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Imaging & Diagnostics

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5 The new IOLMaster 700 from ZEISS — First Results concerning the Cataract Penetration Rate
In a recent study, Dr Puech and colleagues evaluated a new biometric device, the IOLMaster 700 — which now incorporates SWEPT Source OCT technology, with the prior model to discover in how many cases limited transparency of ocular media made biometric measurements impossible.

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According to Professor Alió, femtosecond assisted intrastromal lenticule extraction could be defined as the ‘refractive surgery of the corneal surgeon’. Here, he discusses his experiences and what the future holds for the technique.

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7 Humphrey Field Analyzer 3 from ZEISS: Improving on a Standard
Since its introduction over 30 years ago, the Humphrey Field Analyzer has become the standard method to assess and monitor visual field loss. To prepare for the launch of the new HFA3, ZEISS performed a survey in 19 evaluation sites to determine the early impressions of this new platform. A summary of the survey results is presented in this article.

9 Product Profiles
AngioVue in clinical management of type II choroidal neovascularization in AMD before and after anti-VEGF treatment

By Dr Bruno Lumbroso and Dr Marco Rispoli, Rome, Italy

OCT angiography has brought impressive changes and improvement to our retina practice since February last year when we began to use OCT angiography. It complements the information given by fluorescein angiography (FA) and brings new elements to FA. Sometimes it can replace it.

**Instrumentation/equipment used**
AngioVue (Optovue, Fremont, California, USA) is dramatically modifying the way retina specialists use imaging.

**Methods**
FA uses a dye injection to highlight the vascular network, but it could lead to side effects, whereas AngioVue records the movement of blood cells inside the vessels. FA needs to be scheduled, but OCT angiography can be performed at any time in the office.

**Images/figures/tables**
We are showing a series of Angioflow images from AngioVue from one eye with CNV type 2 in AMD, treated with intravitreal aflibercept.

Figure 1 was taken before treatment. It showed a neovascular network with many tree-like anastomoses. We often found in our images an afferent vessel and peripheral anastomoses. In age-related macular degeneration, choroidal neovascularization is typically seen as a sharp vascular net, one that is not blurred by dry leakage.

Figure 2 was taken 24 hours after aflibercept injection. It was obvious that the neovascular network was much smaller, with fewer anastomoses. Flow changes produced a fragmented aspect of the network. Secondary branches decreased or disappeared entirely post-injection. The presumption was that flow decreased inside the capillaries but what surprised us was that these same branches re-appeared later in a few weeks’ time.

Figure 3 showed that by day 35, the neovascular network was back almost to baseline level. The only difference was that some branches appeared to be thicker. In my opinion, this was confirmation that this patient could be on monthly treatment regimens.

**Results**
AngioVue images differ from fluorescein angiography images. They do not show dye leakage or staining. They provide an important additional diagnostic device to our technology.

OCT angiography shows the vessel contents and does not show their walls. That allows us to highlight capillary abnormalities much better than we could with FA.

**Conclusion**
This new technology provides clinicians with new useful information that is less expensive to administer than current imaging modalities and that has fewer side effects. In short, Angioflow images on AngioVue may be the future of retinal imaging. There is, however, a learning curve when you begin to use this Non-Invasive Microvascular Imaging technology.

Full details of the AngioVue can be found on page 9

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IOLs and biometry

First clinical experience and results with a novel IOL system for dry AMD

By Dr Fritz Hengerer, PhD, assistant professor of ophthalmology, Goethe-University Frankfurt am Main, Frankfurt, Germany.

A new intraocular mini-telescope (iolAMD, London Eye Hospital Pharma) offers significant surgical and optical advantages compared with previous technology, and its features make it an exciting advance for cataract surgery patients with vision loss related to macular disease. Here, I will present the reported outcomes achieved after 4 months of follow-up in 18 eyes implanted by Dr Bobby Qureshi along with my own initial clinical experience with the intraocular mini-telescope.

Dr Qureshi’s series

For the eyes in Dr Qureshi’s series, mean Snellen preoperative near uncorrected visual acuity (UCVA) (decimal) was worse than 0.14, preoperative distance best-corrected visual acuity (BCVA) was 0.12, and simulated distance BCVA was 0.19. Mean postoperative distance BCVA was 0.2, exceeding the simulation-predicted value, and mean near BCVA improved by 50% to 0.21.

The refractive outcomes were similar to those achieved with monofocal implants. There was a myopic shift in all cases from pre- to postoperative (mean 1.5 D) and a mean of about 0.5 D of induced astigmatism. However, the refractive changes can be neglected.

There were no intraoperative or postoperative complications. Mean IOP was 18 mmHg preoperatively and 16 mmHg postoperatively, and mean endothelial cell count showed a decrease of about 18%.

Images from anterior segment OCT demonstrated stable lens positioning and microperimetry results confirmed the benefit of the telescopic and prismatic effect for improving threshold sensitivity and fixation stability.

First implantation

I performed my first implantation of the device in July 2014 in a patient with stage 3 AMD who had a monofocal IOL in the fellow eye. My next two cases were in the fellow eyes of a second patient with stage 3 AMD. All of the procedures were done through a 3.2-mm superior incision with a 5-mm capsulorhexis.

In the first implanted eye, baseline distance BCVA was 0.03. The patient was unable to read with that eye, but the simulation predicted near BCVA would improve to 0.1 after implantation of the intraocular mini-telescope. At 30 days postoperatively, near and distance UCVA were both 0.25, distance BCVA was 0.4 and near BCVA was 0.5.

With these outcomes, the patient had visual acuity that allowed him to keep his driver’s licence.

The results from the second patient who received the intraocular mini-telescope in both eyes suggested outcomes are enhanced with binocular summation.

Preoperatively, distance BCVA was 0.05 in the left eye and 0.16 in the right eye. The patient was unable to read with his right eye and had 0.16 BCVA at near in the left eye.

In binocular testing at 30 days after the second eye surgery, distance UCVA was 0.5, near UCVA was 0.63, and BCVA for both near and distance was 0.8.

The patient is very happy and particularly pleased because he is able to read stories to his grandchildren, which he could not do before.

I would also emphasize the importance of completely removing viscoelastic between the two lenses to optimize their relative positioning, and I must note that there is the potential to adjust the orientation of the sulcus lens in a future procedure to improve vision for patients when their macular pathology advances.

The sulcus IOL is not fixed like a toric lens, but can be rotated later according to the patient’s needs, potentially extending vision as the disease progresses.

More information about this product can be found on page 9
The new IOLMaster 700 from ZEISS — First Results concerning the Cataract Penetration Rate

By Dr Michel Puech, Explore Vision Paris, France

For more than 15 years, the IOLMaster has become the benchmark for optical biometry instruments with a large number of devices in use and excellent compatibility with the values of the IOL constants given by the ULIB site. The arrival of a new biometric instrument, the IOLMaster 700, has generated great interest. This is particularly the case because it is the first time that SWEPT Source OCT technology has been brought into the field of biometry. This technology provides clear advantages over the previous systems, including the possibility of detecting unusual eye geometries and poor fixation patterns. This allows for a more accurate performance of IOL power calculations and, consequently, a significant improvement in the refractive outcomes. Furthermore, the SWEPT Source OCT technology has the additional advantage of its extremely rapid data acquisition, including the ability to measure the axial length along 6 different axes.

We have recently performed a study comparing the new IOLMaster 700 with the previous IOLMaster 500. We sought to discover in how many cases limited transparency of ocular media made biometric measurements impossible.

Methods and materials
Patients who were referred to the Centre Explore Vision in Paris for IOL power calculation were consecutively included in this prospective study. In all cases, axial length measurements were performed with the IOLMaster 500, followed by a measurement with the IOLMaster 700. A total of 427 eyes were examined, of which 288 eyes were eligible for the current study. The exclusion criteria included eyes with active ocular pathologies, such as uveitis or retinal degenerations, as well as eyes that had undergone previous ocular surgery. We counted the cases where no measurement was possible, which was most frequently due to the loss of transparency in the media, and then compared this number between the devices.

Results
It was not possible to obtain a biometric measurement in a total of 31 eyes (10.76%) with the IOLMaster 500. In all cases, this was due to the reduced transparency in the ocular media of these eyes. In contrast, with the IOLMaster 700, it was only in 16 eyes (5.55%) that no measurement was possible. This was also due to the insufficient transparency of the ocular media. In our sample, the IOLMaster 700 halved the number of cases in which an axial length measurement could not be obtained.

Discussion
The fact that the IOLMaster 700 performs 6 radial scans helps to optimize the axial length measurement when compiling the results. This seems to be the main reason to explain our results. Likewise, the fact that SWEPT Source OCT technology is used, has the advantage that the entire eyeball is scanned, and the different structures to be found in the entire visual axis are recognized. This facilitates the proper axial length measurement, even in the presence of some dense cataracts. Furthermore, unusual eye geometries such as tilt or decentration of the crystalline lens can be detected and taken into consideration in the choice of IOL model. The fixation check of the IOLMaster 700 is another advantage of this new biometer. It enables the examiner to check whether the image is being obtained in the right position and to reduce the risk of refractive surprises due to incorrect measurements caused by undetected poor fixation. Finally, the possibility of visually verifying of which structures of the eye have indeed been measured is of great help.

Conclusion
The IOLMaster 700 is more effective in obtaining biometric measurements in eyes with less transparent ocular media. The check for decentration or tilt of the crystalline lens, the fixation pattern, and the visualization of the measured structures all help to eliminate potential sources of error and, therefore, to optimize cataract surgery outcomes.

References

Full details of this offering can be found on page 10

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Laser Surgery

**SMILE — from initial experiences towards the future**

By Professor Jorge L Alió, Alicante, Spain

Femtosecond assisted intrastromal lenticule extraction has become a possibility for corneal refractive surgery. My first experiences with this technology have been outstanding. Coming from initial training with FLEx and entering into SMILE, I would define the technique as the ‘refractive surgery of the corneal surgeon’. It indeed requires surgical expertise and what is valuable is that the skills needed to properly perform the technique can be acquired with a short learning curve.

In addition to the short learning curve, I was surprised by the outstandingly good results. Patients are corrected with a remarkable refractive precision and visual recovery is fast. For me, it was a new experience to achieve patient recovery quickly instead of having some delay. Both spherical and cylindrical myopia are properly corrected and so far we have been blessed by a predictability demonstrated by the technique for the range of myopic correction in which it is indicated. Patients are also happy to be corrected by a new technique that minimizes cuts in the cornea.

**SMILE in comparison to Femto-LASIK**

As reported in recent studies\(^1\),\(^2\) and at meetings such as ESCRS and others, our own study confirmed that the outcomes for correcting myopia and myopic astigmatism with SMILE are at least similar to Femto-LASIK. Most probably, the lack of higher order aberrations in high myopia is taking the correction of these highly refractive errors back to corneal procedures instead of phakic IOLs.

Biomechanical mathematical models have demonstrated a potential of better preserving biomechanical stability with SMILE than with Femto-LASIK,\(^3\),\(^4\) which can be attributed to the fact that SMILE is a minimally invasive flapless procedure. Thus, there are associated benefits for future evolution of the eye and lack of regression in the long-term,\(^5\) as well as the expected and previously demonstrated advantages for the ocular surface. Additionally, the longevity of the postoperative outcomes makes this technique unique for the selection of the correction of myopia and myopic astigmatism.

**Will SMILE using femtosecond technology become the dominant technique?**

The answer is probably yes. I can clearly see a case for using only one laser for corneal refractive surgery. It would be valuable to have a femtosecond laser with a minimally invasive SMILE technique that is capable of treating myopia and hyperopia; performing corneal tunnels for ICR to treat keratoconus patients; relaxing incisions; customized incisions for the diversity of corneal grafts that we perform today; and, most probably, other indications that will arise in the future. I do believe that SMILE will evolve further in the field of refractive surgery and provide benefit for both our patients and our refractive surgery practices.

**References**

3. J.L. Alió et al., 'Target vs obtained radius of curvature in small incision lenticule extraction (SMILE) and femtosecond lenticule extraction (FLEx)'; Submitted for publication in *JCRS*.

Full details of this offering can be found on page 10.
Humphrey Field Analyzer 3 from ZEISS:
Improving on a Standard

By Shareef Mahdavi, SM2 Strategic, Pleasanton, California, USA

The Humphrey Field Analyzer was first launched in 1984 as a means of automating the accurate yet arduous Goldmann manual kinetic perimetry test used to measure defects in the visual field. Over the years, the HFA has become the standard method used to assess and monitor visual field loss. Over 45000 units are in use worldwide, providing clinicians with a standard platform for measuring, analysing and communicating test results.

In preparation for the launch of HFA3, ZEISS (Dublin, California, USA) placed evaluation units in 19 sites in the US for use with patients over a several month period. SM2 Strategic was asked to survey doctors and technicians at these sites and report on their early impressions of the new platform. 28 users (12 doctors, 16 technicians) completed an online survey at the end of the evaluation period; the summary of findings is shown below.

Evolution of a standard
When first introduced to glaucoma specialists, the HFA was a breakthrough due to its ability to standardize the way a perimetry test was conducted and then analysed. The use of a microprocessor-based device that could be programmed to do a complete analysis of the central 30 degrees of the visual field (while varying the brightness and placement of a Goldmann stimulus) was an early form of automation within ophthalmology. With the addition of software that could statistically analyse a test and compare it to a database of normal eyes (STATPAC), the HFA forever changed the way that glaucoma patients were diagnosed and managed.

Over the last three decades, the platform has continued to evolve, becoming smaller in size, faster in test speed and easier for physicians to interpret results. With each improvement in hardware and/or software, the HFA has become increasingly indispensable as a tool to assess functional vision. An overview of the major innovations offered by each generation of the HFA platform is shown below.

Evolution of a Standard

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In a word...

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<thead>
<tr>
<th>Standards</th>
<th>Speed</th>
<th>Analysis</th>
<th>Workflow</th>
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<td>SITA with STATPAC</td>
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<td>Gaze Tracking</td>
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<td>STATPAC</td>
<td>Combianted Reports</td>
<td>Liquid Trial Lens</td>
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First impressions
In this survey group, highest consideration in evaluating any new diagnostic tool is given to quality (75% of respondents), innovation (50%) and price (36%). The users at the evaluation sites have given high marks to the HFA3, with 75% saying their first impressions have been very positive and 25% somewhat positive. Four in five users (78%) were impressed with the Liquid Lens Technology, with two-thirds of users rating the SmartTouch Interface and the RelEYE Monitor for Gaze Tracking highly. Just under half (46%) gave similar ratings to the FORUM Glaucoma Workplace.

Written positive comments referred to the new modern look and feel of the unit, overall improved ease of use, and how the above hardware features make it a better overall experience for technicians and patients. Overall, these new features combine to allow for faster workflow and the elimination of steps (e.g., having to go to another...
Perimetry

The HFA3 is a significant improvement over HFA II-i

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The workflow using HFA3 was noticeably faster for technicians to complete

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The overall experience in HFA3 was more comfortable for patients

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<td>21%</td>
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The ability to access data is easier because of the HFA3

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The ability to analyze data is easier because of HFA3

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The user interface is easier for technicians to administer tests

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The Liquid Trial Lens technology is a significant improvement over the trial lens

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<td>43%</td>
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I recommend our clinic/practice upgrade to the HFA3

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<td>29%</td>
<td>50%</td>
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I would willingly recommend the HFA3 to my colleagues at other practices

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(N = 28, 12 = Ophthalmologist/Optometrist, 16 = Technician/Administrator)

Summary: The decision to upgrade

Without question, the HFA3 is a much needed redesign of a product that has succeeded by evolving over the past 30 years into the dominant standard in automated perimetry. While there is no additional reimbursement and the visual field test itself is not faster, practices need to recognize that newer often means better in ways that make clinics run smoother and faster. While more difficult to quantify, easier training for new technicians and faster setup and administering of visual fields are of definite value. And the modern unit will integrate better with the growing ‘digital infrastructure’ required (e.g., FORUM) and future advancements in analytics across devices (HFA and OCT).

Is HFA3 a need or a want? We asked this question in the survey and found that for one-half of the survey sample ‘want’ outweighed ‘need’ by a margin of 11 to 3. The other half of the sample indicated it is equally both a need and a want. The ‘bottom line’ sentiment can be found in the two questions regarding the decision to upgrade: 79% indicate they will recommend their own clinic upgrade and 93% would willingly recommend other practices upgrade to HFA3. For practices seeking even greater efficiency and the opportunity to incorporate the latest feature set in their management of glaucoma patients, HFA3 makes sense.

Full details of the HFA3 can be found on page 11
AngioVue OCTA system

The leader in Spectral-Domain OCT innovation has revolutionized ocular structure assessment once again.

Introducing AngioVue
The AngioVue OCTA system is a non-invasive, dyeless technique for visualizing the presence of ocular bloodflow in the vessels.

AngioVue allows clinicians to assess microcirculation in ocular diseases with unprecedented microvascular detail. Unlike other imaging methods which use contrast agents, AngioVue allows visualization of vasculature within specific layers of the retina, without the blurring or obscuring effects of staining or pooling.

5 Essential Technologies
The unique combination of five important components make AngioVue a clinical reality.
- High-speed spectral-domain OCT (70,000 A-scans/sec).
- Patented Motion Correction Technology (MCT) to improve image quality.
- Patented Split Spectrum Amplitude Decorrelation Algorithm (SSADA) to enable efficient scan acquisition.
- CUDA parallel processing architecture to reduce processing time.
- Patented en face visualization of 3D OCT data.

Offering OCT Angiography scanning of 3 x 3 mm, 6 x 6 mm and 8 x 8 mm of the retina, and 3 x 3 mm or 4.5 x 4.5 mm of the optic disc, the analysis reports present side-by-side OCT angiography and OCT structure (en face) results derived from the same data. En face OCTA images of the superficial vascular plexus, deep vascular plexus, outer retina and choroicapillaris area can be displayed for assessment and adjusted by the clinician for optimal viewing of the desired area within the 3D volume.

AngioVue OCTA system

London Eye Hospital Pharma has released a new surgical implant for patients diagnosed with early, intermediate and late stage dry AMD, established wet forms of AMD as well as other forms of macular disease.

The iolAMD is an injectable, small incision telescopic implant improving patient safety and surgical ease. It is composed of two soft, hydrophobic acrylic IOLs (one high-minus and one high-plus) that are arranged in a Galilean telescopic configuration, providing up to 1.3X magnification. These lenses contain hyper-aspheric surfaces and unique wavefront characteristics that reportedly reduce optical distortions that can be associated with high powered lenses, as well as creating an increased tolerance of refractive lens positioning.

The iolAMD lens system is designed for flexibility — in cases where macular disease progresses, modification of the path of light can be made through rotation or replacement of the anterior IOL.

“iolAMD transforms the lives of patients — it is associated with faster visual rehabilitation compared with previous intraocular telescopes and better quality vision,” said Dr Bobby Qureshi, consultant ophthalmic surgeon, and chief medical officer and founder, London Eye Hospital Pharma, London. “In addition, it makes for happier surgeons. The implantation procedure is simple and fast, has a short learning curve because it involves existing skills, and it has safety advantages because the lenses are injected through a small incision and situated in the posterior chamber, away from sensitive corneal structures.”

The platform is CE marked and commercially available in select European countries. iolAMD is not currently available for sale in the US.

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Website: www.iolamd.com

Optovue
2800 Bayview Drive, Fremont, California 94538, USA
Tel.: +1 510 623 8868
E-mail: info@optovue.com
Website: www.optovue.com

The AngioVue Imaging System
The only commercially available, dual-modality OCT system capable of imaging and displaying function and structure of the ocular microvasculature — through a non-invasive procedure.
IOLMaster 700 from ZEISS

The new IOLMaster 700 from ZEISS with SWEPT Source Biometry allows irregular geometries of the eye or insufficient fixation to be already identified during the diagnosis. Apart from optical biometry, it also offers OCT imaging across the entire length of the eye. The ZEISS IOLMaster 700 enables cataract surgeons to view the complete longitudinal section of the eye, from the cornea to the retina. Irregular eye geometries, for example tilting of the lens axis, are therefore easier to identify. It is expected that this will facilitate a reduction in refractive surprises.

The unique Fixation Check provides more confidence in biometry. Surgeons can now reduce the risk of refractive surprises due to incorrect measurements caused by undetected poor fixation. Compared with previous procedures, in which the measurement result was derived from an A scan curve, the image-based measurement with the ZEISS IOLMaster 700 brings both physician and patient added safety, as the expected refractive outcome can be more reliably predicted.

As with the ZEISS IOLMaster 500, this new device also simplifies the workflows prior to cataract surgery. The Reference Image eliminates the need for manual pre-operative and intraoperative marking of the astigmatism axis on the patient’s eye before implantation of a toric IOL, as well as manual data transfer. Both were previously necessary for alignment of the toric lenses.

The ZEISS IOLMaster 700 is fully compatible with previous versions and provides access to the database of the User Group of Laser Interference Biometry (ULIB). This database contains the lens constants of more than 270 IOL models and is based on more than 50,000 cataract operations. The unique telecentric keratometry allows particularly robust and reproducible measurement of the corneal surface.

SMILE — 3rd Generation of Laser Vision Correction

Small incision lenticule extraction or SMILE is redefining refractive surgery. Only 3.5 years after its international launch, the SMILE procedure has been established in the market as the 3rd generation laser vision correction beyond PRK and LASIK. This unique, flapless and minimally invasive procedure has now been successfully performed in all major markets.

SMILE is based on the removal of a tissue disc (called lenticule) instead of tissue ablation, distinguishing it from PRK and LASIK. An excimer laser is not required. Unlike LASIK, the SMILE procedure is performed without a flap.

ZEISS is at the forefront of the 3rd generation laser vision correction method with the flapless, minimally invasive ReLEx SMILE. The refractive lenticule is created in the intact cornea, using the femtosecond laser system VisuMax from ZEISS. Refractive correction is achieved by extracting the lenticule through a small incision.

ReLEx SMILE offers several advantages over traditional refractive techniques. Due to the use of femtosecond cutting instead of ablation, it enables a refractive correction which is not affected by ambient room conditions or corneal hydration and leads to excellent predictability, also for higher corrections.1,2 As the procedure is flapless, the upper corneal layer and nerve tracts of the cornea remain largely intact. Therefore, dry eye syndrome is less likely to occur compared to LASIK.2–5 Furthermore, the small incision lowers the incidence of infection and epithelial ingrowth, and the healing of the cornea is better.6

ReLEx SMILE is approved for the correction of myopia (up to –10.00 D) and myopic astigmatism (up to –5.00 D) up to an SEQ of –10.00 D and offers major future potential for broadening the indication range.

References
Humphrey Field Analyzer 3 from ZEISS

The new Humphrey Field Analyzer 3 (HFA3) from ZEISS, is the next generation in visual field testing and analysis. The HFA3 is designed to accelerate clinic flow while delivering the same gold-standard testing strategies and test patterns. The New HFA3 provides a streamlined and faster workflow with an array of new features designed to:

- Reduce setup time with a single trial lens. Using liquid pressure, the new Liquid Trial Lens instantly delivers each patient’s refractive correction with the touch of a button.*
- Save time with an intuitive new SmartTouch interface, which reduces the number of steps required for the technician to start a perimetry exam.
- Accelerate clinic flow with equipment that can be learned quickly and operated easily.
- Improve confidence in test results with RelEYE, which allows doctors to instantly review the patient’s eye position, at any stimulus point. RelEYE data is available on the instrument and when reviewing test results with FORUM Glaucoma Workplace.
- Simplify test administration, with an easy-to-use kinetic graphical user interface with a full 180-degree field of view.

ZEISS Humphrey Field Analyzer 3

*Some patients may require a separate lens. Liquid Trial Lens available on the HFA3 model 860.

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