Comparison of the Ocular Surface in Adult and Pediatric Contact Lens Wearers

Katherine Bickle, OD MS FAAO
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Contact Lens Market

- 40.9 million CL wearers in the US
- $2.5 billion market in the US
- $7.2 billion market worldwide

Children in Contact Lenses

- Proportion of pediatric CL wearers
- Reasons for fitting
  - Sports, other activities
  - Patient's request
  - CL material options
  - Cosmetic
  - Myopia control
  - Medically necessary

AOA Children & Contact Lenses Study

Children in Contact Lenses

- Benefits to practice
  - Patient and parent satisfaction
  - Children may come back for visits more frequently
  - CL's and spectacle purchases
  - Referrals

2016 CL Spectrum Survey

Nichols, 2017

Long-term Consequences of Fitting Children in Contact Lenses

- Risk of microbial keratitis
- Ocular surface changes
- Dryness and discomfort leading to contact lens intolerance

Contact Lens Dropout

Annual Contact Lens Dropout Rates

- Rumpakis: 15.9%
- Richdale: 24.1%
- Pritchard: 34.0%

Reasons for Contact Lens Dropout:

1. Discomfort and/or dryness (most common)
2. Poor vision
3. Cost
4. Handling and care
Dry Eye Disease: Background

- Prevalence
  - Wide range reported in studies (5-35% of the population)
- Symptoms vs. signs
  - Lack of correlation of signs and symptoms (Nichols et al, 2004)
- Diagnostic testing
- Etiology
  - Evaporative (86% of dry eye patients, Lemp et al, 2012)
  - Aqueous deficient
  - Combination

Factors Associated with Dry Eye

- Contact lens use
- Medications (hypertensive, antidepressants, oral contraceptives, antihistamines, glaucoma)
- Systemic conditions
- Acne rosacea
- Ocular surgeries (refractive)
- Environmental conditions (humidity levels, wind)
- Computer use
- Smoking status
- Age

Pediatric vs. Adult Contact Lens Wearers

- Extensive literature on adult lens wearers while data on children is limited
- Ability of children to understand and cooperate while performing measurements
- Systemic diseases

Systemic Diseases in Children

- Cystic fibrosis
- Ectodermal dysplasia syndromes
- Juvenile rheumatoid arthritis
- Graft-versus-host disease
- Sjogren syndrome
- Diabetes
- Vernal keratoconjunctivitis

Subjective Comparisons

- Based upon symptoms, the prevalence of dry eye in CL wearers is 2-3x that of non-CL wearers of the same age
- Contact Lens Dry Eye Questionnaire (CLDEQ)
  - Pediatric: 4.3% considered to have dry eye
  - Adult: 56.2% considered to have dry eye

Subjective Comparisons

- Contact Lenses in Pediatrics (CLIP) Study
  - 84.6% of those ages 8-12 reported their eyes never or rarely felt dry
Subjective Comparisons

Ocular Surface Disease Index

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pediatric group (0-40)</th>
<th>Adult group (≥40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have you been diagnosed with dry eye?</td>
<td>1,823 (80%)</td>
<td>1,743 (79%)</td>
</tr>
<tr>
<td>2. Do you have dryness?</td>
<td>0.74 (74%)</td>
<td>1.51 (51%)</td>
</tr>
<tr>
<td>3. Dryness or watery eyes</td>
<td>0.73 (73%)</td>
<td>1.51 (51%)</td>
</tr>
<tr>
<td>4. Israel’s venous?</td>
<td>0.71 (71%)</td>
<td>1.50 (50%)</td>
</tr>
<tr>
<td>5. Feelings?</td>
<td>0.71 (71%)</td>
<td>1.50 (50%)</td>
</tr>
<tr>
<td>6. Soreness?</td>
<td>0.70 (70%)</td>
<td>1.49 (49%)</td>
</tr>
<tr>
<td>7. Driving at night?</td>
<td>0.69 (69%)</td>
<td>1.48 (48%)</td>
</tr>
<tr>
<td>8. Working with a computer or blue light source?</td>
<td>0.67 (67%)</td>
<td>1.46 (46%)</td>
</tr>
<tr>
<td>9. Working at night?</td>
<td>0.67 (67%)</td>
<td>1.46 (46%)</td>
</tr>
<tr>
<td>10. Frequent eye movement</td>
<td>0.66 (66%)</td>
<td>1.45 (45%)</td>
</tr>
<tr>
<td>11. Dryness at rest (every day)?</td>
<td>0.59 (59%)</td>
<td>1.41 (41%)</td>
</tr>
<tr>
<td>12. Areas that are not on eyelids?</td>
<td>0.58 (58%)</td>
<td>1.40 (40%)</td>
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</tbody>
</table>

Han et al, 2013

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Blink rates

- Adults: 12 blinks/minute
- Children (4-6 years old): 8 blinks/minute
- Infants: (36-53 weeks): ~5 blinks/minute
- Infants (0-17 weeks): 2 blinks/minute

Meibomian Glands

- Sebaceous glands that secrete the lipid layer of the tear film
- Total number
  - Number in upper eyelid: 25-40
  - Number in lower eyelid: 20-30
- Delivery of meibum through blinking forces

Images: International Workshop on MGD

Meibomian Gland Atrophy

Pediatric group fit in corneal reshaping lenses

<table>
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<tr>
<th>Months</th>
<th>1 Month</th>
<th>3 Months</th>
<th>6 Months</th>
<th>9 Months</th>
<th>12 Months</th>
</tr>
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<tbody>
<tr>
<td>Infants</td>
<td>92/100</td>
<td>100/100</td>
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Arita et al. 2009
Tear Film Break-Up Time

- Pediatric population
  - 36 subjects
  - Mean age: 7.64 years (2.16-15.83)
  - Mean NITBUT: 21.76 ± 4.06 seconds

Non-invasive tear break-up time

- Advantages
  - Non-invasive (no disruption to the tear film)
  - No reflex tearing after dye instillation
  - Data obtained from equipment
- Equipment
  - Oculus Keratograph 5M
  - Tearscope

Tear Film Break-Up Time

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<th>Age Group</th>
<th>1 Month</th>
<th>4 Weeks</th>
<th>2 Weeks</th>
<th>2 Months</th>
<th>6 Months</th>
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<td>Normal</td>
<td>15.0 ± 1.0</td>
<td>12.4 ± 1.1</td>
<td>12.0 ± 0.9</td>
<td>12.5 ± 1.7</td>
<td>12.0 ± 1.8</td>
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Pediatric Population

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<tr>
<th>Study</th>
<th>NIBUT (sec)</th>
<th>TBUT (sec)</th>
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<tr>
<td>Nichols et al.</td>
<td>11.2 ± 0.8</td>
<td>7.6 ± 10.4</td>
</tr>
<tr>
<td>Sengor et al.</td>
<td>9.5 ± 1.5</td>
<td>7.57 ± 2.67</td>
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Tear Osmolarity

- Normal values
- Inter-eye difference
- Measurements should be performed no sooner than 2 hours after therapeutic eye drops

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Summary

- There are several indications for contact lens wear in children and children prefer contact lenses compared to spectacles
- Limited knowledge of the ocular surface on pediatric soft contact lens wearers
- Pediatric contact lens wearers appear to have less dry eye symptoms than adult contact lens wearers
Thank you!

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