Digital Solutions in the Cataract Workflow from ZEISS

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Introduction

Cataract surgeons in today's competitive business environment demand solutions that enhance efficiency, cost-effectiveness, and clinical outcomes. Patients, at the same time, are demanding more from their surgeons. They want to maintain an active lifestyle into their later years, performing their everyday activities mostly without visual aids. Cataract surgeons must be thoughtful business people, striving for maximum efficiency in the clinic while taking the time to manage the concerns and expectations of every individual patient. Most patients expect a great deal more from their cataract surgery than they did 20 years ago, in part because modern technology has brought cataract surgery outcomes close to what corneal refractive surgery provides. With modern IOL calculation formulas, more sophisticated and accurate diagnostic devices, many high-quality toric and presbyopia-correcting IOLs on the market, and constantly improving surgical techniques, patients can expect excellent results from their surgery. This advanced technology creates more challenges for the busy surgeon, especially when patients are willing to pay extra for premium results. Surgeons understand that outstanding surgical results are directly related to the quality of the planning done prior to the surgery itself. The voluminous data available for every patient and the rapidly expanding treatment options make surgical planning a time-consuming prospect if the surgeon must process all that information with traditional manual methods.

For these reasons, cataract surgeons are focusing more intently on achieving excellent outcomes through meticulous surgical planning and more precise alignment of toric lenses during surgery. Thankfully, ZEISS has created several powerful digital solutions to support cataract surgeons and their teams by integrating the entire process of cataract surgery—from the office to the OR and back.

ZEISS FORUM

FORUM® from ZEISS is a scalable and flexible ophthalmic data management solution. It streamlines practice workflows by connecting involved devices and providing access to all patient examination data, allowing healthcare professionals to make confident decisions at a glance.

Streamline the Workflow

ZEISS FORUM enables a fully electronic workflow that automatically sends patient demograph-

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ics to diagnostic devices. It facilitates a completely paperless workflow that saves storage space and reduces the cost of printing.

Decide with Confidence

ZEISS FORUM facilitates clinical case visualization by preparing ophthalmic data and images in a way that lets healthcare professionals make decisions with confidence. ZEISS FORUM effectively supports patient care with unique features and workplaces designed specifically for glaucoma, retina, and cataract surgery.

Simplify the Environment

ZEISS FORUM integrates conveniently with the healthcare providers' existing IT infrastructure using established standards as well as customized tools. Its centralized storage of all examination data ensures patient record consistency across the network, including EMR, HIS, DICOM, and non-DICOM instruments—those created by ZEISS as well as instruments from other manufacturers. FORUM's multi-site solution ensures that patient data is consistently available and shared across multiple sites.

ZEISS EQ Workplace

The EQ Workplace® software from ZEISS is a cataract surgery planning software based on ZEISS FORUM allowing cataract surgeons to streamline and automate processes in the cataract workflow. The software gives users the ability to access and review ZEISS IOLMaster and other diagnostic data in one place, calculate, select, and order IOLs remote of the measurement device, and prepare surgery for CALLISTO eye® from ZEISS. It also generates personalized IOL constants for future improvement of outcome prediction.

Preoperative Surgical Planning

Data Review
ZEISS EQ Workplace enables automatic data transfer and auto-population of data, saving cataract surgeons valuable time preoperatively. Biometry and diagnostic data can be accessed and reviewed remotely in the workplace or from any FORUM workstation, supporting the complex decision of selecting the right IOL for the patient.

IOL Calculation
With all relevant data for IOL calculation already pre-populated, ZEISS EQ Workplace allows a quick and easy calculation and selection of the IOL for surgery. It uses state-of-the-art IOL power estimation formulas to determine the proper IOL power and automatically uses the right calculator depending on the eye status and within the surgeon's preferred formulas. Available formulas include the Barrett Suite and Haigis Suite, Holladay I and II, Z CALC, and more. Users can compare multiple IOLs and formulas, can change and add IOL models, select a different formula or power, and see the results update immediately.

IOL Ordering
ZEISS EQ Workplace can send an e-mail order of the planned IOL directly from the workplace to pre-defined recipients. The essential data related to the IOL planned in EQ Workplace automatically transfers to the IOL in order to avoid error-prone manual transcription.

Surgery Preparation
ZEISS EQ Workplace allows users to set all relevant surgical assistance parameters in the workplace. It then automatically transfers these parameters, the planned IOL, and reference image to ZEISS CALLISTO eye.

Documentation
ZEISS EQ Workplace produces a planning PDF that can be printed, saved, forwarded, or archived as DICOM in ZEISS FORUM. Surgical teams

may reference this document to be sure everyone is familiar with the plan.

Individual Constant Personalization

ZEISS EQ Workplace uses post-op refractions entered into the post-up screen of the workplace to personalize the surgeon's constants for each IOL model. Surgeons can use their own personalized optimized constants, or optimized constants imported from IOLCon (https://iol-con.org).

Intraoperative Assistance.

Surgery Preparation and Digital Toric Alignment

The surgical plans created in EQ Workplace can be imported by ZEISS CALLISTO eye in the operating room. This means that the OR team will have the details of every patient's surgical plan available in the device used for toric alignment without additional manual data entry.

During surgery and to further protect against never-events, the IOL at hand can be verified by comparing it with the IOL selected prior to surgery as displayed in ZEISS CALLISTO eye.

ZEISS VERACITY Surgery Planner

ZEISS VERACITY Surgery Planner is only available in the USA and Canada.

ZEISS created **VERACITY Surgery Planner** to address the challenge of time-consuming surgical planning for a variety of treatment options based on traditional manual methods. ZEISS VERACITY Surgery Planner represents an entirely new category of medical software, a tool that serves as the hub for all information related to ophthalmic surgery, a web-based digital assistant that brings the relevant data together in one location and automates much of the planning process, intraoperative documentation, and outcome analysis. The primary objective is to save time and prevent errors that could adversely affect outcomes.

Preoperative Surgical Planning

Configurability

Even though surgical teams can begin using ZEISS VERACITY Surgery Planner with minimal initial setup, the tool is highly configurable—flexible—so each team can continue working without disruption of its normal workflow.

Electronic Medical Record (EMR) Integration

Surgeons and their team members spend a great deal of time entering patient information into their EMR systems as part of the normal clinic workflow. ZEISS VERACITY Surgery Planner exploits that effort by importing that data directly from the EMR system, so team members are not duplicating effort. VERACITY Surgery Planner can import data from most EMR systems in the USA. This automated data transfer typically includes patient demographics, refractions, visual acuities, problem lists, medications, allergies, and prior surgical procedures.

Diagnostic Device Integration

ZEISS VERACITY Surgery Planner directly interfaces with most of the diagnostic devices commonly used in planning cataract surgery: optical biometry, corneal topography, and OCT. This includes devices made by ZEISS (IOLMaster 700, ATLAS topography, CIRRUS OCT) and many non-ZEISS devices: Lenstar (Haag-Streit), OPD-scan III (Nidek), Pentacam (Oculus), Cassini (Cassini), iTrace (Tracey Technologies), and more. VERACITY Surgery Planner imports the discrete data generated by these devices as well as the images they produce.

Patient Questionnaire

ZEISS VERACITY Surgery Planner incorporates answers from a configurable patient questionnaire that can be sent to patients in advance of their appointments via text message. This digital process automatically captures the patient's concerns, desires, and expectations for surgery. The text message can also include embedded patient education videos unique to each practice.

Data Validation and Alerts

ZEISS VERACITY Surgery Planner analyzes the imported data and alerts the surgical team to data inconsistencies, abnormal data, and other patient-related issues that could be of concern for the cataract surgeon.

Suggestions

ZEISS VERACITY Surgery Planner processes the available patient data acquired from the EMR, diagnostic devices, and the patient questionnaire and then generates a suggested treatment plan focused on the patient's desired outcome, and consistent with the surgeon's configured preferences.

IOL Calculations

ZEISS VERACITY Surgery Planner uses some of the most well-respected IOL power estimation formulas and toric calculators to determine the proper IOL power. These include the ZEISS AI IOL Calculator, Barrett Suite, Kane, Holladay II, the Abulafia-Koch toric calculator, and more. The system automatically uses the Barrett True-K calculator for eyes with prior corneal refractive surgery. ZEISS VERACITY Surgical displays the net astigmatism and the predicted final refraction for every surgical plan. When users change the IOL model or power, they see the results update immediately. ZEISS VERACITY Surgical also calculates the proper powers for a series of back-up lenses.

Automated Constant Optimization

ZEISS VERACITY Surgery Planner uses post-op refractions imported from the EMR system to optimize the constants automatically for each IOL model. Surgeons can use community-based optimized constants or their own personal optimized constants.

Arcuate Incisions

ZEISS VERACITY Surgery Planner also includes formulas for calculating the appropriate arcuate incisions for astigmatism reduction when a toric IOL is not possible.

Surgical Plan

The surgical plan ZEISS VERACITY Surgery Planner produces is much more than an IOL calculation. It includes documentation of the pre-ferred surgical method (standard phaco vs. femtosecond laser), supplemental procedures (i.e., MIGS), supplemental techniques (i.e., ZEISS miLOOP, capsular tension ring), anesthesia method, and many other details.

Surgery Scheduling

ZEISS VERACITY Surgery Planner assists with scheduling procedures, including non-cataract eye surgeries, so the entire surgical team can plan and work efficiently in the same digital environment.

Documentation

ZEISS VERACITY Surgery Planner generates a planning document for each case that can be sent to the ASC in advance of the surgery. Some surgical teams use it to be sure everyone is familiar with the plan.

Intraoperative Assistance

Digital Toric Alignment

The surgical plans created in ZEISS VERACITY Surgery Planner can be imported by ZEISS CALLISTO eye in the operating room. This means the OR team will have the details of every surgical plan available in the device used for toric alignment without additional manual data entry.

OR Display

ZEISS VERACITY Surgical generates a display of the surgical plan appropriate for use in the OR so every member of the surgical team is aware of the essential information for that case, including the proper IOL model and power, supplemental procedures or techniques planned, and any other patient-related concerns (Flomax, allergies, etc.).

Automated Operative Note

When the procedure has been completed, ZEISS VERACITY Surgical automatically generates a comprehensive operative note that includes the relevant details of the procedure. The system comes with preconfigured notes for virtually every type of cataract surgery and the most common supplemental procedures, but users can edit these templates as needed.

Postoperative Data Analytics

ZEISS VERACITY Surgery Planner imports post-op refractions from the EMR for use in its data analytics tool. Surgeons can view graphical displays of their surgical results in multiple formats depending on filter settings. Without any manual data entry in ZEISS VERACITY Surgery Planner, surgeons can see how often their patients' post-op refraction is within 0.5 D of target, or see which formula is providing the best results, or see how many premium lenses they are implanting each month.

ZEISS CALLISTO eye

Surgeons understand that toric IOLs are superior to arcuate incisions in the management of astigmatism. A correctly aligned toric IOL is the key to reduce postoperative astigmatism because a malrotation of only 3° will reduce the astigmatism correction by as much as 10% [1]. For these reasons, surgeons who desire excellent surgical outcomes require precise toric IOL alignment, which requires the appropriate adjustment for cyclotorsion. Historically, surgeons have turned to marker-based technologies, intraoperative aberrometry, and markerless computer-guided alignment to add precision to their toric alignment during surgery.

With ZEISS CALLISTO eye markerless alignment, manual marking steps can be skipped altogether for an efficient [2] and precise [3, 4] toric IOL alignment to reduce residual astigmatism. ZEISS CALLISTO eye imports surgical plans created in EQ Workplace or VERACITY Surgery Planner, or IOL selections made in ZEISS IOLMaster 700, and uses that information to generate intraoperative overlays for computer-guided cataract surgery. This efficient technology saves time for the OR team by eliminating the need for manual preoperative marking, manual data transfer, and manual intraoperative marking.

In a single-center study ($n = 57$ eyes), the mean overall surgical time for toric IOL patients treated with ZEISS CALLISTO markerless was significantly shorter than for patients using manual marking (727.2 ± 198.4 s versus 1110.0 ± 382.2 s; $P < 0.001$). The mean deviation from the target induced astigmatism was also significantly lower in the digital (CALLISTO eye) group (0.10 ± 0.08 D versus 0.22 ± 0.14 D; $P = 0.008$) [2]. The authors conclude that the "digital tracking approach for toric IOL alignment was efficient and safe to improve refractive outcomes [and] image-guided surgery helped streamline the workflow in refractive cataract surgery" [2]. A single center, randomized, contralateral, controlled study ($n = 104$ eyes) that compared the outcomes of markerless toric lens alignment (ZEISS CALLISTO eye) with intraoperative aberrometry (Alcon ORA system) demonstrated a residual astigmatism of 0.29 ± 0.22 D for CALLISTO eye group and 0.46 ± 0.25 D for ORA group ($P = 0.00039$). More than 25% of the patients in CALLISTO eye group had no postoperative astigmatism, whereas only four patients (8%) in ORA group showed no postoperative astigmatism. 92.2% of patients had <0.5 D in CALLISTO eye group and 76.5% in ORA group. 100% of patients were below 1.0 D in CALLISTO eye group and 96.1% in ORA group. The median absolute error in predicting cylindrical correction was reported to be similar for both groups: 0.35 D for CALLISTO eye group and 0.39 D for ORA group ($P = 0.91$). The authors concluded that "intraoperative markerless computer-assisted registration and biometric guidance summarily yielded less remaining refractive cylinder than toric IOL placement guided by intraoperative aberrometry" [5].

The assistance functions provided by ZEISS CALLISTO eye are surgeon-controlled via foot control panel or hand grips. CALLISTO eye's Z ALIGN® feature facilitates rotational alignment of toric IOLs and centration of IOLs on the visual axis (from data provided by IOLMaster 700). ZEISS CALLISTO eye's incision assistant helps to position incisions (optionally on the step axis and opposite clear cornea incisions when needed) and paracentesis. The device's rhexis assistant helps surgeons to size and shape the capsulorrhexis and center it on the visual axis provided by the ZEISS IOLMaster. And the LRI assistant guides surgeons in performing limbal relaxing

incisions when a toric IOL is either insufficient or inappropriate for astigmatism management.

ZEISS CALLISTO eye helps surgeons address increasingly lofty patient expectations by projecting valuable information directly into the surgeon's view through the microscope.

Summary

ZEISS supports cataract surgeons with two cataract planning solutions, EQ Workplace and VERACITY Surgery Planner, and the intraoperative surgical guidance system, ZEISS CALLISTO eye, all created to improve efficiency and reduce errors while adapting to the surgeon's existing workflow.

ZEISS EQ Workplace supports cataract surgeons and their staff by streamlining the entire cataract surgery planning process. It saves valuable time during preoperative processes, reduces the risk of an IOL selection error, further protecting against never-events, and gives surgeons access to relevant data from anywhere in the clinic. By connecting ZEISS IOLMaster via FORUM to the ZEISS CALLISTO eye in the OR, EQ Workplace builds a secure data trail into the OR by remotely preparing all the surgical assistance functions for ZEISS CALLISTO eye. This digitization improves patient safety and efficiency in the clinical workflow.

ZEISS VERACITY Surgery Planner is a tool conceived by surgeons and perfected over the years by gathering feedback from surgeons using the product in actual clinical settings. It was designed to save time, and it does. In a recently published, prospective study, ZEISS VERACITY Surgical significantly reduced surgical planning time when compared with traditional paper-based methods ($P < 0.00001$) [6]. Improved efficiency is but one advantage. The automated data transfer and data validation ZEISS VERACITY Surgery Planner provides can help prevent errors that could result in poor patient outcomes. And the automated data analytics tool provides valuable insights that could lead to improvements in techniques and surgical decision-making.

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