Implications of the Contact Lens Discomfort Workshop Findings for Your Practice

Impetus for workshop
- Implication for patients, practitioners and industry
- 37 Million wearers; $7.6 Billion
- Market is stagnant at 5-6% growth rate
- Best guess is 8% new wearers every year

Contact Lens Drop-outs
- Difficult to get exact figures
- Dumbleton, 2013: (n=4207); Canada 2008-10
  - 40% lapsed for 4 or more mos.
  - 23% permanently stopped
  - Fewer lapsed in SiHy (19% vs 34%)
  - More who lapsed wore dailies (22% vs 18%)
  - Lapsed wearers were older

Contact Lens Drop-outs (cont.)
- Young, 2002: (n=236); UK
  - Short term 23% at 1 mo. quit; losing another 27% by 6 mos.
  - Highest success rates were for bi-weekly and daily wearers
  - Lowest success were for toric and multifocal wearers

Contact Lens Drop-outs (cont.)
- Richdale, 2007: (n=453) US
  - 24% permanent lapsed
Primary Causes for Dropout\textsuperscript{2,3}

- Discomfort (24% to 51%)
- Dryness (20%–24%)
- Vision (13%)
- Redness (7%)
- Expense (7%)

Definition and classification\textsuperscript{6}

Contact lens discomfort is a condition characterized by episodic or persistent adverse ocular sensations related to lens wear, either with or without visual disturbance, resulting from reduced compatibility between the contact lens and the ocular environment, which can lead to decreased wearing time and discontinuation of contact lens wear.

CLD v. Dry Eye\textsuperscript{7–11}

Problems Plaguing the Study of CLD

- Limited understanding of etiology
- Poor correlation between symptoms and signs
- Lack of a “gold standard” test/questionnaire for CLD

Definition and classification

Epidemiology\textsuperscript{12}

- Natural history and patient profile
- Canadian Dry Eye Epidemiology Study (CANDEES) of general pop.
- n=13,517; ages 10–80
- 50.1% of CLW had DED symptoms
- 21.7% of NW had DED symptoms
Epidemiology

Risk factors for CLD
- Non-modifiable
  - Sex: mixed results
  - Age: best evidence suggests an inverse relationship
  - Ethnicity: no relationship identified
  - Poor Tear Film: assoc. with CLD
  - Blink interval: little evidence
  - Systemic Disease: little evidence
  - Seasonal allergies: (+) small subset

Risk factors for CLD
- Modifiable
  - Medication: contraceptives & isotretinoin
  - Intake: incl. EPO, omega 3 & 6, ETOH
  - Smoking: weak
  - Cosmetics: maybe but not studied
  - Compliance: definitely
  - Psych/Fatigue: CLD worse EOD for all

Other Risk factors for CLD (25% of symptomatic wearers have no signs, but 75% do) [25]
- Factors secondary to lens wear
  - Thinning of pre-lens tear film (PLTF)
  - Instability of PLTF
  - Shortening of meibomian glands (MG)
  - Alterations in corneal sensitivity
  - Changes in cornea & conj. epith.

Other Risk factors for CLD
- Environmental Factors
  - Humidity and air movement
  - Unproven: Temp., altitude, smoke, Heat/AC, seasonality in climate

Contact Lens Materials, Design & Care Systems Impact on CLD [26]
- Impact of materials trends (bulk & surface)
  - Hydrogels: low H2O; no impact ionicity
  - SiHy: H2O; ionicity
  - Higher Transmissability (Dk/t) seems not to matter or has a small effect
  - Modulus: SiHy > Hydrogels for comfort but no difference for dryness
**Contact Lens Materials, Design & Care Systems Impact on CLD**

- Impact of materials trends (bulk & surface)
  - Dehydration – not assoc. with CLD
  - Friction & Lubricity -- (+) with comfort
  - Wettability – inconclusive
  - PVA/HA Wetting agents– No direct evidence of improved comfort
  - GP v. Silty v. Hydrogel no diff. in comfort medium or long-term

- Impact of design
  - OAD – (?) Most 13.8 to 14.2 mm but shrink on the eye with the increase in temp.
  - Movement – (+) tendency is for loose lenses to feel more uncomfortable
  - Centration – no data
  - Edge – rounded profiles less comfortable

- Deposits
  - Visible deposits – poor correlation w comfort
  - Quantified deposits – Proteins, Lipids and Mucin show poor correlations
  - Modality – no disadvantage to EW v. DW

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*Figure 1: Comparison of linear modulus with equilibrated water content for various contact lens materials.*

*Figure 2: Impact of design on CLD:
- OAD – (?)
- Movement – (+)
- Centration – no data
- Edge – rounded profiles less comfortable

*Figure 3: Comparison of edge profiles for different contact lenses.*

*Figure 4: Comparison of deposits between different contact lenses.*

*Figure 5: Impact of modality on CLD:
- Deposits – no disadvantage to EW v. DW*
Contact Lens Materials, Design & Care Systems Impact on CLD

- **Duration of wear** – differences disappear over time (2w) as patients are desensitized; end of the day CLD a major concern
- **Impact of age & replacement interval** – DD appear better than 2-W or Monthly IF replaced on time

Contact Lens Materials, Design & Care Systems Impact on CLD

- **Biocides**
  - $H_2O_2$ – Suggestive may be better than preserved systems
  - PHMB vs Polyquad – Conflicting reports
  - All comparisons influenced by multiple agents → confounding variables

Contact Lens Materials, Design & Care Systems Impact on CLD

- **Surfactants** – Poloxamines may be better than Poloxamides; HPMC and EOBO appear to help; more study needed
- **Chelating agents** – citrates help
- Bottom line: Contact lens-related dryness is associated with a diverse range of causes and lens care product is NOT a significant factor
- MPS-Lens interactions occur; signs do not correlate well with symptoms

Footnote: Rewetting Drops, Lubricants and BPS

- 47% of CL wearers use rewetting drops
- Proactive use is more effective than reactive use
- Expect some relief in symptomatic wearers but overall, little value over using saline

Pearls

- Few PROVEN links between CLD and material, design and care systems
- However, there is some evidence indicating improved comfort by modifying
  - Shortening replacement cycles
  - Material choices to lower modulus lenses
  - Lens designs to ones with flatter, thinner edges
  - Use of dual disinfection systems with SiHy materials
Contact Lens Interactions with the Ocular Surface and Adnexa

- Interactions with cornea
  - Epithelial
  - Cells thin and increase in size as modulus increases and Dk/t decreases but not assoc. with CLD
  - Apoptosis and barrier function are reduced with CL wear but not assoc. with CLD at best
  - Weak link between staining and CLD

- Interactions with cornea
  - Stroma
  - CL wear decreases keratocyte density not affected by Dk/t and may be more profound for SCL v. GP Not related to CLD
  - Stromal infiltrates may or may not be assoc. with combinations of SiHy-MPS and CLD when overtly symptomatic
  - NVZ superficial or deep and is not assoc. with CLD but is with low Dk/t lenses

- Interactions with cornea
  - Endothelium – not assoc. with CLD
  - Blebs are related to dec. pH causing localized edema
  - Central density is dec. w/o cell loss
  - Polymegathism with PMMA, GP & Hydrogels but not with SiHy; related to blebs
  - Permeability is equivocal

- Interactions with cornea
  - Edema
    - GP and low Dk/t hydrogels during the day
    - 1%-6% corneal edema
    - Hydrogel EW → 10%-15%
    - SiHy EW → 3% → overnight in non-CL
    - No assoc. btw. Microcysts, oxygen levels, edema levels and CLD
  - Greater temperature behind the lens
  - Increased evaporation of the pre-lens tear film reduce the temperature
Contact Lens Interactions with the Ocular Surface and Adnexa

- Interaction with the conjunctiva
  - Staining - not entirely all related to edge but associated with discomfort
  - Flaps - No correlation with CLD
  - LIPCOF - Correlates with symptoms of dryness
  - Conjunctival chalasism
  - Hyperemia
  - Squamous cell metaplasia
  - Goblet cell density
  - Plaepbral conj
### Contact Lens Interactions with the Ocular Surface and Adnexa

- **Interaction with the conjunctiva**
  - Conjunctival chalasis
    - Senescent change not related to CLD
  - Hyperemia
    - May be seen in both asymptomatic and symptomatic wearers
  - Squamous cell metaplasia
  - Goblet cell density
  - Plapebral conj

- **Goblet cell density**
  - Equivocal; depends on site and methods used but some suggest a decrease but not clearly related to CLD

- **Morphology**
  - CL wear may induce changes
  - Hypersecretion
  - Vascularization, irregular morphology, blockage, damage to junction
  - MG drop-out
Desquamated epithelial cells, meibum and peri-glandular inflammation

Fuller, 2013

Contact Lens Interactions with the Ocular Surface and Adnexa

- Interactions with the lid margins
  - Lid-wiper epitheliopathy – 67%-80% of symptomatic CL wearers v. 13%-32% of asymptomatic subjects; may be one of the few signs assoc. with dryness in CL and Non-CL wearers

Contact Lens Interactions with the Ocular Surface and Adnexa

- Pearls
  - So, make a habit of INSPECTING LIDS
  - Proposed links to CLD
    - LIPCOF
    - LWE
    - MGD
    - Conj. Metaplasia
    - Goblet cell density (GCD)

Contact Lens Interactions with the Tear Film

- Pearls
  - CL’s disrupt the lipid layer increasing evaporation \( \Rightarrow \) CLD
  - Tear film stability is affected by multiple factors
  - CLD is related to tear volume and turnover but not tear film thickness
  - Tear ferning may have some value
