Dynamic Stimulation Aberrometry

access wavefront dynamics during accommodation

Technology

Application of aberrometry and wavefront analysis for the evaluation of vision is state of the art. This technology enables versatile ways to evaluate vision and to find new correction approaches. However, seeing is a dynamic process and requires dynamic examination approaches to evaluate vision dynamics correctly. DSA beyond todays approaches for wavefront diagnosis provides a patented technology base that allows overcoming today's limitations within this innovative area by adding dynamic stimulation aberrometry capabilities.

Dynamic **S**timulation **A**berrometry System (**DSA**) package allows you to measure, analyze, and study the dynamic behavior of the ocular wavefront evaluation during accommodation. DSA functions as an add-on to the approved WaveFront Sciences, Inc. wavefront aberrometer measure heads as used e.g. within the WaveFront Sciences “Complete Ophthalmic Analysis System” (COAS) or the Carl Zeiss Meditec “Wavefront Analyzer” (WASCA).

DSA provides stereoscopic binocular target stimulation for a wide range of target distances and individuals characterized by varying interpupillary distance or orbital cavity contour. Different sequence schemes (e.g. far-near-far) and target switching intervals for dynamic measurement can be configured.

DSA is designed as an easy to use high precision optomechanical plug-on to the aberrometer cover and includes additional configurable driving electronics and sophisticated application software. The installation of the DSA package does not require extended technical changes of your aberrometer system but simply adds additional functionality. This functionality extends the capabilities of your aberrometer system and allows you to go beyond todays limitations!

Application

DSA allows to measure the individual wavefront dynamics appearing during changes of the seeing distance, i.e. when a person tries to focus on a target where the target distance abruptly can be initiated to change between two distances (near and far target states or vice versa). In reality the near target can be switched in and out of the optical pathway to make it visible or invisible for the observer which, hence, will see the near or the far target respectively. This allows for very fast changes in the target distance. Far target may be applied from about 0.5 meters up to any possible distance and near target can be set in 0.25 Diopter steps between 3 Diopters and 9 Diopters. For myopes an additional target (Fixtarget) can be applied instead of the far target.
Special care was taken regarding the design of optical target inspection pathways of DSA. It is realized in a way to provide natural seeing conditions. Both eyes see the target under a natural stereoscopic angle to guarantee binocular stimulated accommodation.
During the changes in target state ocular wavefront measurements are continuously initiated with a repetition rate in the range of 25 frames per second (depending on the computer configuration of your aberrometer). No difficult procedures or settings are necessary to perform a dynamic measurement but just the standard procedures of your aberrometer you are familiar with. For a typical sequence where far and near targets are applied in an alternating way several hundreds of measurements are acquired with the aberrometers; a prerequisite to open up new prospects. This renders possible to study the speed, acceleration, stroke and stability of the accommodation process by monitoring the refraction parameters and the changes in higher order aberrations induced during accommodation. All measurements are accessible for a variety of conditions like illumination in photopic, mesopic or scotopic ambient light conditions.

Another way to use DSA is to study the ability for static accommodation, i.e. the maximum individually reached accommodation stroke. Therefore the target can be changed stepwise from 3 Diopter position towards 9 Diopters in 0.25 Diopter steps. Together with the dynamic measurements the direct influence of vision dynamics will become obvious.

Especially due to the stereoscopic stimulation principle DSA might be the right tool for basic research or application within the area of

- ✓ presbyopia,
- ✓ accommodative IOL's,
- ✓ refractive surgery,
- ✓ or other fields of investigation.

Features

- ✓ Stimulation: binocular (keeping the natural stereopsis)
- ✓ Sequence of Stimulation: Near-Far-Near, Far-Near-Far
- ✓ Fartarget Distance: 6 m or 3 m (recommended), others possible
- ✓ Fartarget Visus: 1.0 @ 6 m or 0.5 @ 3 m, others on demand
- ✓ Fixtarget Settings: 3 D to 5.75 D (depending on neartarget setting)
- ✓ Neartarget Visus: 0.1 @ 4 D (0.25 m), others on demand
- ✓ Neartarget Settings: 3 D to 9 D
- ✓ Neartarget Flip-Time: below 250 Milliseconds (flip IN/OUT)
- ✓ Target Switching Cycle Time: 4.0 Seconds interval between target flipping (configurable)
- ✓ Target Illumination: active, switchable
- ✓ Target Setting Accuracy: better 0.25 D (Fixtarget, Neartarget)
- ✓ Patient Alignment: Aberrometer standard procedure using iris control
- ✓ Patient Interface: Aberrometer system head-chin rest
- ✓ User Interface: Aberrometer system
- ✓ Data Analysis: DSA Software
- ✓ OSA wavefront notation (ANSIZ80.28-2004) supported
- ✓ Medical CE approval, Class IIa, 93/42/ECC (provided aberrometer is medical CE marked)

Developed in cooperation with
Carl Zeiss Meditec

optana MEDIZINTECHNIK

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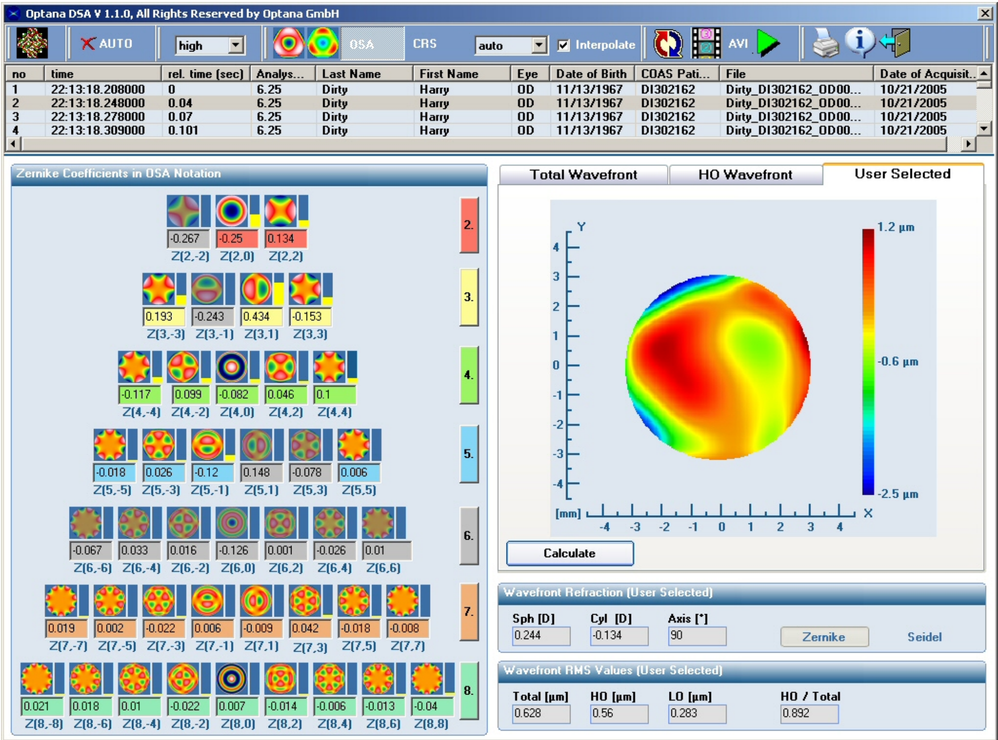
DSA Set-up

DSA initial installation, calibration and testing will be performed by a service technician. Once installed DSA during normal operation is plugged within minutes to your aberrometer by simply put the optomechanical DSA unit onto the aberrometer cover and securing it using three fixation screws. Exact positioning is automatically safeguarded due to factory aligned distance controls. The optomechanical DSA unit can be installed or removed whenever you want, however, in principle it can also be left in place even when you intend to just use the standard aberrometer functions and no DSA capabilities.

Measurements

Measurements are simply performed via the aberrometer software in the same way you may be familiar with. You just have to select the target sequence on the DSA control-box and to set the target distances on the optomechanical DSA unit in addition when using DSA capabilities. After the alignment of the patient in front of the aberrometer the target can be inspected with both eyes via the mirror arrangement in a natural way.

Many hard and software safety measures like face protection were implemented to make application of DSA save. Mechanical design implements ergonomic aspects like beveled edges and clearence to cover patients with pronounced face and nose contours.

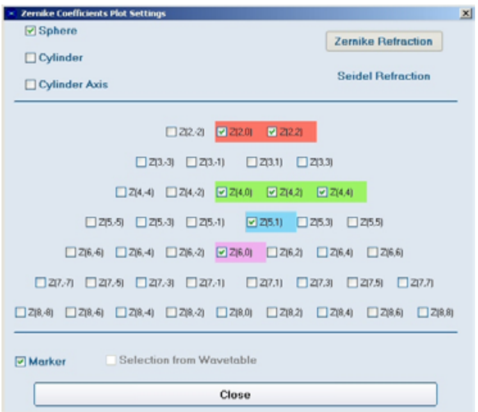


Wavefront dynamics

DSA comes with an additional software package for the sophisticated analysis of aberrometer data file sequences. Beside other options and settings it allows you to toggle groups of aberrations or single aberrations, to play online animations of data sequences or to generate AVI movies of the wavefront dynamics.

Eye response over time

Another feature of the DSA software is the time sequence plot functionality to analyze and evaluate wavefront refraction and aberrations during the accommodation as a function of time. It allows you to select whatever you intend to be plotted over time like sphere, cylinder, axis, higher order aberrations or RMS values by simply click and go. You can mix these different information to e.g. plot sphere plus spherical aberration.



Each plot can be further customized regarding scaling, ticks and more concerning your special interests or examination or presentation purposes. Plots in detail allow you to inspect the eye's response on the target stimulation when applied during the sequence in a versatile way. Such information will e.g. uncover the relation between sphere and spherical aberration and the influence and interaction of higher order aberrations on accommodation.

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