

# Detecting Cardiovascular Disease Using Noninvasive Imaging of the Eye

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## BACKGROUND

Cardiovascular disease is the leading cause of mortality and disability worldwide. It is also prevalent, affecting 9% of the population over 20 years of age. Patients with cardiovascular risk factors can reduce their risk of developing catastrophic cardiovascular events such as heart attack and stroke through lifestyle modification and medications. Unfortunately for many, the disease may go undiagnosed until the occurrence of serious events. Identifying biomarkers of subclinical ischemia can help identify patients with occult cardiovascular disease.

## TECHNOLOGY DESCRIPTION

Researchers at UC San Diego have developed a method that capitalizes upon the ability to directly visualize individual layers of the retina at submillimeter resolution *in vivo* using spectral domain- optical coherence tomography (SD-OCT) and identified features that are prevalent in patients with cardiovascular diseases.

Optical coherence tomography (OCT) is a non-invasive imaging test that uses light waves to take cross section pictures of your retina. This allows the ophthalmologist to see each of the retina's distinctive layers and to map and measure their thickness, which helps with diagnosis. These measurements also provide treatment guidance for glaucoma and diseases of the retina, including age-related macular degeneration (AMD) and diabetic eye disease. The spectral-domain (SD)-OCT devices include a spectrometer in the receiver that analyzes the spectrum of reflected light on the retina and transforms it into information about the depth of the structures according to the Fourier principle. In other words, image acquisition by an SD-OCT machine, would allow the doctor to identify these features and predict whether there is an underlying cardiovascular disease.

## APPLICATIONS

Cardiovascular disease poses a heavy economic burden with a total cost expected to reach \$1.1 trillion by 2035. Tests that can help identify patients with cardiovascular disease may lead to institution of early interventions. This invention allows for the identification of features that can be used as surrogate markers of ischemia and can help identify patients with cardiovascular diseases including those at risk of developing strokes.

## ADVANTAGES

A cost-effective test with high specificity can be used to rule-in the presence of the disease and identify patients at risk who may benefit from additional targeted diagnostic tests. The advantage of the test is that it detects an endpoint and can serve as a screening test rather than a diagnostic test. This test identifies a subset of patients who would definitely benefit from additional workup. The test has high specificity with a high positive predictive value (96%). It is noninvasive, inexpensive, does not involve any ionizing radiation and do not require dilation of the eye or the use of an intravenous dye.

## STATE OF DEVELOPMENT

We demonstrated the validity of this method in a case control study. A prospective study is underway.

## INTELLECTUAL PROPERTY INFO

The invention is patent-pending and is available for licensing and collaborations.

## PATENT STATUS

Patent Pending

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## OTHER INFORMATION

### KEYWORDS

Retinal imaging, cardiovascular  
  
disease, surrogate markers of  
  
ischemia, stroke, optical coherence  
  
tomography, Vascular dementia,  
  
arrhythmia.

### CATEGORIZED AS

- **Imaging**
  - Medical
- **Medical**
  - Diagnostics
  - Disease: Cardiovascular and Circulatory System
  - Screening

### RELATED CASES

2020-160-0