

Automatic Eye Disease Screening System: EYESTAR™

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SIGNIFICANCE

According to the Center for Disease Control (CDC) and the Alliance for Aging, “more than 38 million Americans age 40 and older are blind, visually impaired, or have an age-related eye disease. The annual economic costs of adult vision loss exceed \$51 billion—a huge share of the \$68 billion annual cost of all vision impairment and eye disease.” This continued increase in the incidence of eye disease is due in part to the rapidly increasing proportion of the aging population, the fast-growing minority population, and the epidemic nature of increases in obesity, that lead to diabetes mellitus. None of these factors are projected to do anything but to continue to add to the number of Americans who will be blind or visually impaired through the next decade. Our goal is to “Stop Blindness by 2020” due to age-related causes and co-morbidity of diabetes.

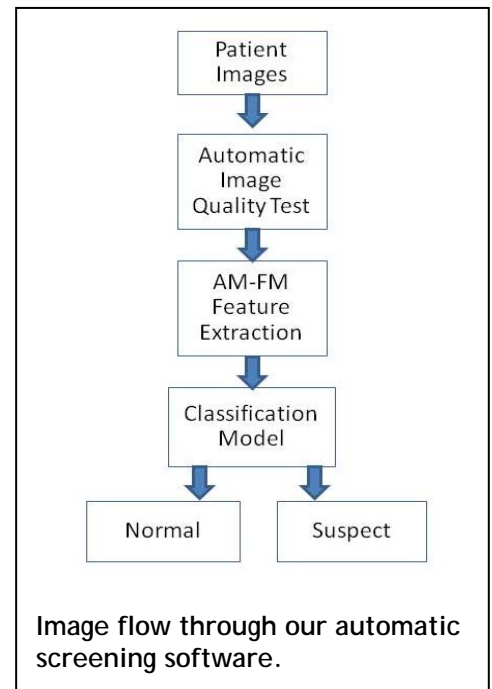
Introduction of EYESTAR™ into the Clinical Practices of FCPs

Through projects, such as summarized herein, that are supported by advanced technologies, including low-cost retinal cameras and computer-based retinal image screening, nearly all blindness due to diabetic retinopathy can be detected and referred for preventative treatment, and most other age-related diseases can be treated to halt or prevent vision loss. However, this requires early detection and rigorous health maintenance. VisionQuest Biomedical has produced a new test based on low-cost imaging technology for early detection of eye disease. Coupled with new treatments and therapies, vision in diabetics and those suffering with age-related macular degeneration can be stabilized or restored.

OUR PRODUCT

Through \$5.2 million in grants from the National Institutes of Health, our patented automated diabetic retinopathy (DR) screening system was developed and is now undergoing final clinical validation. We have established our first screening site at the Retina Institute of South Texas, San Antonio, TX.

The eye disease screening system is based on techniques developed by VisionQuest and are described by Agurto¹ and Murray². The journal paper by Agurto, et al. presents the details on how our patented methodology based on amplitude modulation-frequency modulation for feature extraction is applied in the detection of lesions associated with retinopathy. The figure depicts the data flow into and through the device. The device will screen individual images for each eye and assign a “finding,” either *for archive* or *for review*. Images from three regions of the retina are introduced to the algorithm.



Images that pass the image quality test are transmitted to the “screening algorithm.” The screening algorithm first extracts mathematical features based on a technique known as amplitude-modulation, frequency-modulation (AM-FM). The features are “clustered” so that an association is established between those features found in normal images or those in abnormal images. Based on these features, the individual images from each eye are classified into two classes: “Normal” or “Suspect”.

Results from preliminary clinical testing (see Table) demonstrate our readiness to embark on a commercial venture. Note that the high sensitivity is achieved for early stages of retinopathy and essentially perfect sensitivity for sight-threatening retinopathy.

| Database | DR Early Stages | | Sight-Threat DR | |
|-------------------|-----------------|------|-----------------|------|
| | Sens | Spec | Sens | Spec |
| Messidor (N=1200) | 98% | 70% | 100% | 88% |
| RIST (N=378) | 91% | 60% | | |

Table - Tests were performed on two databases as indicated. *Retina Institute of South Texas (RIST)

This image analysis process almost instantaneously analyzes a set of retinal images from a patient. The fully quantitative analysis produces results that are consistent and fully reproducible. Our methodology is useful not only in clinical settings for detecting asymptomatic eye disease, but it can precisely and quantitatively determine changes in the disease for standard treatments or in establishing drug efficacy in clinical trials.

An additional key innovation and differentiator from other “manual” (no automation) screening systems is our low-cost retinal camera. Our \$4,000 estimated cost is five to ten times lower price than current commercial cameras. This is an enabling technology that allows us to put a camera in every family care and primary care physicians’ office.

BENEFITS TO FAMILY PRACTICE PHYSICIANS

Adoption of the EYESTAR™ system provides user-friendly equipment improved healthcare for patients, low impact on clinical activities, and screening results in minutes. It is the first line of defense against sight loss from retinal disease.

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1. Agurto C, Murray V, Barriga ES, Murillo S, Pattichis M, Davis H, Russell SR, Abramoff MD and Soliz P, “Multiscale AM-FM Methods for Diabetic Retinopathy Lesion Detection,” IEEE Medical Imaging, Feb 2010.
2. Murray, V, Rodriguez P, Pattichis MS, “Multiscale AM-FM Demodulation and Image Reconstruction Methods with Improved Accuracy,” IEEE Transactions on Medical Imaging, May 2010.

A few minutes to screen, . . .
...the rest of your life to see

EYESTAR™



Stamp Out Blindness by 2020