Data Integration for Clinical Decision Making

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In the current reality of delivering eye care, providers are faced with multiple headwinds. On a daily basis, we face:

- Increasing patient populations in need of eye care
- Higher disease burden
- Compressed clinic schedules
- Insurance reimbursement reductions and restrictions
- Greater necessity for patient education

We also see an explosion of high-quality data, mostly in the form of imaging and diagnostics, giving us more and more data on each disease, each patient, from multiple devices. Multi-modality diagnostics and imaging, now the standard in my clinic for even routine patients, yields mountains of data, with different analysis algorithms and almost infinite dimensional views, capturing more structures and more geography of the eye.

Only a few years ago, I saw patients with only a 45-degree color fundus camera to take pictures of the macula and, if I was lucky, stereoscopic optic nerve photos and basic visual fields. Now, in my clinic, I regularly employ OCT angiography and ultra-widefield color fundus photos and auto-fluorescence, RNFL and optic disc OCT analysis, for example. I have found that being able to quickly and easily compare specific findings and lesions over time, on different modalities, has become critical to guide my treatment decisions, such as OCTA-guided retinal treatment with intravitreal injections. MIGS treatments and new glaucoma medications are also options to treat glaucoma, all guided by disease progression detected by modern diagnostic imaging modalities. For me, on every patient, I review and analyze an ever-increasing amount of data, that is becoming increasingly complex and unbearably time consuming.

How can we navigate these challenges? How can we leverage our diagnostic tools to provide more efficient care to our patients? How can I get the most out of my tools, to give the most to my patients? For me, the answer is simple: improved data integration, visualization, and analysis.

Efficiency of Analysis, Efficiency of Care

In today's environment, I can no longer afford the time to log onto multiple platforms to review different images, and I refuse to skimp on critical aspects of care, settling to only view single snapshots of data-rich modalities. I need to be able to use this mountain of diagnostic data to support complex and often expensive treatment decisions. For some time, it has been clear to me that it is no longer enough to casually view a single snapshot of just "this time and last time."

This is why I believe data integration, combining our diverse data to give new insights quickly, is critical to our future. Multi-modality image overlay, point-to-point registration and comparison, as well as expanded temporal comparison with treatment effect overlays, all are ways we must leverage our data for efficiency and patient care.

For example, I prefer single-click integration and overlay of macular OCT and OCT-A images with ultra-widefield angiography and color images that enable me to see the whole picture of the disease state in one view. Quick and easy registration and synching of OCT images over many months with corresponding time-linked thickness plots and treatments finally give me a clear picture and timeline for what works for any patient. Seeing multiple data plots of OCT-derived RNFL thickness, ganglion cell thickness, mean deviation and super imposed and baseline-adjust shows me the critical information I need—fast and easily.

Integration for Better Care

Look at the complexity and careful configuration of an airline cockpit next time you take a flight. Consider the data on the screens of a professional financial analyst or trader. Both use advanced data integration and real-time display analysis to deliver efficiencies in complex, fast-paced, data-rich environments. Isn't it time doctors have a similar solution to efficiently support our complex and data-rich environments? I know that I give better care when I have better data support.

The Integrated Diagnostic Imaging platform from ZEISS — My cockpit for modern patient care. This leap forward brings the best in modern diagnostic data integration to my clinic and allows me to efficiently receive, integrate, analyze, and interpret multimodal data in a single view, putting me back in the cockpit. It is the only software-driven platform that can easily and seamlessly integrate multimodal imaging with the click of a button, between modalities, over all time periods, and with treatment data.

ZEISS
WORKPLACES

Using the first software-based solution for integrated data analysis. It's not a viewing station or PACS system, it is a truly different and amazingly advanced data integration solution

This solution brings this data together, making it possible, and simple, to make individualized assessments and optimal management decisions, rapidly and easily. With separate modules aimed at diagnosis and management of glaucoma and retinal conditions, it's clear to me that this kind of data integration will continue to change my practice and allow us to give better care, more efficiently.

Rapid Multi-modality Image Integration for Retinal Disease

Multimodal imaging and diagnostics are critical in retinal disease, and nowhere is efficient data integration more useful. I've been impressed by how easily the platform integrates and displays the data I need with these key features:

- **Multimodal image overlay and transparency** – Instantaneous overlay of OCT/ OCTA, ultra-widefield, FA, ICG and other color photos, and smooth transparency adjustment to view these different modalities simultaneously and synched

- **Images linked to treatment** – Easily visualize treatment and response over time

- **Graphical data display** – Graphing multiple parameters, such as OCT macular thickness, for easy assessment of treatment efficiency

- **Dynamic data synchronization** – Easily compare and correlate data from multiple visits on a single screen.

Structure and Function Correlation for Glaucoma

For my patients with glaucoma, I want to see a lot of data, displayed over time. I like RNFL thickness graphs, mean deviation graphs, and ganglion cell graphs, as well as color maps over time and visual fields. I gain tremendous added value from my diagnostic machines by being able to integrate the data in these key ways:

- **Multiple metric graphs** – ability to easily view RNFL and GCL thickness plots with mean deviation and cup-to-disc ratio together on one screen

- **Comparison over long-time horizons** – up to 15 data points for each patient, for each metric can be viewed and analyzed on one screen

- **Baseline adjustment** – the graph baseline can be easily adjusted as significant changes occur, like surgery or laser or other treatments

- **Serial thumbnails** – easily view many small images at once, such as color maps and visual fields, easily seeing changes over time (up to 15 images shown on one screen)

- **Statistical analysis** – automatically understand if a change is statistically significant

- **IOP integration** – linking IOP with all the other data, by quick data entry by a tech, all of the metrics I need are in one place

Case Examples

Modern approach to diabetic retinopathy

Ultra-widefield (UWF) imaging is quickly becoming the standard of care for diabetic detection and disease management. The introduction of this new technology has led to a new understanding of diabetic retinopathy. Predominantly peripheral lesions (PPL) are present in up to 50% of eyes with diabetic retinopathy. Eyes with PPL have roughly a 3x increased risk of deterioration of diabetic retinopathy by two or more stages, and a 4.7x increased risk of progression to PDR within four years. *[(Silva et al (2013) Ophthalmology, Silva et al (2014) Diabetes Care, Wessel et al (2012) Retina, Price et al (2015) Clin Ophthalmol, Silva et al (2015) Ophthalmology)]*

When I see a patient with diabetic retinopathy in my clinic, I prefer to have macular OCT and OCTA as well as UWF color and angiography imaging to gain a full understanding of their disease, especially peripheral pathology and foveal vasculature. Retina Workplace allows immediate automatic overlays of color and FA imaging, with OCTA macular overlays.

Weitwinkel OCT-A   Ultra-Weitwinkel Echfarbe   Ultra-Weitwinkel FAF

Hochauflösendes SD-OCT
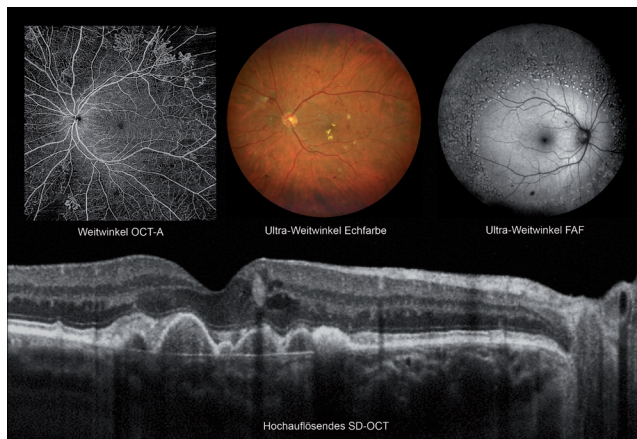
It's important for me to be able to easily fade between FA, OCTA and color images, and click to center an OCT cross-section on any diabetic lesion.
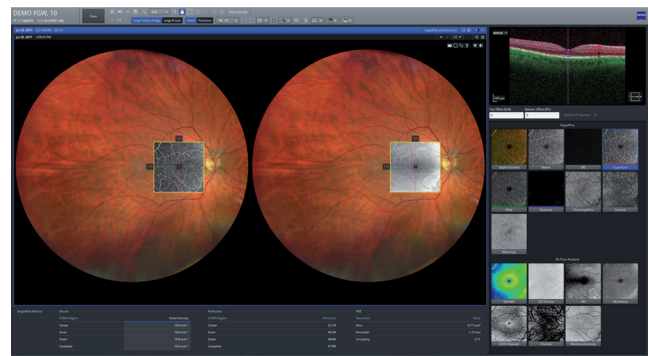
I prefer central subfield thickness from the OCT to be shown graphically over time, annotated with the date and type of treatment (usually an injection). I can easily see poor response immediately, spot specific leaking microaneurysm's and adjust my treatment plan in seconds. I also use these images to teach my patients about their disease, which I find improves compliance. Integrating all types of multimodal data, both in the periphery and macula and with treatment correlation, is simple with Retina Workplace, and the ability to do this quickly has altered my practice and supports me to give better patient care.
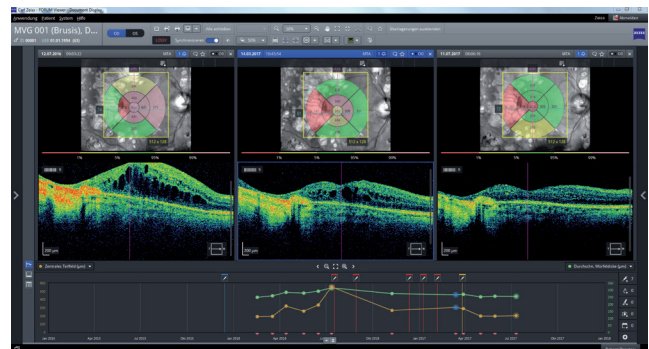
AMD: better evaluation for better treatment

For frequent evaluation and treatment of AMD, I prefer OCT and OCTA at every visit, with periodic color fundus photos or FA, allowing me to evaluate disease activity and progression. I like to see images from three time points displayed on the viewing screen simultaneously: presentation of new disease, last visit, and current visit. I find this layout gives both the patient and me a constant reminder of the progress we have made, increases compliance and shows me changes in the last month. I prefer to have the OCT and OCTA overlayed atop color fundus photos, with point-to-point registration, so I can easily fade between modalities and synch OCT crosssections with en face views, often viewing all three images simultaneously in a semi-transparent overlay. I need this multimodal image linking to be instantaneous and seamless. The second half

of my data evaluation is to look at all my data longitudinally. Having the OCT central sub-field thickness from every time point automatically graphed with treatment annotation shows me immediately if higher priced medications show additional efficacy with any given patients, and it shows me where to go next. Evaluating my clinical data environment in this integrated and multi-dimensional way with Retina Workplace has opened my eyes to the future of superior patient care.
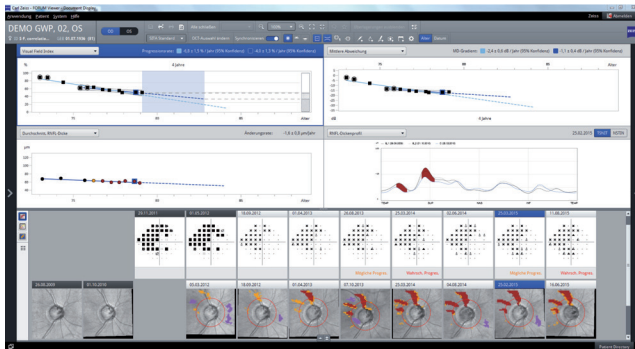
Primary Open Angle Glaucoma: Assess progression via Structure and Function

In the past when I evaluated a patient with glaucoma, I tended to look at "this time and last time," sometimes with a single metric progression graph (like mean deviation or RNFL OCT). With higher demands from patients and more treatments available, I don't think that traditional evaluation is sufficient. I now have frequent visual field data and OCT data (both RNFL and GCL) on all my patients with glaucoma. Visual fields give me functional data and SD-OCT (with SLO) gives me structural data, but the key for me has been the data integration that is now at my fingertips with Glaucoma Workplace.

Now, when I evaluate for glaucoma my standard view is to display four graphs on the top half of my screen, showing four of my favorite metrics: RNFL thickness, GCL thickness, mean deviation, and IOP, with up to 15 data time points, all synced in time, with statistical analysis. On the same screen, I like to show small images of the last 10 visual field mean deviation, giving me a visual perspective of progression. I also like small images of the color RNFL thickness map. I can easily detect color change over time in each quadrant, and with this data display, it's easy to see exactly how well controlled the disease is, show the patient the data to help them with compliance or make a decision for surgery. When an intervention is done (medication change or surgery), I can reset my baseline to see the exact effect. I have found tremendous insights with the integration of all the data, on one screen, over as many as 15 time points.

I consider the ZEISS Integrated Diagnostic Imaging platform to be a key part of patient management, giving me the data integration that I need to make the best decisions for my patients, efficiently and quickly.