Pediatric Contact Lenses
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Description: Pediatric contact lenses fit for medical necessity including aphakia, aniridia, amblyopia, anisometropia, and prosthetic reasons will be covered. Theories of myopia control with contact lenses and the recent research results in this area will be presented.

Learning Objectives:
1. Understand the indications for pediatric contact lens fitting
2. Learn all the various contact lens options for medically indicated pediatric contact lenses
3. Learn of myopia control with contact lenses theories and studies

Indications (5-10 min)

- **Aphakia**
  - Genetic
  - Rubella
  - Post-partum trauma
  - PHPV and micro-ophthalmia

- **High Myopia**

- **High hyperopia**
  - Accomodative esotropia

- **Irregular Astigmatism**
  - trauma
  - HSV scarring

- **Photophobia**
  - aniridia
  - iris coloboma
  - albinism
  - Achromatopsia

- **Oclusion**
  - Disfigurement
- Amblyopia
  - Anisometropia (refractive) >2D
  - Nystagmus
    - Often accompanied with high refractive error
  - Myopia Control?

**Amblyopia (10 min)**

**Prevention**
- Amblyopia is responsible for more vision loss in <45 y.o. age group than all other causes of vision loss combined
- Amblyopia prevalence: 2.5% in North America

**Risk Factors for Amblyopia**
- Deprivational
  - cataracts
  - corneal opacities
  - ptosis
- Strabismus
- Refractive
  - Anisometropia >2D
  - Iso-ametropia
    - bilateral high myopia
    - especially bilateral high hyperopia
  - Meridional Aniso
    - high astigmatism
    - especially unilateral oblique astigmatism

**Benefits of CL's over spectacles (5 min)**
- Field of view
- Decreased abberations
- Prevent aniseikonia
- Increased magnification for myopes
- No induced prism
- No awkward frames to maintain in place

**Spectacle induced prism**

**Accomodative Esotropia**

- CLs may eliminate BO prism effect of (+) lenses which increase Accm demand
  - Ex. +8.00 OU in near gaze
  - P=F x cm= 8 x 0.3= 2.4 BO OU
  - total 4.8 BO prism induced at near

**Aneisekonia**

- Highest risk is in refractive anisometropia (vs axial)
- Relative spectacle magnification disparity
- 1% mag per D of refractive disparity
- 3% easily tolerated
- >5-7% impaired binocular function
  - Ex. Magnification effects in unilateral aphakia
    - spectacles 20-30% magnification
    - CL 8-12% magnification
    - IOL normal

**Success Rates of CL in Children (1 min)**

- Literature suggests:
  - 79% successful wear in congenital cataract pts
  - 50-75% successful wear in traumatic cataract
- Only ~10-16% complication rate or intolerance
- Most failures are 2nd to noncompliance or failure with Amblyopia tx
  - Moore et al, 1993
    - 40/199 unsuccessful
    - 26/40 d/c 2nd to poor VA and amblyopia
    - 14/40 d/c 2nd to CL difficulties
Contact Lens Options (10 min)
Soft/Hydrogel

■ Advantages
  - comfort
  - stays in place

■ Disadvantages
  - high cost
  - low Dk
    • corneal edema
  - poor handling
  - not durable
    • rippage
    • deposits
  - infection risk in EW
  - no UV protection avail.
  - cannot mask irregularity

Soft prosthetics/occluders

■ 'Occluders'
  - Amblyopia therapy
    • High plus or high minus lenses to blur
  - Disfigurement or amblyopia therapy
    • Adventures in Color, Ciba, Alden, Custom Color Contacts, CooperVision
    • cost:$60-$325/lens

Prosthetic lenses

■ Aniridia, full or partial
■ Iris Coloboma
■ Hand painted to color match
■ Ciba, Adventures in Color, Custom Color Contacts, CooperVision
■ $180-$375/lens

Silicone Elastomer/B&L Silsoft

■ Advantages
  - comfort
- stays in place
  - low loss rate
- fair/easy handling
- hyper Dk, safe EW

■ Disadvantages
- very high cost
  - sub-standard insurance reimbursements
- hydrophobic
  - heavy lipid deposits
- no UV protection avail.
- cannot mask irregularity
- limited parameters
  - 3D steps, 3 base curves

Rigid Gas Permeable (RGP)

■ Advantages
- low cost
- ANY availability
- easy handling
- high Dk
- safe EW
- UV filters avail.
- Optics
  - irregular or high corneal astigmatism

■ Disadvantages
- adaptation/comfort
- skill in fitting
- lens loss/dislocation
- possibility of self insult

RGP Measurement Techniques

■ OK to estimate pre-fitting measurements in infants and small children
■ Must be able judge fit and alter appropriately
  - Hand held keratometer (if available)
  - Measure corneal diameter
- Diagnostic rigid lenses
- Use anesthetic if not EUA
- fluorescein strips
- cobalt blue filter
- Retinoscopy for OR

Fitting RGP’s

- Diameter (OAD)
  - 1-2 mm smaller than corneal diameter
  - relatively larger than adult OAD to prevent loss

- Power
  - based on trial lens and OR
  - correct for VD (assume 12mm)
    - Ex. +20.00 spectacle = +26.3D contact lens
    - Ex. -15.00 spectacle = -12.75D contact lens
  - correct for tear layer
    - not uncommon for 2-3 D lacrimal lens

Selecting RGP Base Curve (BC)

- Fit steeper than usual to prevent loss
- Material
  - high or hyper Dk
    - Fl 92, Fl 151, BXO, HDS 100, Menicon Z

Case Histories (5-10 min)

Case 1: 5 y/o female
- History of trauma (fingernail) in right eye
- Followed by Herpes Simplex Viral infection
- Meds: Oral acyclovir syrup
- No topical medications
- Referred by pediatric ophthalmologist for CL fitting

K’s and Rx

- OD 45.25 @ 018, 48.12 @ 08
- MR: OD +3.50-3.00X20 20/40
  - OS –0.25-0.75X083 20/20

Subjective Symptoms

- Glare, halos, monocular diplopia OD
- Told glasses would be problematic
Assessment

- HSV scarring resulted in local corneal irregularity
- Superficial scarring / contracture = high astigmatism
- (Deep stromal scarring = haze and irregular astigmatism)
- RGP lenses create a new smooth optical surface
- FL pooling reveals areas of irregularity

Case 2

- 4 yo male
- central corneal ulcer OD
- dense central scar, BCVA spectacles <20/100
- fit with Menicon Z +0.50 Rx
- VA 20/20
- scar lessening
in severity
with CL use

Case 3

- 4 yo female
- Hx trauma OD with central corneal scar
- Anisometropic astigmatism
- Tx with spectacles and patching OS
  - spectacle VA 20/70
- spherical RGP Rx PL
  - VA 20/25

Case 4

- 9 yo Dx failed school screening
  OD PL 20/20
  OS +7.75-2.50X175 20/200
  - Fit with soft toric CL OS and intensive amblyopia tx
  - Acute SCL induced edema after 2 years
  - Refit to RGP Bitoric
  - 20/20 VA OS!

Case 5

- 4 yo female
- Hx: poked with pencil OS
- corneal laceration inferiorly, well healed
- post-op refraction:
  - OD PL
  - OS +4.00 -5.50 x050 20/60
- K's OS: 42.50/47.25@135
- Fit with Bitoric RGP:
  - 7.82/7.15 10.0/8.2 +1.75/-2.25 = 20/30+
  (43.12/47.12) SPE bitoric

Pediatric Aphakia (5 min)

Alternative treatments
- Epikeratophakia
- IOL

Fitting Aphakia
- 2 stages of visual acuity development
  - birth to 6 months: 20/800 to 20/20
  - 6 months to 6-7 years; visual acuity is still in plastic phase
  - prompt attention to visual compromise is necessary, especially in first 6 months of life
- Unilateral aphakia has higher rate of amblyopia than bilateral aphakia
  - effect of compliance, amblyopia tx, magnification differential

Fitting Aphakia

- Power
  - Typical CL powers range from +20.00--+40.00 in first year of life
  - Average CL Rx <1 y.o. +31.00
  - 1st month: 80% of infants require Rx changes
  - -5 to -10 D change by 24 months

- Near Overcorrection
  - +3.00 D until age 2
  - +1.00 D to +1.50 D between age 2-3
  - plano with bifocals at age 2 1/2 to 3
Fitting Aphakia

- **Power**
  - Ex: (infant) +25.00 retinoscopy
  - Contact lens equivalent power=+36D
  - Over plus 3 D for near
  - Final Rx= +39 D
  - RGP available in any parameter
  - Silsoft highest Rx is +32.00

Fitting Aphakia

- **Base Curve**
  - Keratometry: 47-49 D at birth
    - 43.5 D by age 3-4
    - offsets 6 mm increase in axial length
  - Significant flattening in first 6 months
  - often stable base curve at 9 months

- **Diameter**
  - Avg corneal diameter: 10 mm at birth
  - Most HVID changes in first year of life, to 11.5 by age 3-4
  - exception, micro-ophthalmia, PHPV diameter may be 6-7 mm
  - small palpebral fissure in neonate, max CL OAD is 13.5 mm in normals

- **Silsoft options**
  - BC 7.5, 7.7, 7.9, OAD 11.5 or 12.3 mm, powers +23.00 to +32.00 in 3D steps

Aphakic VA expectations

- **Davis et al**
  - congenital unilateral aphakia: 25% 20/40 or better
  - traumatic unilateral aphakia: 47% 20/40 or better
  - congenital bilateral aphakia: 67% 20/40 or better

- **CL vs IOL correction**
• Pediatric IOLs do not lead to a significantly different visual acuity after surgery compared to lensectomy with contact lens correction
• Binocularity may be improved with pediatric IOL vs CL correction
• Not enough evidence to recommend Pediatric IOLs, contact Lenses should be continuously recommended

Myopia Control with RGPs (5-10 min)

- Myopia is the most common ocular disorder affection humans
- Epidemiology of myopia
  - US 25%
  - CHINA 55%
  - JAPAN 40%
  - SINGAPORE 70%

- Current Theory of Myopia progression
  - Retina actively regulates scleral growth by detection and signaling defocus
  - Retinal blur stimulates elongation of axial length

Myopia Control

- Problems with previous studies
  - not randomized
  - high drop out rate
  - data somewhat incomplete

- Hypothesis
  - RGP suppress myopia progression largely due to axial length control, and some corneal flattening, although corneal flattening appears to return to baseline with little change in refraction

Myopia Control:

Singapore Myopia Study


  - 2 year randomized CT in 428 Singaporean 6-12 y.o.
  - Randomized to RGP or Spectacles
  - RGP fit on K or STK
Results:

- **Myopia**
  - RGP: increase -1.33 D
  - Spectacles: increase -1.28 D

- **Axial Length**
  - RGP: increase 0.84 mm
  - Spectacles: 0.79 mm

- **Median WT 7 hours**
  - <40% wore lenses > 8 hours/day

- RGP did not slow rate of myopia progression, even among children that used them regularly

Conclusion

- “It is unlikely that this intervention holds promise as a method by which to slow the rate of progression of myopia in children.”

**Myopia Control Studies**

- **Contact Lens and Myopia Progression Study (CLAMP)**
  2004, Walline
  - 3 year randomized CT of 112 8-11 yo
  - Mean age 10.5 years
  - 60% girls
  - Entrance spherical equivalent: -2.09D
  - All subjects completed a run in period to adapt to RGPs
  - 78.4 % could adapt to RGPs
  - Control group is soft CL’s

**Update on Most Recent Studies**

- **Orthokeratolgy in children**
  - Cho 2005
  - Walline 2009
- SMART Study
- Santodomingo 2009
- Cheung, Cho 2009
- Soft Multifocal Studies

THANK YOU