

Ophthalmology Times

**Research Scholar**  
Honoree Program

Application of Active Learning of the Contrast  
Sensitivity Function in Patients with Macular  
Disease and Good Visual Acuity

Karen M. Wai, MD

Massachusetts Eye and Ear

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# FINANCIAL DISCLOSURES:

None

# MY ROLE IN THIS RESEARCH:

Please answer which of the following portions of the research you participated in:

- Conception and design of the work/project
- Acquisition of data
- Analysis and interpretation of data
- Creation and/or critical review of the presentation

# Background: “*Why can’t I see?*”

- Visual acuity is the most widely used test to assess visual function, but may not always accurately describe a patient’s self-assessment of visual limitations, especially in those with macular disease
- Contrast sensitivity better correlates with day-to-day activities
- Contrast sensitivity function (CSF) is perhaps a more accurate measurement of visual function - but how can we quantify it?

# Background: The search for a perfect test

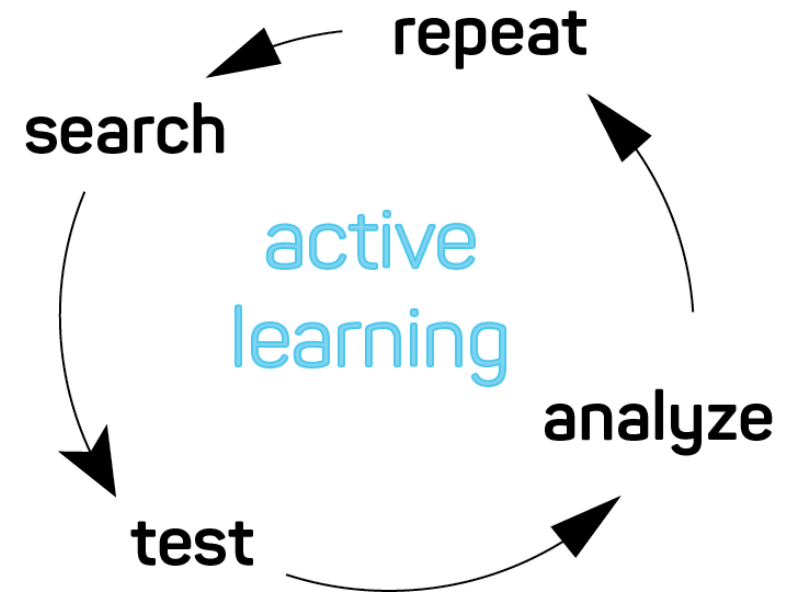
- Absence of a reliable and clinically applicable test has hindered adoption of CSF testing in routine clinical practice
  - Pelli-Robson chart: tests CS only in a single spatial frequency
  - Conventional lab CSF testing: too time consuming
  - Vistech test or functional acuity contrast test: poor test-retest reliability



# Background: How can we apply an intelligent tool for vision testing?

## The quick contrast sensitivity (qCSF) method

- Use of an adaptive algorithm to select optimal optotypes from >2400 candidate test items
- High sensitivity
- Time efficient
- Maximal information gain



# Objective

We evaluate qCSF method in assessing visual function deficits in eyes with macular disease that retained good measured letter acuity compared to healthy control eyes

# Methods

- Prospective cross-sectional study
- Patients recruited from December 2016 to February 2020
- Inclusion criteria:
  - Eyes with maculopathy [retinal vein occlusion (RVO), macula-off retinal detachment (RD), dry age-related macular degeneration (AMD), wet AMD] OR healthy control eyes without evidence of maculopathy
  - Retention of good measured visual acuity ( $VA \geq 20/30$ ;  $0.176 \log\text{MAR}$ )
- Exclusion criteria:
  - Visually significant cataracts ( $>2+$  nuclear sclerosis)
  - Presence of any ocular disease (ex. glaucoma)



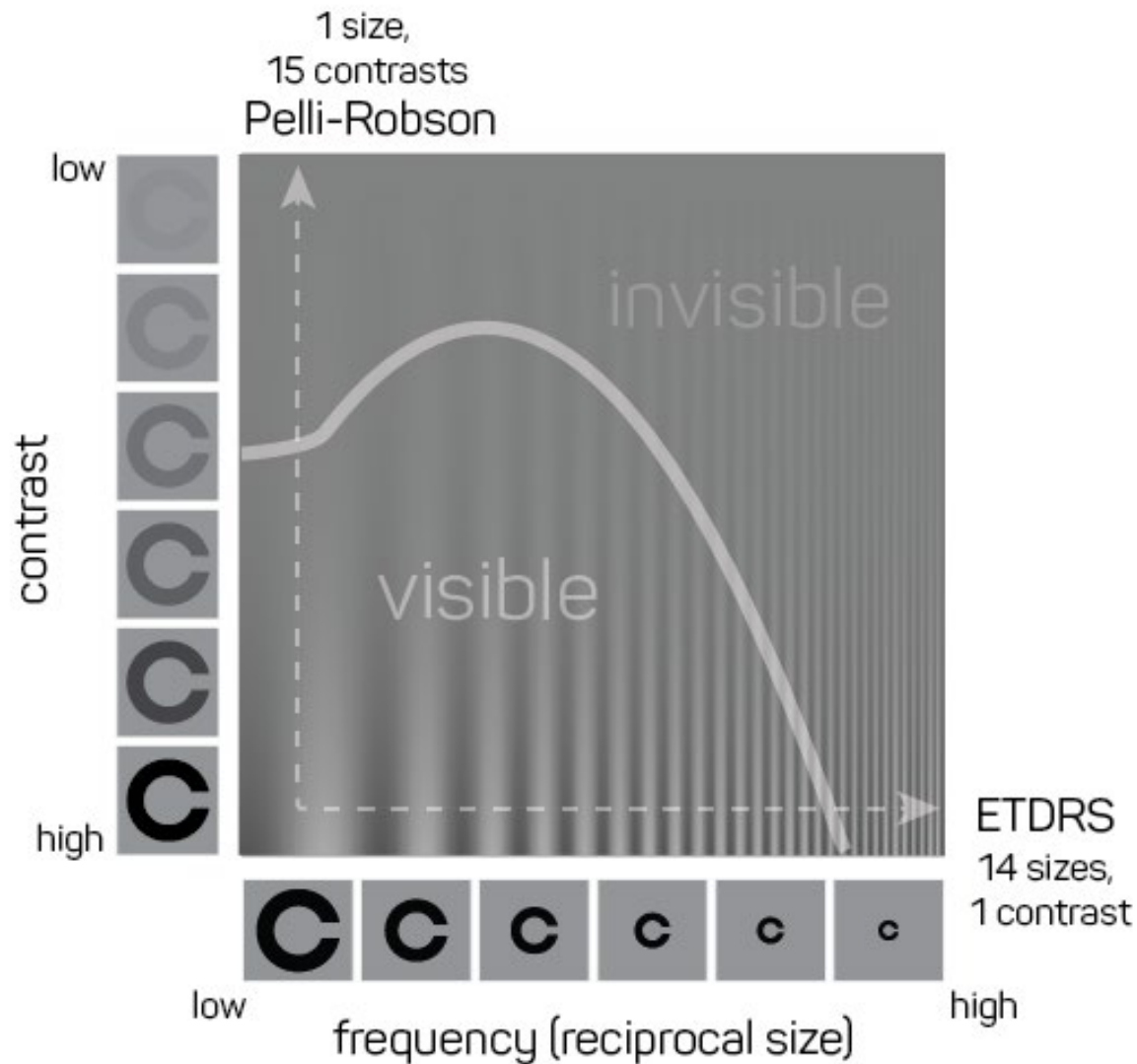
# Methods cont.

- qCSF testing
  - Manifold Contrast Vision Meter (Adaptive Sensory Technology (AST), San Diego, CA)
  - Intelligently selects from 128 possible contrasts, 19 possible spatial frequencies



Sentio

Sentio Response Tablet



## Main outcomes:

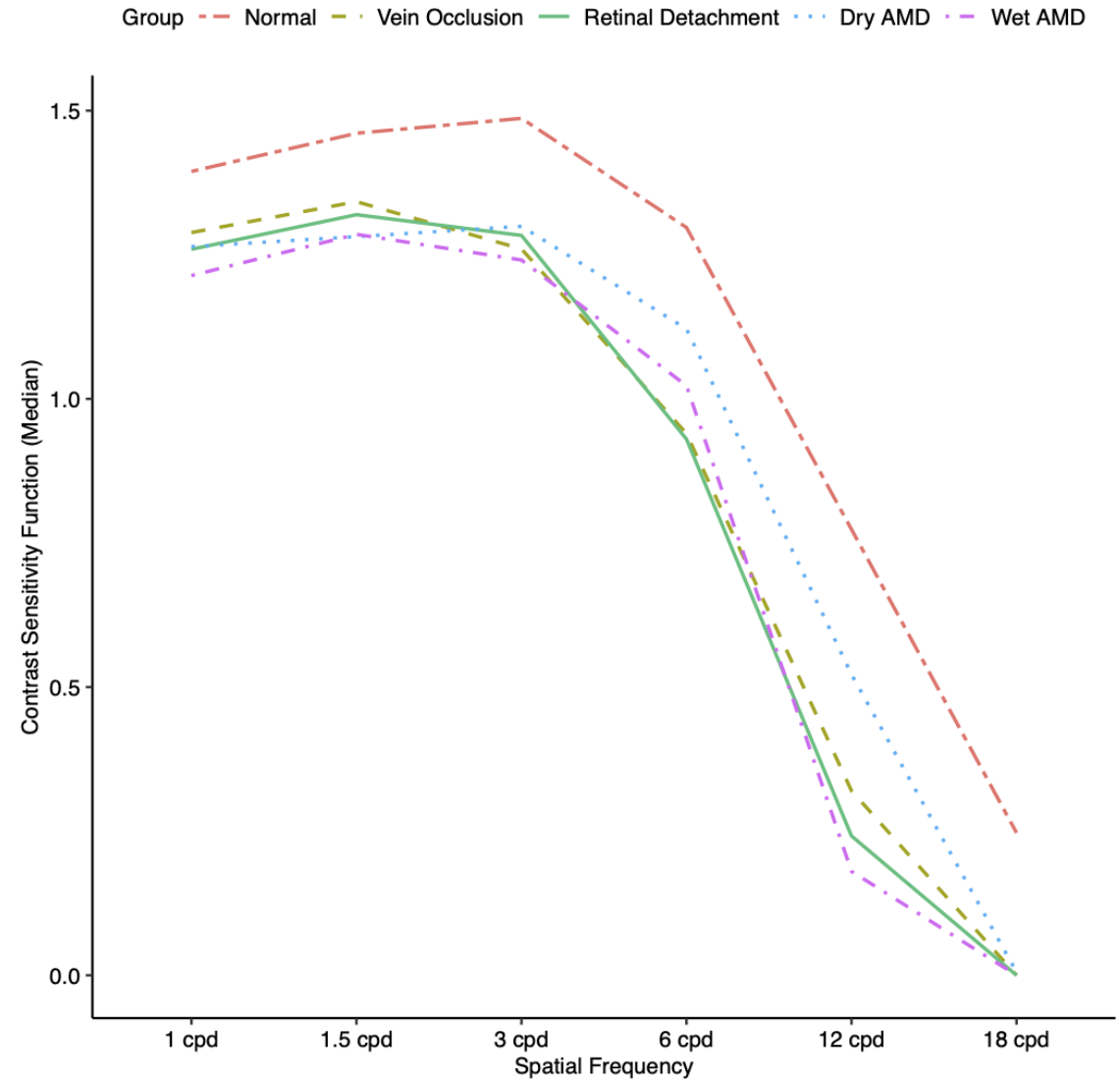
- Area under the log contrast sensitivity function curve (AULCSF)
- Contrast sensitivity thresholds at six spatial frequencies from 1 – 18 cycles per degrees (CPD)

# Results

- 151 eyes from 120 patients with a maculopathy compared to 93 control eyes from 82 patients
  - 27 eyes with RVO from 25 patients
  - 22 eyes with history of macula-off RD from 22 patients
  - 84 eyes with dry AMD from 58 patients
  - 18 eyes with wet AMD from 15 patients

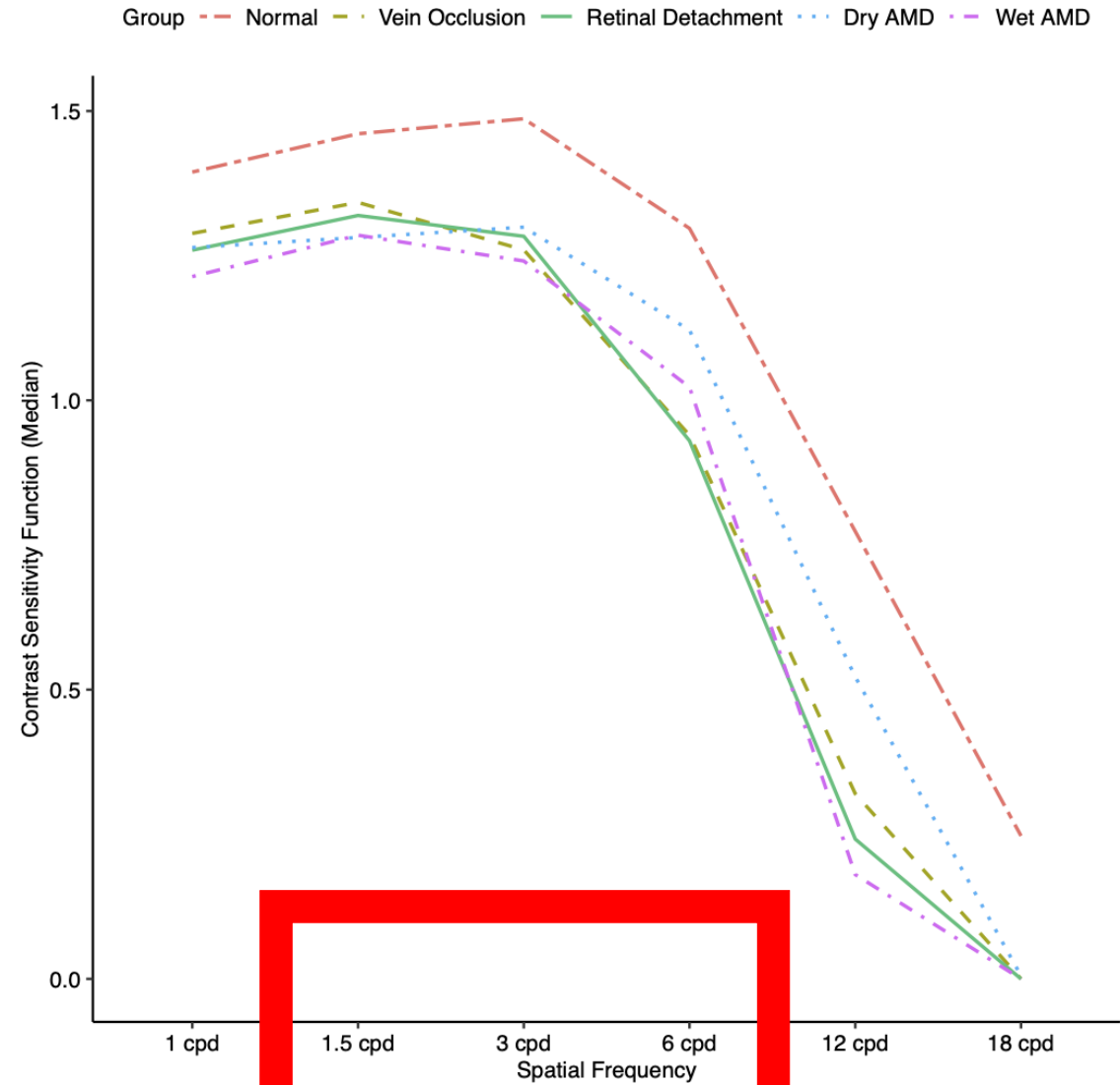
# Results

- Presence of maculopathy was associated with:
  - Reduction in AULCSF relative to control eyes
  - Reduction in CS thresholds among all spatial frequencies except at 18 CPD relative to control eyes



# Results

- Notably, reductions in CS thresholds were most evident at intermediate spatial frequencies
- Subgroup analysis for very good visual acuity patients ( $VA \geq 20/20^{-1}$ ) – similar results



# Conclusions: A better assessment of how well our patients can see

- Eyes with macular disease, despite high letter acuity, had significant reductions in contrast sensitivity function relative to healthy controlled eyes
- qCSF is a promising visual function endpoint given its ability to recognize and assess functional deficits in eyes with macular disease that otherwise can go unrecognized by current testing methods

# Thank you!

- Dr. John B. Miller
- Harvard Retinal Imaging Lab
- Ophthalmology Times Research Scholar Honoree Program

