The WaveLight ALLEGRO Analyzer

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Principle of the Tscherning Aberrometer

- A well defined array of light rays passes the entire eye
- On the retina the array of rays generates a spot pattern
- Due to aberrations individual rays will be refracted differently, resulting in a distortion of spot pattern on the retina.
Principle of the Tscherning Aberrometer

- Based on the pattern distortion the device derives the optical aberrations

- This data set can be used for Wavefront guided treatments with the ALLEGRETTO WAVE™ Excimer Laser System
Data points

- A dot pattern of 168 dots are used in a 10x10mm array
- This results to a 1mm dot pattern on the retina
- The ALLEGRO Analyzer samples 90 data points over a 6.5mm pupil
Measuring principle

Aberroscope lens
0 ... +4 D

10 mm

1 mm
Optical Ocular Aberrations

Measurement of local distortions

Optical Ocular Aberrations

Local distortions → Calculation of Wavefront Error → Calculation of Ablation Profile → Custom LASIK
Advantages of the Tscherning system

Measurement in the visible spectrum

- The world of human vision
- Patient see their own aberration
- No demand to transform aberrations from IR to VIS (dispersion) as visible light is used for the measurement
Advantages of the Tscherning system

Measurement in the direction of human viewing

• Uses of the ingoing visual pathway
• No need to discuss similarity of in- and outgoing beam paths.
• Only valid images can be processed.
• An image is projected on the retina instead of a spot
• Tilt (Prism) can be measured
Advantages of the Tscherning system

Built-In autorefractor capability

- Size of central spot circle is a mass for the spherical error of the eye.
- Shape of the central spot circle is a mass for the cylindrical error of the eye.
Wavefront Reconstruction

• With the Tscherning system, the position of the ideal dot pattern is known
• The deformed dot pattern is captured with a low light sensitive camera
• According to the actual and the ideal dot pattern, and the internal lens positions, the wavefront error is reconstructed and displayed in Zernikes polynomials
Detecting Skew rays

• Skewed rays can not be detected in the first step by the ALLEGRO Analyzer
• If the assumption of a skew ray, a series of images can be taken with different magnifications, using the aberroscope lens
• According to the direction of the movement of the spot, a skewed ray can be detected
Minimizing adverse effects using the Tscherning principle

It appears that even opaque eyes can be measured because a clear image is seen on the instrument display. But it is really caused by reflections and scatter of the lens.

Only valid images can be processed. The individual beams are distracted by the opacity. No clear image can be seen, therefore no valid measurement can be taken. Low risk of treatments with wrong data.
Minimizing adverse effects

- If the spot pattern is not well detected, a low pass filter minimizes adverse effects
Patient alignment

• A passive Eyetracker is used for exact centration of the patients eye

• The same eyetracker principle is used in the laser system for perfect centration of the ablation
Patient alignment

Head alignment

Toggle horizontally between both eyes and check pupil height using the built-in eyetracker cross hair
Patient alignment

Z-position alignment

Alignment depending on the K-values of the patient
Patient alignment

X/Y-position alignment

X/Y-tolerance: max. 100µm

Z-tolerance: max. 200µm
Patient alignment

- Autocapturing when image is well centered
- Only centered images can be exported
Alignment of the patients head using the built in cross line projector of the laser system
• Patients limbus is marked on the 0 and 180 degree position with a corneal marker at the Slit lamp

• Eyetracker is tracking the center of the pupil
Data Link

Measurement → Floppy Disc → ALLEGRO WAVE A-Cat → ALLEGRO WAVE T-Cat → ALLEGRETTO WAVE Laptop Software + ALLERETTO WAVE Laser System

Custom ablation
The ALLEGRETTO WAVE Laser System

Advantages of the ALLEGRETTO WAVE laser system:

• Excellent clinical results for standard treatments, using wavefront optimized ablation profiles

• Wide range of treatment types
Wavefront optimized treatment

Wavefront optimized Ablation profile

A circular beam is being projected on the cornea.

Circular in the centre

Elliptical in the periphery. Ablative power is lost in several ways light is being reflected. The ellipse covers a larger area, resulting in a lower energy density. The lower ablation rate causes a spherical aberration resulting in poor night vision. The ALLEGRETTO WAVE algorithm compensates for this.

Reflection and Projection

Reduced Ablation, lower Fluence
Range of treatment types

Wavefront guided treatments (A-CAT) using the ALLEGRO Analyzer for:

- Patients with significant higher order aberrations
- Patients with visual discomfort
Range of treatment types

Topography guided treatments (T-CAT) using the ALLEGRO Topolyzer for patients with previous refractive surgery, like:

- Post RK patients
- Decentered ablations
- Small optical zones
- Post Keratoplasty cases
- Irregular astigmatism
Range of treatment types

• F-CAT treatment to adjust the post op asphericity of the patient (Q-value)

• The Q-Value adjusted treatments are more individualized than the standard Wavefront optimized treatments
Thank you very much for your attention