Adaptive optics as a tool to improve visual outcomes in refractive surgery

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Adaptive Optics
Adaptive Optics in the eye
Adaptive Optics in the eye
Adaptive Optics in the eye
from retinal imaging...
to visual evaluation
Adaptive Optics in the eye
from the lab to the clinic
...toward practical applications
Early laboratory version of the AO Vision Analyzer
Voptica clinical compact version of the AO Vision Analyzer
Adaptive Optics Vision Analyzer (AOVA)

- LCOS (spatial light modulator)
- Micro-display
- H-S
I. Objective HS refraction and aberrations measurements
II. Visual testing (VA, CSF, etc...) under any optics and different object distances...
II. Visual testing (VA, CSF, etc...) under any optics and different object distances...
Eye’s Optics

Objective characterization

Adaptive Optics Vision Analyzer

Visual testing

Subjective analysis
Eye’s Optics
Objective characterization

Adaptive Optics Vision Analyzer

Visual testing
Subjective analysis

Vision correction
Optical Solutions
Applications of adaptive optics in vision and ophthalmic research

- New (or revisited) experiments

- **Interactive design of new ophthalmic solutions**

- Visual function assessment

- Surgery outcomes optimization
“Traditional” approach

Phase profile design

Prototype implementation

Clinical testing

Mass production
“AO-based” approach

- Phase profile design
- Prototype implementation
- Clinical testing
- Mass production

Adaptive optics vision analyzer
Applications of adaptive optics in vision and ophthalmic research

- New (or revisited) experiments
- Interactive design of new ophthalmic solutions
- **Visual function assessment**
- Surgery outcomes optimization
AO vision analyzer

beyond Phoropters

Refraction!
Comparison of AO-guided refraction and “standard” phoropter

**AutoRefractometer**

**HS objective refraction**

**Phoropter**

**AO–Guided refinement**
### Spherical equivalent (D)

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The diagram shows a scatter plot with spherical equivalents on the X-axis and exam times on the Y-axis.
Applications of adaptive optics in vision and ophthalmic research

- New (or revisited) experiments
- Interactive design of new ophthalmic solutions
- Visual function assessment
- Surgery outcomes optimization
Quality of vision under any optical solution... with AOVA
Light adjustable intraocular lenses (LALs) allow optimum refractive outcomes
Light adjustable intraocular lenses (LALs) allow optimum refractive outcomes, but also...

*customized near vision* providing good quality of vision at all distances and patients’ spectacle independence!
Surgery

Two weeks

Corneal stabilization

adjustment + lock-ins

Voptica Adaptive Optics Vision Analyzer
Patients implanted *bilaterally* with LALs

One eye was set to near emmetropia and the fellow targeted to a value of *spherical aberration* to extend depth of focus.
Monocular ("far" eye)
Monocular ("near" aspheric eye)

Binocular vision
Potential of AO-guided presby-LASIK (collaboration with Prof. F. Malecaze)

Optimum induced corneal asphericity for each patient based in the customized AO assessment!
- Adaptive optics for ophthalmic applications is reaching maturity both for retinal imaging and visual testing.

- This technology is already available for improved outcomes in refractive surgery within clinical environments.
Thank you for your attention,

Pablo Artele