The quest for perfection in the Ocular Surface

DIMITRIOS MIKROPOULOS MD, PhD

PERFECTION is lots of little things done well
~ Fernand Point ~
Structure and Function of the Ocular Surface

• Complex interactions exist between the three main structures of the ocular surface:
  • Cornea
  • Conjunctiva
  • Tear film

• The ocular surface is a functional unit that:
  • **Maintains** the integrity of the cornea
  • **Preserves** the quality of the refractive surface of the eye and, thus, visual function
  • **Resists** injury and protects the eye against environmental conditions

Definition and Common Causes of OSD

• Ocular surface disease (OSD) includes any condition that:
  • Leads to a dysfunctional tear film
  • May cause noticeable irritation to the front of the eye and degradation of vision

• OSD is related to structural or functional problems of the eyelids, cornea or conjunctiva

• Common forms of OSD include:
  • Blepharitis (inflammation of the eyelids)
  • Tear film dysfunctions (e.g. dry eye disease)
    • Sjögrens syndrome
    • Meibomian gland dysfunction


Impact of Ocular Surface Disease on Visual Acuity and Contrast Sensitivity

- The tear film provides the greatest optical power of any ocular surface and is essential for good quality vision.
- Corneal surface irregularity due to epithelial desiccation can lead to decreased visual acuity.
- Decreases in spatial contrast sensitivity ranged from 35% to 70% in patients with dry eye disease, compared with normal eyes.
  - Evidence indicates that decreased spatial contrast sensitivity correlates with loss of visual acuity in patients with dry eye.


Impact of OSD on Vision-Related Quality of Life

- Impaired visual acuity, contrast sensitivity, and visual function can have a profound effect on vision-related quality of life.
- Dry eye disease decreases the quality of patients' lives and their ability to perform daily functions.

<table>
<thead>
<tr>
<th>Daily Life Function</th>
<th>Patients Reporting Interference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night time driving</td>
<td>32.3</td>
</tr>
<tr>
<td>Reading</td>
<td>27.5</td>
</tr>
<tr>
<td>Computer work</td>
<td>25.7</td>
</tr>
<tr>
<td>Watching television</td>
<td>17.9</td>
</tr>
</tbody>
</table>

Dry eye disease is defined as a multifactorial disease of the ocular surface and tear film that results in symptoms of discomfort, visual disturbance and tear film instability.

It is characterized by hyperosmolarity of the tear film and inflammation of the ocular surface.

The Cycle of Inflammation in Dry Eye

Management of OSD is based on careful clinical observation and accurate diagnosis of the underlying causative factors.

Identify the problem

Ask for symptoms of OSD

Slit-lamp examination can be used to examine the eyelids, margins, glands, and the ocular surface.
Symptoms of OSD

- Dry eyes sensation
- Tearing
- Burning
- Foreign-body sensation
- Stinging or burning sensation
- Eyelid itching
- Photophobia
- Grittiness
- Repeated blinking
- Visual disturbances

Questionnaire: Ocular Surface Disease Index (OSDI)

- A set of 12 questions
- Used as a measure of outcome in randomised controlled trials
- Scores on scale (grading from 0 to 4)
- OSDI score = [(sum of the scores for all questions answered) x 100]/[(total number of questions answered) x 4]
- Assessment: Scale of 0–100
  - Higher the score more severe the disease
- Advantage: OSDI is a valid and reliable instrument for measuring the severity of Dry Eye disease

### Common Signs of OSD

<table>
<thead>
<tr>
<th>Sign</th>
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<tbody>
<tr>
<td>Abnormal Schirmer test</td>
</tr>
<tr>
<td>Abnormal tear break-up time test (TBUT)</td>
</tr>
<tr>
<td>Corneal and/or conjunctival staining</td>
</tr>
<tr>
<td>Meibomian gland dysfunction</td>
</tr>
<tr>
<td>Lid margin vascularization</td>
</tr>
<tr>
<td>Lid margin laxity and/or irregularity</td>
</tr>
</tbody>
</table>

### Delayed Clearance

**Loose interface – Floppy eyelid**
Lower eyelid horizontal laxity

Ineffective tear spread
Ocular Surface irregularity

- Dellen
- Pingueculae
- Pterygium
- Conjunctivochalasis

Tseng SC. A practical treatment algorithm for managing ocular surface and tear disorders. Cornea. 2011

Blepharitis-MGD
Lipid layer deficiency

Tear Meniscus Height

Tear meniscus height: <0.35 mm
Schirmer’s Test

≤3 mm: Confirmed diagnosis of an aqueous-deficient eye
≤5 mm: Highly probable diagnosis of an aqueous-deficient eye
6 to 10 mm: Marginal or grey zone of aqueous deficiency

TBUT Test

Normal: >10 sec,
Dry Eye ≤10 sec
# Ocular surface staining

<table>
<thead>
<tr>
<th></th>
<th>Fluorescin</th>
<th>Lissamine green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staining of healthy cells</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Staining of dead cells</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Blocked by mucin</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Intrinsic toxicity</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Phototoxicity</td>
<td>✗</td>
<td>Not done</td>
</tr>
<tr>
<td>Stromal diffusion</td>
<td>Fastest</td>
<td>Fast</td>
</tr>
<tr>
<td>Staining promoted by</td>
<td>Cell-cell junction disruption</td>
<td>Cell-cell junction disruption or cell death</td>
</tr>
</tbody>
</table>

### Fluorescein Staining

![Staining images]
Lissamine green Staining

Grading of corneal and conjunctival staining Oxford Scheme

Bron AJ. Grading of corneal and conjunctival staining in the context of other dry eye tests. Cornea. 2003
Meibomian Gland Expression

Osmolarity Measure

- Hyperosmolarity is a well-established fundamental characteristic of dry eye disease
- The osmolarity test assists clinicians in making a rapid differential diagnosis
MMP-9 test

- MMP-9 is produced by the entire lacrimal system
- Reliable biomarker for inflammation, consistently elevated in the tears of patients with OSD

InflammaDry limit of detection

Literature meta-analysis supports that normal levels of MMP-9 in human controls range from 3-41 ng/ml

**NEGATIVE TEST RESULT**

MMP-9 < 40 ng/ml

**POSITIVE TEST RESULT**

MMP-9 ≥ 40 ng/ml

Therapeutic management

- Correct eyelid abnormalities
- Normalize lid margin
- Correct surface irregularities

- Stabilize tear film
- Control MGD
  - Lid hygiene
- Reduce inflammation
Management of Dry Eye

• In aqueous tear deficiency
  • Use of preservative-free artificial tears
  • Use of punctal plugs can prevent tear drainage and prolong the effects of tear substitutes.


Management of Dry Eye

Punctal plugs

• Punctal occlusion does not reduce inflammatory mediators
• Punctal occlusion may exacerbate symptoms of blepharitis, so this must be treated beforehand
• The Delphi treatment guidelines for ocular surface disorders recommends that inflammatory conditions be treated before punctal occlusion

Management of Dry Eye

- In lipid layer deficiency (MGD)
  - use of lid hygiene,
  - warm compress and lid warming
  - nutritional supplement
  - topical azithromycin and oral doxycycline
  - lubricants with lipids


Management of Dry Eye

Control ocular surface inflammation

- The choice of steroids depends on the severity of inflammation
  Weak topical steroids (fluorometholone, or prednisolone 0.5% PF) can be used on an ‘as required’ basis or as short tapering courses
  In severe inflammation (e.g. acute vernal keratoconjunctivitis), more potent topical steroids (e.g. dexamethasone 0.1%, or Prednisolone 1%) are required

Management of Dry Eye

Control ocular surface inflammation

- **Topical ciclosporin A (CsA)** (various preparations) has been shown to be effective in several ocular surface disorders without the adverse effects of steroids. However, ciclosporin is often poorly tolerated during disease exacerbations and its full efficacy is only achieved several weeks from the initial dose.

- Ciclosporin has been shown to be better tolerated if introduced following a few weeks of treatment with topical steroids.

References:

Management of Dry Eye

- **Eye platelet rich plasma (E-PRP)** has been shown to reduce punctate epithelial erosion, increase tear film stability and improve best corrected visual acuity following surgery.

References:
A Healthy Ocular Surface means that a lot of “little things” go well.

THANK YOU FOR YOUR ATTENTION