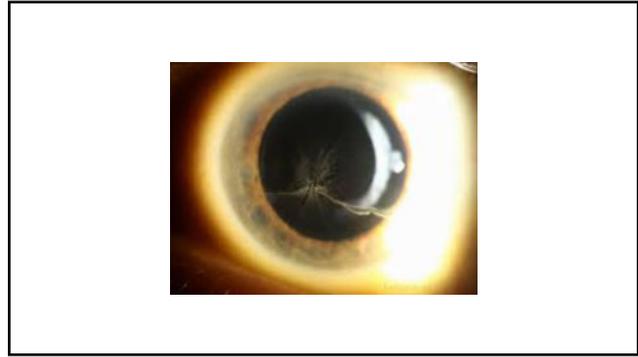
Brimonidine Allergy

48





55



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**Table 2. Safety summary**

	Netarsudil/ Latanoprost FDC (n=238)	Netarsudil 0.02% (n=443)	Latanoprost 0.005% (n=237)
<b>Eye disorders, n (%)</b>			
Conjunctival hyperemia	160 (67.6)	120 (51.4)	52 (21.9)
Conjunctival hemorrhage	37 (15.6)	44 (19.5)	3 (1.3)
Cornae verticillata	42 (17.6)	33 (14.6)	0 (0)
Eye pruritus	27 (11.3)	22 (9.7)	3 (1.3)
Punctate keratitis	12 (5.1)	18 (7.9)	10 (4.2)
Lacrimation increased	17 (7.1)	29 (12.8)	1 (0.4)
Visual acuity reduced	13 (5.5)	13 (5.8)	6 (2.5)
Vision blurred	11 (4.6)	15 (6.6)	3 (1.3)
Diophrants	14 (5.9)	8 (3.5)	5 (2.1)
<b>Administration site conditions, n (%)</b>			
Irritation site pain	55 (23.1)	60 (24.7)	19 (7.6)

Percentages may not sum to 100% of patients in each treatment arm due to rounding.  
Patients with the most common (≥ 5%) adverse events in the treatment arms eligible for publication in this study.  
N/A: Not a known adverse event.

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**Netarsudil Side Effects:  
Conjunctival Hemorrhage**

- Conjunctival hemorrhage (17.2%)
  - Small
  - Transient
  - Visualized by examiner with slit lamp magnification
- Do not appear to be associated with or cause ocular pathology

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Rho Kinase  
"Brimonidine  
effect"

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**Outline: Glaucoma Lasers: What's New?**

- Background on Ophthalmic Lasers in Glaucoma
  - ALT
  - SLT
- Evolution of Lasers in Glaucoma
  - Initially was for uncontrolled glaucoma, or failed medical therapy
  - One time application with ALT
  - When SLT became approved, most used it as third or fourth line
    - IOP reductions didn't seem all that great as used late in the line
    - Many questioned if SLT worked if a patient was on or had been on a PGA
  - Some questioned if it worked after cat sx
- Most trials before 2010 showed mixed results and poor study design

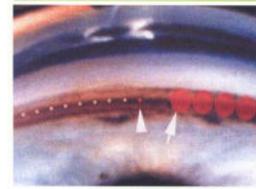
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Outline: Glaucoma Lasers: What's New

- LIGHT Trial
- COAST Trial
- Direct SLT

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Gonioscopy view of ALT/SLT



ALT (small dots) → photocoagulation; SLT (large dots) → biochemical response w/o thermal damage  
Karmel, 2002

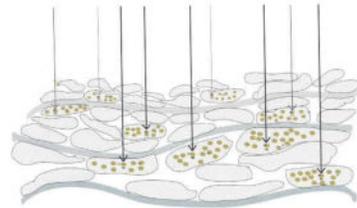
62

Selective Laser Trabeculoplasty (SLT)

- 400 um spot size
- 3.0 nsec duration compared to 0.1 msec ALT
- Necrosis-induced phagocytosis of debris at the spot of the burn
- No visible tissue response on TM during procedure
- Destroys melanosomes of pigmented TM cells
- Sparing adjacent non-pigmented cells and tissues

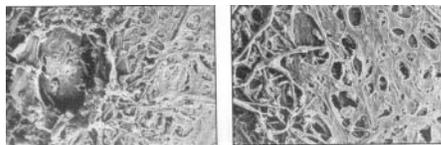
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SLT: Selectively targets pigmented TM cells



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ALT vs. SLT



High energy level -> vaporizes tissue water -> forms TM crater

SLT: Treated/Untreated TM looks similar

Alvarado, 2002

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SLT General Considerations

- -Energy levels. Champagne bubbles .8 1.0 mj.
- -Target selections. 400 micron. Spot size. Paint entire mesh work
- -Placement of lens. Quicker with assistance less bubbles. GonioVisc/Sol vs Celluvisc
- -Treatment regimen: 360 degrees per session.

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### Pre-Op

- Basic exam components
  - VA, IOP, etc.
- Gonioscopy
  - Assess angle structure
  - Assess pigmentation
- 1 gt Iopidine or Alphagan
- Pilo 1% if need to pull iris out of angle to better visualize TM for treatment

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### SLT Gonio Lenses



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Clinical Ophthalmology

Dovepress  
Taylor & Francis Group

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ORIGINAL RESEARCH

### Incidence of Conjunctivitis and Keratitis with Reusable Ophthalmic Laser Lenses at an Academic Medical Center

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**Purpose:** To determine the incidence of keratitis and conjunctivitis associated with reusable contact lens use during ophthalmic laser procedures at an academic medical center.

**Patients and Methods:** All laser procedures were performed at a single nonprofit academic medical center (Jacksonville, FL, USA). Data from patients that underwent neodymium-doped yttrium-aluminum-garnet (Nd:YAG) capsulotomy or selective laser trabeculoplasty (SLT) with reusable contact lenses between 2014 and 2023 was analyzed retrospectively. The post-procedure infection rate, defined as the incidence of newly diagnosed superficial keratitis and/or conjunctivitis within two weeks of the laser procedure, was calculated by dividing the total number of affected eyes by the total cohort size. A break-even analysis was conducted to evaluate the economic impact of reusable lens implementation.

**Results:** A total of 2285 eyes of 1363 patients were included in this study. The incidence of previous conjunctivitis in this cohort was small (0.4%) and no eyes had a prior history of keratitis. Of the 1372 Nd:YAG capsulotomy and 913 SLT procedures performed, only one eye (0.044%) developed signs of post-operative conjunctivitis and none developed keratitis. The single case of unilateral conjunctivitis occurred within one day of a Nd:YAG capsulotomy and was secondary to medicamentosa. A cost analysis showed that reusable ophthalmic laser lenses become more cost-effective than disposable lenses after approximately 86 SLT procedures and 91 Nd:YAG capsulotomies, while reducing medical waste by 79%.

**Conclusion:** Given the negligible rate of conjunctivitis, substantial cost savings, and significant reduction in environmental waste associated with reusable capsulotomy and trabeculoplasty lenses, the routine use of disposable ophthalmic lenses should be reconsidered.

**Keywords:** reusable ophthalmic lenses, Nd:YAG laser capsulotomy, selective laser trabeculoplasty

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### Procedure Technique

- Insert gonio lens (cushioning solution)
- Visualize angle
- Establish a system when performing these procedures and always do it the same (i.e. start at 6 and rotate clockwise)
- Before rotation lens identify a landmark

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### Procedure Technique

- Recommended initial power setting
  - 0.8 – 1.0 mj (won't need to go more than 1.1 or 1.2 – go up in very small increments if needed)
- Desired tissue response will be subtle to see – a slight change in the surface of the TM is adequate treatment
- A small amount of bubble every few pulses appropriate
- Goal of 100 non overlapping spots over 360 degrees

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### Procedure Technique

- If patient had PDS – you may want to only treat 180° of one eye initially
- Have seen cases of IOP increase in PDS patients due to excess pigment = extra inflammatory response
- Some are treating only 180° then wait for to see what response is obtained
- Rule of thumb is more pigment use less energy still applies with SLT

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### Post-Op

- Check IOP 30 – 45 minutes after procedure
- If any increase second drop of Iopidine or Alphagan
- Pred Acetate qid– 5 days
- RTC one week – some are not having patient return at one week

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#### ORIGINAL STUDY

### Effect of Anti-Inflammatory Regimen on Selective Laser Trabeculoplasty Outcomes: A Randomized Controlled Trial

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 Caroline C.P. Barbosa, MD,† Laura Oltramari, MD,\*  
 Guilherme B. Guedes, MD,‡ Marcelo M. Nascimento, MD, PhD,§  
 Tiago S. Prata, MD, PhD,||¶ Carla N. Urata, MD,\* and  
 Ricardo Y. Abe, MD, PhD\*#

**Purpose:** Patients in the prednisolone acetate 1% group post-SLT had higher treatment success rates comparing with other anti-inflammatory drugs.

**Patients and Methods:** A prospective randomized controlled trial. We included newly diagnosed primary open angle glaucoma

POAG patients, we found higher success rates in patients treated with prednisolone acetate 1% after SLT. In addition, higher baseline IOP appears to positively influence postoperative outcomes.

**Key Words:** lasers, glaucoma, anti-inflammatory, glaucoma open angle, corticosteroid

(J Glaucoma 2025;34:421-427)

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Miranda et al / Glaucoma • Volume 34, Number 6, June 2025

TABLE 3. Kaplan-Meier Survival Estimates After Selective Laser Trabeculoplasty Across Groups

Time	Prednisolone 1% (48 subjects)		Prednisolone 0.12% (44 subjects)		Ketorolac 0.5% (42 subjects)		P
	Censored	Survival probability, n (%)	Censored	Survival probability, n (%)	Censored	Survival probability, n (%)	
1 mo	0	100	0	97.7	0	100	0.855
3 mo	3	100	1	90.9	4	95.2	0.029
6 mo	3	93.3	5	72.2	6	74.0	0.550
9 mo	0	90.9	0	69.7	0	70.0	0.623
12 mo	35	83.7	23	63.9	13	67.0	0.003

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In summary, this randomized controlled trial investigated the effect of 3 different anti-inflammatory drugs post-SLT (prednisolone acetate 1%, prednisolone acetate 0.12%, and ketorolac tromethamine 0.5%) in treatment-naïve newly diagnosed POAG patients. As SLT is becoming increasingly common as first-line therapy for ocular hypertension and POAG, it is important to investigate the use of which postlaser eyedrops could eventually interfere in success rates of the procedure. We showed that, even though the absolute percentage difference in IOP between the 3 groups did not reach statistical significance, we found that patients in the prednisolone acetate 1% group had better survival rates comparing with other anti-inflammatory drugs after SLT.

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### Continued SLT Considerations

- Final treatment discussion:
- What to expect:
- Long term effectiveness:
- Multiple use discussion on exit:
- First line treatment?
- Medication compliance?
- Medication cost?
- Pigmentation decrease energy
- Use of gonioscopy increases SLT skill

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### Early Clinical Trials SLT

- Latina et al., 1998 Ophthalmol
- 70% response rate
- Avg decrease in IOP= 23.5% or 5.8 mmHg
- Works well in previous ALT patients without causing IOP spikes

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### Procedure Billing

- 65855 – SLT/ALT code
- 10 day global period
- National average for reimbursement is approximately \$316 per eye
- Kentucky allowable is \$288.09

81

### Introduction

- Glaucoma has an adverse effect on Health Related Quality of Life due to<sup>3,4</sup>
  - Progressive loss of field of vision
  - Inconvenience of eye drops
  - Side effects of eye drops
  - Cost of medications

3. Medeiros FA et al. Longitudinal changes in quality of life and rates of progressive visual field loss in glaucoma patients. Ophthalmology. 2015;122:293-301.

4. Nordmann JP et al. Vision related quality of life and topical glaucoma treatment side effects. Health Qual Life Outcomes. 2003;1:75.

82

### Selective Laser Trabeculoplasty versus eye drops for first-line treatment of ocular hypertension and glaucoma

- United Kingdom study set in 6 hospitals
  - Recruited patients from 2012-2014
  - Observer masked
  - Randomized
  - Treatment naïve patients/newly diagnosed OAG
    - No previous IOP lowering drops, laser or surgery

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### LIGHT Study Design

- 718 patients entered the study (1235 eyes)
- Patients randomized on a 1:1 basis to either:
  - SLT (356 patients, 613 eyes)
  - Drops (362 patients, 622 eyes)

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### Entrance Criteria

- For OAG
  - MD not worse than -12dB in the better eye
  - MD not worse than -15dB in the worse eye
- Visual acuity of 6/36 or better in treated eyes
- NO previous intraocular surgery
  - Except uncomplicated phacoemulsification at least 1 year prior to randomization into the trial
- Other exclusions:
  - Contraindication to SLT
  - Unable to use eye drops
  - Symptomatic cataract
  - Active treatment for some other type of ocular condition

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### Target IOP's in the LIGHT Study

- Based on Canadian Target IOP workshop
  - Disease stratification Mild, Moderate, or Severe
- Target IOP determined by both a % from a single untreated baseline measurement and an absolute threshold
  - Either 20 or 30% based on patient's clinical characteristics

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### Progression or Deterioration of Glaucoma During LIGHT Study

- Looking for progression of glaucoma OR conversion of OHT to OAG during the study
  - Impact on treatment escalations
- Decisions derived from the decision support software
  - Primarily based on HVF and HRT data
  - Verified by a consultant ophthalmologist for progression
  - Decide if it is "likely progression" or "possible progression"

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### Treatment Escalations in the LIGHT Study

- Based on guidelines from multiple international glaucoma and eyecare societies including AAO
- Treatment escalated IF:
  - There is strong evidence of progression irrespective of IOP level
  - IOP above target by more than 4 mmHg at a single visit
  - IOP above target by less than 4 mmHg and less strong evidence of progression...(possible progression)
- Additional 20% IOP reduction was then the goal if treatment escalated

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### SLT Laser Standardization

- Protocol defined settings and endpoints
  - 360 degree treatment
  - 100 non-overlapping spots
    - Approximately 25 per quadrant
  - Power could range from 0.3-1.4 mJ
- One re-treatment with SLT was allowed if IOP reduction was obtained with the first SLT
  - If there was and AE (IOP spike) then repeat was precluded
- After that the next escalation was medical therapy (drops)

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### Topical Medication Algorithm

- Drug classes for 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>d</sup> line treatment were determined by the NICE guidelines<sup>5</sup>
- First line-PGA's
- Second line- Beta Blockers
- Third line- TCAI or Alpha Agonist
- Fixed combinations were allowed
- MMT=Clinician judged max most intensive combination of medicines that could be tolerated

5. National Institute of Health and Clinical Excellence. DoH; 2010. NICE. Guidance on Glaucoma: Diagnosis and management of chronic open-angle glaucoma and ocular hypertension.

90

### Outcome Measures

- Primary outcome
  - Health-related quality of life (HRQoL) at 3 years
    - Assessed by the EQ-5D
    - Recently this measure has come under scrutiny as to its ability to find differences in HRQoL in a short time frame like this study (3 years)
    - Glaucoma is largely asymptomatic even at levels sufficient to make driving unsafe
    - In this study, baseline HRQoL were above average
    - Unlikely that EQ-5D is sufficient tool to see meaningful data

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### Secondary Outcomes

- Cost and Cost effectiveness
- Glaucoma disease specific HRQoL
- Clinical effectiveness of SLT vs. Drops
- Safety of SLT vs. Drops

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### Results

- Overall 509 (95%) of 536 SLT treated eyes were at target IOP @ 3 years
- Target IOP achieved without medication in 419 (78.2%) of 536 eyes treated in SLT arm
  - 321 eyes (76.6%) required only one SLT session

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### Results

- 499 (93.1%) of the 526 eyes treated medically were at target IOP @ 3 years
  - 346 (64.6%) were using a single medication
- At 3 years:
  - 94.0% of visits were at target IOP for SLT group
  - 93.1% of visits were at target IOP for med group

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### Treatment Escalations and Progression of Disease During Study

- More treatment escalations occurred in the SLT group (348 eyes) than the Medication group (299 eyes)
- Progression
  - 36 eyes in the Medication group showed algorithm-confirmed progression
    - 3 eyes converted from OHT to OAG
    - 33 eyes with OAG progressed
  - 23 eyes in the SLT group
    - 2 eyes converted from DHT to OAG
    - 21 eyes with OAG progressed
- 11 eyes (1.8%) in the Medication group required incisional glaucoma surgery
  - NO EYES IN SLT GROUP REQUIRED INCISIONAL SURGERY

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### Adverse Events

- SLT Group
  - 6 eyes had an IOP rise of 5mm Hg or more on day of treatment
    - Only 1 eye required treatment
  - 122 eyes (34.4%) had transient discomfort, blurred vision or photophobia not requiring treatment
- Medication Group
  - 150 eyes had aesthetic side effects or allergic reactions

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### Cost of Therapy

- Eye drops were approximately double the cost effect of SLT
- Difficult to extrapolate to US market but general financial math should apply
- Eventual ophthalmic surgery (trab, tube, cataract etc) over the 3 years was significantly less in the SLT group compared to the Medication group

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### Primary Outcome Measure

- Primary outcome
  - Health-related quality of life (HRQoL) at 3 years
    - Assessed by the EQ-5D
- Small trend towards better HRQoL for SLT group vs. Medication group but not statistically significant
  - Recently this measure has come under scrutiny as to its ability to find differences in HRQoL in a short time frame like this study (3 years)
  - Glaucoma is largely asymptomatic even at levels sufficient to make driving unsafe
  - In this study, baseline HRQoL were above average
  - Unlikely that EQ-5D is sufficient tool to see meaningful data

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### Secondary Outcome Measures

- Cost and Cost effectiveness
- Clinical effectiveness of SLT vs. Drops
- Safety of SLT vs. Drops

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### Cost and Cost Effectiveness

- SLT as first line resulted in a significant cost savings relative to surgery and medication
  - Approximately 451 dollars/pounds savings in provider related visit costs per patient
  - For every patient given SLT in lieu of drops, the cost savings are greater than the cost of SLT for **2 additional patients!**
  - This is also equal to the cost of five additional office visits

100

### Clinical effectiveness of SLT vs. Drops

- Rate of Disease Progression
  - In the Medication group 36 patients (5.8%) had disease progression
  - In the SLT group 23 patients (3.8%) had disease progression
    - 74% remained drop free at 3 years

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### Clinical effectiveness of SLT vs. Drops

- IOP Control
  - SLT first approach provided better IOP control over 3 years with more visits at target IOP compared to drops
    - Less intense drop treatment than Medication group
    - NO glaucoma surgeries required compared to Medication group
  - Could be due to adherence with SLT vs. Drops

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### Clinical effectiveness of SLT vs. Drops

- IOP Control
  - SLT provides better diurnal IOP stability<sup>6</sup>
    - Could be due to continuous effect on TM versus episodic administration of medication
  - Primary SLT afforded drop free control of IOP for 3 years in 74.2% of patients
    - This is much higher than in previous studies with less stringent success criteria
    - Prior treatment and more severe disease likely reduce the effect of SLT in those patients<sup>7</sup>
    - Likely the reason for such a robust response in treatment naïve patients in this study

6. Greenidge EC et al. Effect of argon laser trabeculoplasty on the glaucomatous diurnal curve. *Ophthalmology*. 1983;90:800-804.  
 7. Nager M et al. A randomized, prospective study comparing selective laser trabeculoplasty with latanoprost for the control of intraocular pressure in ocular hypertension and open angle glaucoma. *Br J Ophthalmol*. 2005;89:1413-1417.

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### Safety of SLT vs. Drops

- This study showed a greater safety profile of SLT than previously reported
  - No systemic side effects reported
  - Only 1 eye had an IOP spike
    - Compared to previously reported rates of 28.8%<sup>8</sup>
    - 2-week IOP checks did not change management for any patient and appears to be unnecessary
      - Avoidance of this could save more \$ to the system
  - Lower rate of cataract surgery in SLT arm which supports the existing evidence of drops increasing incidence of cataract and surgery<sup>9</sup>

8. Wang et al. Systematic review and meta-analysis on the efficacy of selective laser trabeculoplasty in open-angle glaucoma. *Surv Ophthalmol*. 2015;60:35-50.  
 9. Hejli A et al. Reduction of intraocular pressure and glaucoma progression; results from the Early Manifest Glaucoma Trial. *Arch Ophthalmol*. 2002;120:1268-1272.

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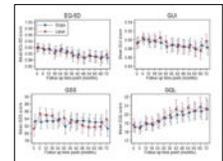
### Conclusions

- Selective laser trabeculoplasty provides superior IOP stability to drops, at a lower cost AND
  - 74% or ¾ of patients are successfully controlled without drops for at least 3 years after a single treatment

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### LIGHT: SIX-YEAR STUDY UPDATE

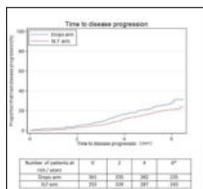
- 633 subjects entered 3-year extension study
- At the beginning of 3-year extension (month 37)
  - SLT: 313
    - 128 received SLT to decrease drop burden, 48 received SLT as treatment escalation
  - Medication: 320
  - QOL scores still non statistically significant



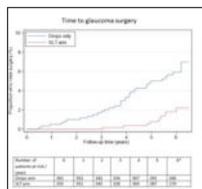
Gazzard G et al. *Ophthalmology*. 2023;130(7):1291-1301

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### LIGHT: SIX-YEAR STUDY



SLT More drop free: 70% vs. 18%



% progression  
 - SLT: 19.6  
 - Med: 26.8

% glaucoma surgery  
 - SLT: 2.4%  
 - Med: 5.8%

Gazzard G et al. *Ophthalmology*. 2023;130(2):139-151.

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LIGHT trial: 6-year results of primary selective laser trabeculoplasty versus eye drops for the treatment of glaucoma and ocular hypertension

Gus Gazzard, Evgenia Konstantakopoulou, David Garway-Heath, Mariam Adelleke, Victoria Vickerstaff, Gareth Ambler, Rachael Hunter, Cathy Bunce, Neil Nathwani, Keith Barton, on behalf of the LIGHT Trial Study Group



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### What's New in SLT

- FDA Approves Belkin's EAGLE DSLT December 2023.
- Direct selective laser trabeculoplasty (DSLTL)-VOYAGER
- Noncontact SLT, 120 automated shots to limbal area



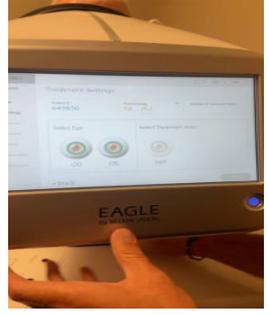
Direct selective laser trabeculoplasty in open angle glaucoma study design: a multicentre, randomised, controlled, investigator-masked trial (GLAUIous)

Nathaniel Condon<sup>1,2</sup>, Aquilino Ascare-Bianco,<sup>1</sup> Brian Solberg,<sup>3</sup> Carlo E. Traverso,<sup>4</sup> Michele Imine,<sup>4</sup> Carlo Alberto Cusioli,<sup>5</sup> Alessandro Basso,<sup>6</sup> Tin Aung,<sup>6</sup> Scott J. Fudenberg,<sup>7</sup> Richard Lindstrom,<sup>1,8</sup> Thomas Bernathos,<sup>9</sup> Kishor Singh,<sup>4</sup> Felix Z. Blumenfeld,<sup>10,11</sup> Gus Gazzera,<sup>12,13</sup> and GLAUIous study group

Gelfen N et al. Journal of Glaucoma. 2017;26(1):201-207.

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### DSLTL Patient Experience



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### 54 YOWM

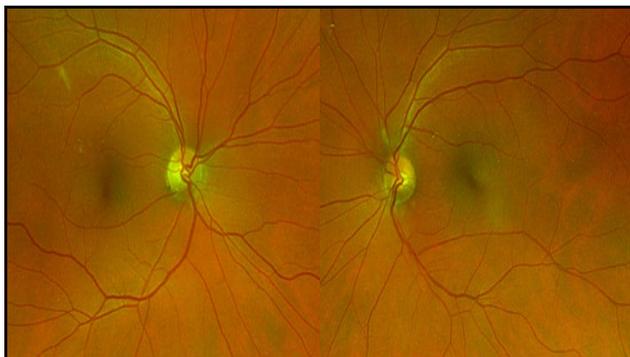
- History of HTN and Hypercholesterolemia
- History of Lymphoma; Treated and in remission
- Medications: Rosuvastatin, Losartan
- Ocular History: Unremarkable

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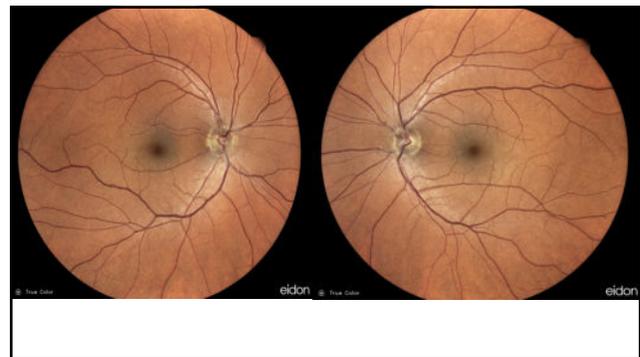
### 54 YOWM

- Presents to a screening where a retinal photograph was taken and blood discovered on review; Not a Drance Heme but active blood leakage
- Referred immediately for exam
- Baseline IOP Max=43mmHg OU
- Pachymetry 602 OD and 601 OS
- Gonio: open to CB 360 degrees OU with 3 + patchy pigment

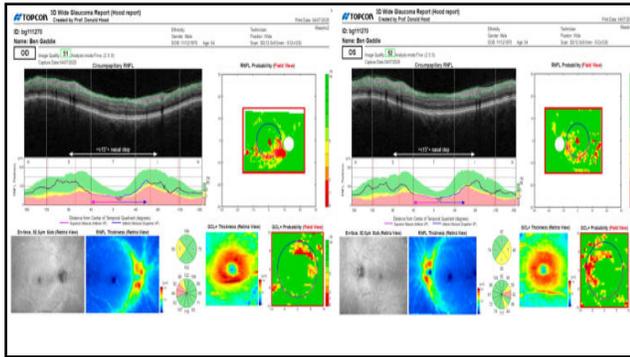
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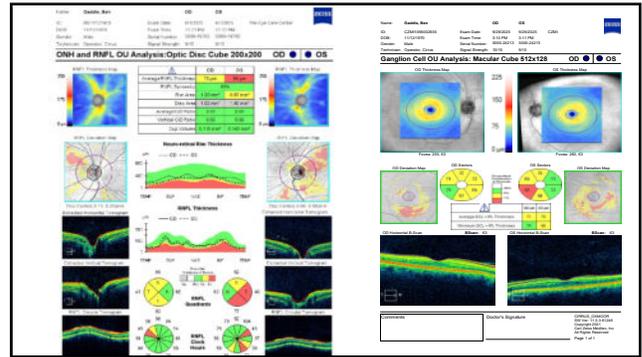
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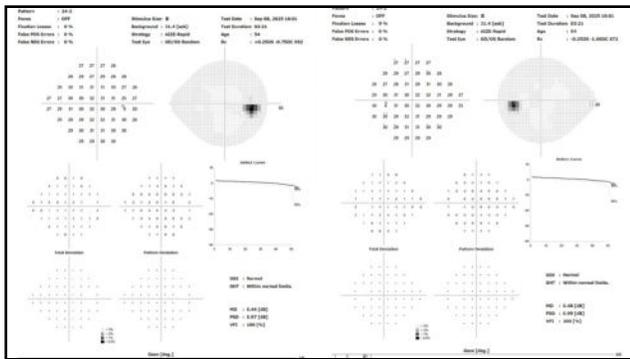
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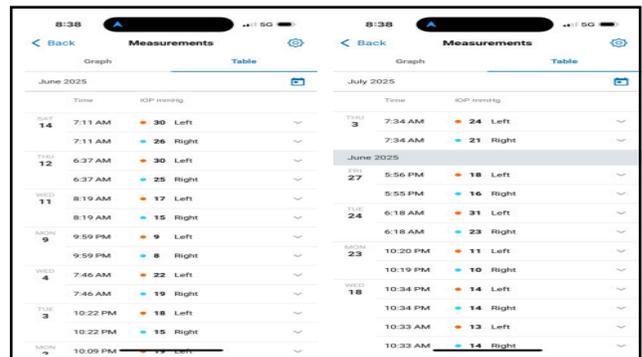
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A screenshot of a mobile application interface showing a list of measurements for April 2025. The list includes dates, times, and numerical values for various measurements.

## Started Treatment 4/20/25

- Latanoprostene (Vyzulta) QD HS OU
- Added OTC off label
  - Nitric Oxide orally
  - Pyruvate orally

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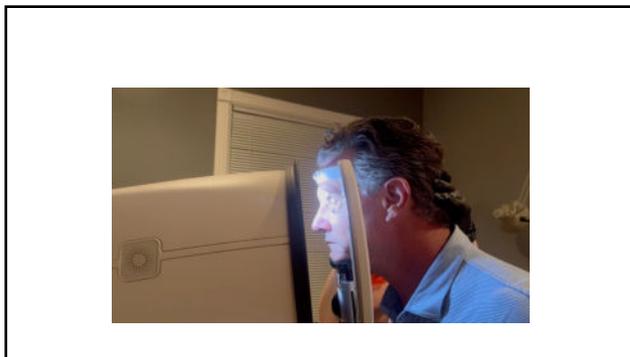
Time	IOP (mmHg)	Eye
7:51 AM	25	Left
7:51 AM	23	Right
9:25 PM	15	Left
9:25 PM	14	Right
4:02 PM	14	Left
4:02 PM	12	Right
10:57 PM	13	Left
10:56 PM	10	Right
10:01 PM	11	Left
10:00 PM	10	Right
12:26 PM	14	Left
12:26 PM	12	Right
12:25 PM	14	Left

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### Most Recent Treatments

- Still on Latanoprostene
- Direct SLT OS
- Standard SLT OD

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AMERICAN ACADEMY OF OPHTHALMOLOGY

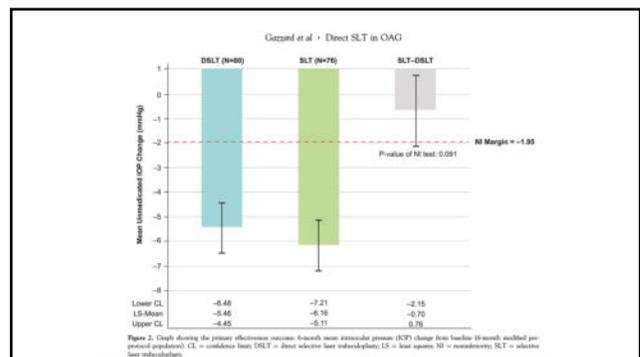
## Randomized Noninferiority Trial of Direct Selective Laser Trabeculoplasty in Open-Angle Glaucoma and Ocular Hypertension

### GLAURIous Study

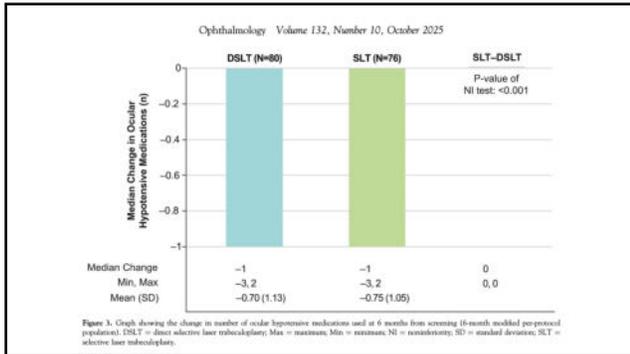
Gus Gazzard, MA(Cantab), FRCOphth,<sup>1,2</sup> Nathan Congdon, MD, MPH,<sup>3,4,5</sup> Augusto Azuara-Blanco, PhD,<sup>3</sup> Eytan Z. Blumenthal, MD,<sup>6,7</sup> Ketevan Gomelauri, MD,<sup>8</sup> Monika Zaliniyan, MD,<sup>9</sup> Carlo E. Traverso, MD,<sup>10</sup> Zohar Bracha, MD,<sup>11</sup> Ana Dealghavei, MD,<sup>12</sup> Yoram Solberg, PhD,<sup>13</sup> Michael Belkin, MA(Cantab), MD,<sup>13,14</sup> Thomas W. Samuelson, MD,<sup>15</sup> on behalf of the GLAURIous Study Group

**Purpose:** Effective glaucoma treatment is limited by nonadherence to medications and access to selective laser trabeculoplasty (SLT). The GLAURIous study compared automated, gonioscopy-free, noncontact, image-guided direct selective laser trabeculoplasty (DSLTL) with conventional SLT in open-angle glaucoma (OAG) and ocular hypertension (OHT) to reduce intraocular pressure (IOP).

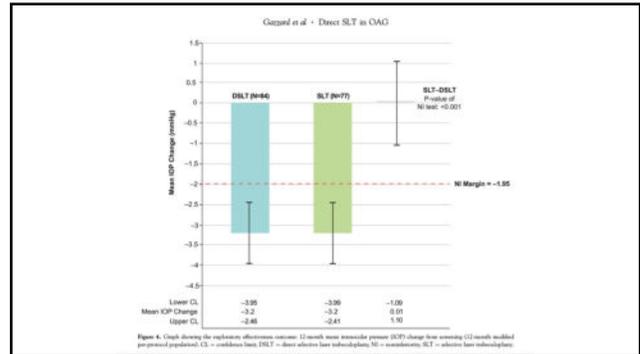
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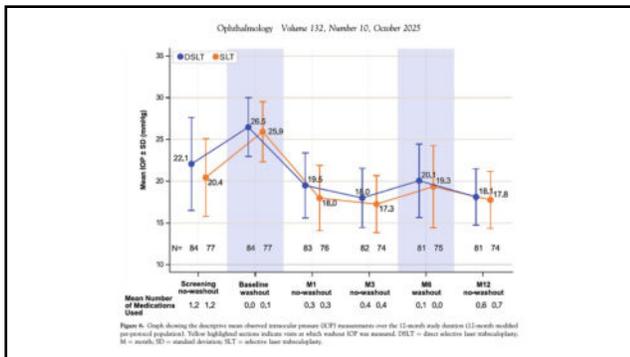
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### GLAurious Trial: SLT vs. DSLT

**Purpose**

- Compare DSLT outcomes to manual SLT (non-inferiority)
- Demonstrate safety and efficacy of DSLT

**Effectiveness Endpoints**

- Primary: Difference in mean IOP reduction from baseline (washout) at 6 months
- Secondary:
  - Proportion with >20% IOP reduction at 6 months without SSI
  - Change in # of medications at 6 months

Parameter	DSLIT	SLT
Screening IOP (mmHg)	22.1	20.4
Baseline IOP (mmHg)	25.9	25.9
M1 IOP (mmHg)	19.5	18.0
M3 IOP (mmHg)	17.0	17.3
M6 IOP (mmHg)	20.0	18.3
M12 IOP (mmHg)	18.1	17.8
Mean IOP (mmHg)	19.7	18.7
Baseline IOP (mmHg) - IOP at 6 months	20.4	18.3
Baseline IOP (mmHg) - IOP at 12 months	18.1	17.8

1. GLAurious Study - Clinical Study Report (CSR), CA-RP-01-006, Rev. 01, 2022

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### GLAurious Trial: SLT vs. DSLT

Months: 6, 12

Group	6 Months (washout)	12 Months (non-washout)
DSLIT (n=80)	-5.5 mmHg (95% CI: -6.5, -4.5)	-3.2 mmHg (95% CI: -4.0, -2.5)
SLT (n=76)	-6.2 mmHg (95% CI: -7.2, -5.1)	-3.2 mmHg (95% CI: -4.0, -2.4)

Difference in Mean: -0.7 mmHg (p=0.09, 95% CI: -2.2 to 0.8 mmHg) at 6 months; Difference in Mean: 0.0 mmHg (p=0.001, 95% CI: -1.1 to 1.1 mmHg) at 12 months.

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Published in final edited form as:  
*J Glaucoma*. 2021 July 01; 30(7): 545-551. doi:10.1097/JGJ.0000000000001788.

### Low-Energy Selective Laser Trabeculoplasty Repeated Annually: Rationale for the COAST Trial

**Tony Realini, MD, MPH<sup>1</sup>, Gus Gazzard, MD<sup>2</sup>, Mark Latina, MD<sup>3</sup>, Michael Kass, MD<sup>4</sup>**

<sup>1</sup>Department of Ophthalmology and Visual Sciences, West Virginia University, Morgantown, WV  
<sup>2</sup>NIHR Biomedical Research Centre at Moorfields Eye Hospital NHS Foundation Trust, London, UK; University College London, UK  
<sup>3</sup>Department of Ophthalmology, Tufts University, Boston, MA  
<sup>4</sup>Department of Ophthalmology and Visual Sciences, Washington University, St. Louis, MO

**Abstract**

At the 2018 annual meeting of the Association for Research in Vision and Ophthalmology (ARVO), Stephano Gandolfi presented a retrospective study of his patients at the University of Parma, Italy, in which a regimen of low-energy selective laser trabeculoplasty (SLT) repeated annually irrespective of intraocular pressure (IOP) produced significantly longer medication-free survival than standard SLT repeated as needed, in patients with primary open-angle glaucoma.

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**Abstract**

At the 2018 annual meeting of the Association for Research in Vision and Ophthalmology (ARVO), Stephano Gandolfi presented a retrospective study of his patients at the University of Parma, Italy, in which a regimen of low-energy selective laser trabeculoplasty (SLT) repeated annually irrespective of intraocular pressure (IOP) produced significantly longer medication-free survival than standard SLT repeated as needed, in patients with primary open-angle glaucoma (POAG) or high-risk ocular hypertension (OHTN).<sup>1</sup> Specifically, newly-diagnosed POAG eyes were treated primarily either with ALT 360° performed once, standard SLT 360° repeated as needed at standard energy, and low-energy 360° SLT (0.4 mJ/spot x 50-60 spots) repeated annually at low energy regardless of IOP. After 10 years of follow-up, medication-free rates were 22.6% in the ALT group, 25.0% in the standard SLT group, and 58.3% in the low-energy SLT group (p<0.001). The median times to medication were 2.8 years, 3.2 years, and 6.2 years, respectively. In light of the recent Laser in Glaucoma and Ocular Hypertension Trial (LiGHT)

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~15 years after the diagnosis of POAG.<sup>110</sup> If we validate an SLT treatment strategy that extends the duration of medication-free disease control, we move one step closer to the possibility of a drop-free lifetime for our patients. Delaying the need for medications by 3, or 5, or 7 years not only confers all the benefits of medication-freedom during this period (which will be all that many patients would need in their lifetimes)—it also allows time for development of safer and more effective drugs dosed infrequently via sustained-release delivery systems, as well as better surgical options, for patients whose lifespans exceed SLT responsiveness. Thus, a new treatment paradigm consisting of SLT, then sustained-release medications, followed by minimally invasive glaucoma surgery and then—for the few who will progress this far—filtering procedures could offer the majority of glaucoma patients the very real possibility of a drop-free lifetime of therapy. As instruments to measure glaucoma *treatment-related* quality of life are developed and validated, the benefits of freedom from the responsibility and detractions of daily medication self-dosing on our patients' well-being are likely to become apparent as well.

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**Pipeline Angle Based Laser Technologies**

- OCT Guided Femtosecond Laser Trabeculostomy
- Excimer Laser Trabecular MIGS
- Low Energy Annual SLT

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**OCT Guided Femtosecond Laser Trabeculostomy**

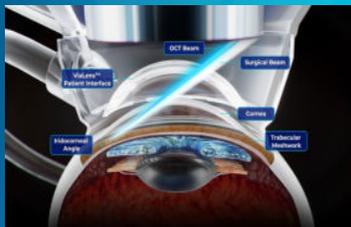
- Decreases IOP by increasing aqueous outflow
- Non invasive/Clear Corneal incision of probe with the aid of a goniolens for angle visualization
- OCT guides the femtosecond into the angle where customized channels are created through the trabecular meshwork
- Elios vision

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**A Surgical Procedure Without the Surgery**

The first Femtosecond Laser Image Guided High-precision Trabeculotomy (FLIGHT)

- Ultra HD gonioscopic & OCT imaging identify landmarks with micron accuracy
- Incision-free femtosecond laser creates precise apertures in the trabecular meshwork to lower IOP
- Repeat treatments can be performed as needed to maintain results



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**Femtosecond Laser Image Guided High-precision Trabeculotomy (FLIGHT) Procedure**



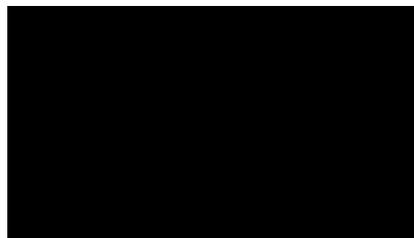
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### Elios Laser Trabeculostomy

- ELIOS uses high precision, non-thermal, laser ablation to create 10 microchannels in the trabecular meshwork to enhance physiological outflow into Schlemm's canal while preserving angle anatomy.

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### Elios Laser Trabeculostomy



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### Micropulse Laser Trabeculoplasty

- Delivers energy in repetitive microsecond pulses followed by intermittent rest periods
  - Reduces buildup of thermal energy and reducing coagulative damage to the TM

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### Baseline Considerations to Co-Manage with a Glaucoma Specialist

- First you need to figure out what you are comfortable with managing:
  - Do you need help making the diagnosis at times, but comfortable managing primary therapy?
  - Do you need help when primary therapy consists of SLT?
  - Do you need help when needing adjunctive therapy (meds or SLT)?
  - Are you uncomfortable after 2 bottles of medications?
  - Are you uncomfortable when you discover progression of glaucoma?
  - Do you need help when referring a patient for cataract surgery who has glaucoma?
- For these needs, find a glaucoma oriented OD or MD in your community!

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### Baseline Considerations to Co-Manage with a Glaucoma Specialist

- Do you need help with a Xen stent, Trab/Tube or advanced MIGS?
- Complicated angle closure/plateau iris cases requiring
  - Lensectomy
  - Goniosynechiaelysis
  - Persistent narrow angles after LPI
  - Narrow angles after NAG attack despite LPI
- Patients experiencing larger fluctuations in glaucoma that are difficult to control
  - Example PXE/PG
  - Patients who have lost substantial or all vision in one eye from glaucoma

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### Baseline Considerations to Co-Manage with a Glaucoma Specialist

- Absolute no-no's for sending patients to a glaucoma specialist
  - You don't want to treat or "mess with" glaucoma
  - You don't have the equipment to diagnose or manage glaucoma
  - You don't take medical insurance

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