Evaluation of tear film quality with a double-pass scattering index

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Persistent dryness, scratching and burning, foreign body sensation in eyes are signs of dry eye syndrome but are not completely correlated to biomicroscopic and clinical aspects.
Moderate dry eye syndrome

- No corneal staining
- Moderate BUT = 5 sec
- Many subjective visual complaints and blurred vision due to tear film instability which are difficult to objectivate.
Two different approaches

- In order to evaluate corneal surface involvement of dry eye syndrome:
  - Assessment of STRUCTURAL analysis with imaging:
    - reliable, but difficult in practice
  - Assessment of FUNCTIONAL analysis:
    - Visual disturbance of dry eye syndrome before corneal staining.
Introduction

- Dynamic visualization of the corneal tear film quality using different methods:
  - Fluorescein staining and BUT
  - The Shack-Hartmann wavefront sensor
  - Wavefront aberration (objective evaluation of optical quality of the eye)
  - Optical scatter map
Introduction

- Fluorescein staining and BUT are subjective tests.
- No strict correlation between BUT and poor optical quality overall in moderate dry eyes.
- We need more precise dynamic tests to analyse drops efficiency, dry eye evolution, to prevent corneal or optical quality complications.
PURPOSE

- To evaluate correlation between:
  - clinical tear film quality (BUT),
  - biological tear film quality (tear osmolarity),
  - static and dynamic change of Ocular Scattering Index (OSI).
METHODS

- Objective measurement of optical quality of the eye with double-pass based device (OQAS, Visiometrics, Spain)

- More precise information with the DP images than Hartmann-Shack images since the device provide BOTH:
  - aberration
  - and intraocular scattering information.
Optical quality depends on:

- aberrations
- but also scattering

Tear film quality play a role in the optical quality of the human eye and may affect aberrations measurements.

Could OSI measurements be used for an objective evaluation of tear film quality?
**Specific software of OQAS**

<table>
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<th>OSI</th>
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- Tear film quality is the factor which may modify OSI during 20 sec in an eye.

- **4 Measurements:**
  - Mean OSI / Maximal OSI
  - Linear regression of OSI
  - Mean variation of OSI
  - Number and Time of blinking
Correlation OSI and Optical quality
Clinical and biological evaluation

- Clinical evaluation:
  - Subjective discomfort (OSDI© score)
  - Slitlamp examination
  - BUT

- Biological evaluation:
  - Tear osmolarity
## Clinical evaluation

<table>
<thead>
<tr>
<th></th>
<th>Minimal dry eye (n=20)</th>
<th>Moderate dry eye (n=13)</th>
<th>Severe dry eye (n=7)</th>
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</thead>
<tbody>
<tr>
<td><strong>Functional signs</strong></td>
<td>+</td>
<td>++</td>
<td>+++</td>
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<tr>
<td><strong>Visual signs</strong></td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td><strong>Conjunctiva or corneal staining</strong></td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td><strong>BUT</strong></td>
<td>&gt;10</td>
<td>&lt; 10</td>
<td>&lt; 5</td>
</tr>
</tbody>
</table>
Correlation clinical / biological tear film quality
OSI: mean, maximal or variation?

- Even if mean OSI is higher in severe dry eye than in moderate dry eye, this value can’t be used for intraindividual comparison but is a very good value for interindividual because of the impact of other light scattering surface (cataract +++)

- Variation of OSI is more reliable

<table>
<thead>
<tr>
<th>No dry eye</th>
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<tbody>
<tr>
<td>Minimal clinical dry eye</td>
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<tr>
<td>Severe dry eye</td>
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</table>
Slope coefficient of OSI linear regression and clinical groups

- No dry eye
- Minimal clinical dry eye
- Moderate clinical dry eye
- Severe dry eye
Slope coefficient of OSI linear regression and biological groups

**Minimal clinical dry eye**

**Moderate clinical dry eye**

**Severe dry eye**
Blinking

- Number of blinking during 20 sec
- Huge variation of OSI

Minimal clinical dry eye

Moderate clinical dry eye

Severe dry eye
Objective analysis: impact of drops on tear film quality

- Osmolarity = 284
- No variation of OSI
- No influence of drops on OSI values
Objective analysis: impact of drops on tear film quality

- Osmolarity = 326
- Huge variation of OSI at T0 (Blue curve)
- Decrease of mean OSI at 5 min (green curve) and at 15 min (orange curve)
CONCLUSION

- This new objective method may quantify the blurry vision associated with dry-eye syndrome:
  - Greater variation of OSI, correlated with clinical or biological dry eye syndrome.
  - Greater number of blinking

- This objective method may be useful to detect and follow-up tear-film related patient’s complaints particularly in moderate dry eye syndrome before corneal surface staining.

- At last, this dynamic analysis of the tear film could evaluate the effect of eye drops on tear-film quality and stability.
THANK YOU for YOUR ATTENTION