UC San Diego Health

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# Optimizing Optical Coherent Tomography (OCT) Images: A Quality Improvement Initiative

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## Background

In ophthalmology, the Optical Coherent Tomography (OCT) has revolutionized diagnostic capabilities, allowing for high resolution imaging of the retinal microstructure. Despite the availability of state-of-the-art imaging systems, concerns persist regarding the variability and suboptimal quality of OCT scans. As Taylor (2018) noted, there is a prevailing acceptance of less-than-optimal imaging practices, highlighting the need for a paradigm shift towards world-class imaging standards.

This study addresses the inconsistencies in OCT imaging by implementing targeted quality improvement measures. Utilizing the capabilities of the Heidelberg Spectralis OCT system, the aim is to enhance image contrast, reduce Signal to Noise Ratios (SNR), and optimize the visualization of retinal layers. Establishing standardized protocols and quality benchmarks will provide clinicians with reliable and high-quality imaging data for precise diagnosis and treatment monitoring.

## Project Description

Consistency is necessary across multiple clinical sites within the UC San Diego Health/Shiley Eye Institute. This project was developed through the quality alignment portion of our DES Tier 2. It was initiated on August 21st, 2023, and completed on December 18th, 2023. With the advent of the PACS-Forum system and the adoption of the Heidelberg platform, the project addresses the critical need for uniformity in OCT imaging, essential for accurate disease progression assessment in patients receiving care at various locations.

Steven “Chris” Oeinck, imaging lead at Shiley Eye Institute, provided leadership in conducting a comprehensive assessment of baseline imaging quality at each clinic site. The findings revealed significant inconsistencies. A plan, with the team’s collective effort, was devised for advanced training and improved equipment maintenance. Insights from attending physicians in the retina subspecialty further provided areas of need, underscoring the collaborative nature of this initiative and the value of each team member's contribution.

With the baseline established, the project set quality goals to achieve world-class standards for providers and patients. Reviewing 100 active patient scans, the study identified key areas for improvement, particularly in contrast, signal-to-noise Ratios (SNR), and resolution of retinal layers.

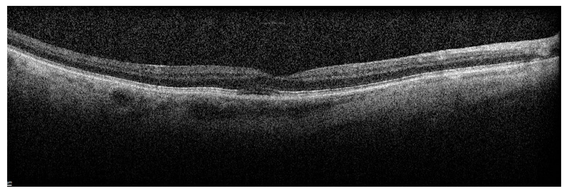
Notably, the study evaluated the impact of automated retinal tracking (ART) on image quality, demonstrating significant advancements in clarity and layer delineation. Standardized protocols were introduced to streamline staff training and ensure consistent imaging practices across all clinical settings, laying the groundwork for sustainable quality improvement. Preliminary results indicate remarkable enhancements in image quality metrics, providing improved diagnostic accuracy and treatment efficacy. Next, the imaging team will focus on comparing image quality measures across different OCT platforms, refining imaging protocols, and optimizing clinical outcomes.

The project represents a pioneering effort to elevate ophthalmic imaging quality to world-class standards. It leverages advanced technology and standardized protocols to benefit providers and patients across the UC San Diego Health/Shiley Eye Institute network. By prioritizing consistency and excellence in OCT imaging, the initiative aims to enhance patient care and significantly advance the field of ophthalmology, underlining its potential long-term benefits.

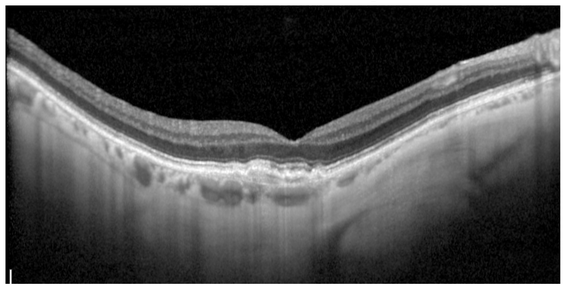
## Materials and Methods

The study retrospectively analyzed 100 active patient scans obtained using the Heidelberg Spectralis OCT system. Patients were categorized into two groups: baseline patients, scanned with inconsistent gates (see graph A and B), and follow-up patients, scanned with optimized settings (see graph C and D). Key parameters, including Line and Cube ART values, as well as Signal to Noise Ratios (SNR), were meticulously evaluated to gauge image quality improvements. Additionally, the study examined the impact of enhanced imaging protocols on the delineation and clarity of retinal layers.

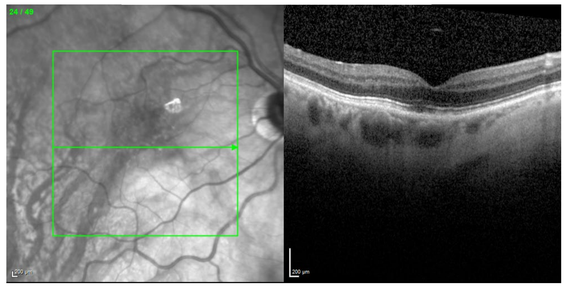
A. Baseline Horizontal line scan- no ART



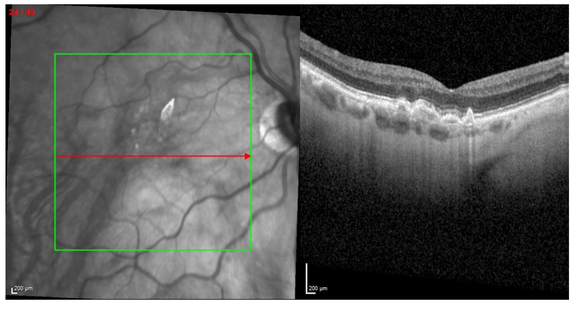
B. Horizontal Line Scan- ART 100 gate



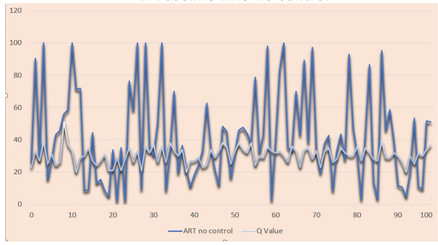
C. Baseline Horizontal Cube scan-no ART



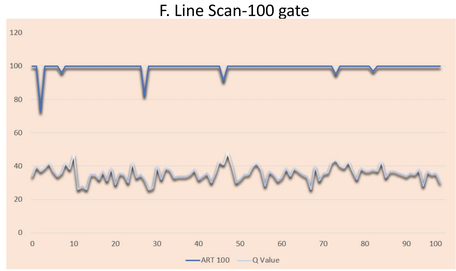
D. Cube Scan- ART 16 gate set



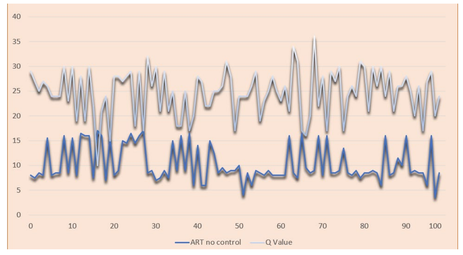
E. Baseline Line-no control



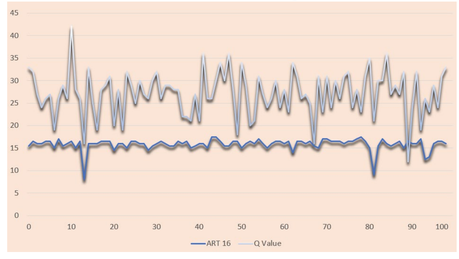

F. Line Scan-100 gate




G. Baseline Cube-no control




H.Cube Scan-ART 16 gate




## Results and Sustainment

We found that by using our new Automated Retinal Tracking ART standards of: Line Value of 100 and Cube Value of 16 consistency issues have been resolved (see images A-D). Appreciation of ART values baseline compared to ART standards show improved placement of Q Value (see graphs E-H). The new standards are easily monitored and quality has surpassed expectation. As a training tool have found the Image Technicians have a better concept and the curve from learning is reduced. Our Physicians have noticed increase in segmentation of retina which reveals better appreciation of treatment accuracy.

## Conclusion

The findings of this study underscore the efficacy of targeted quality improvement initiatives in optimizing OCT imaging quality. Through the strategic utilization of advanced technology and standardized protocols, significant enhancements in image contrast, SNR, and retinal layer visualization were achieved. Notably, the implementation of benchmarked imaging standards facilitated staff training and fostering a culture of accountability and transparency in imaging practices. Moving forward, ongoing assessments will explore the comparative efficacy of different OCT platforms, thereby informing continuous refinement of imaging protocols and advancing clinical care delivery.