

1 PEDIATRICS MADE EASY

TIPS FOR PEDIATRIC EYE EXAMS AND PRESCRIBING

2 FINANCIAL DISCLOSURES

- NONE

3 OUTLINE

- Epidemiology
- Age of Pediatrics
- History
- Visual Acuity
- Binocular Vision Testing
- Refraction
- Ocular Health
- Refractive Errors
- Prescribing

4 LEARNING OBJECTIVES

- Understand the differences in case history for the different age ranges within pediatrics
- Identify different ways to examine pediatric patients
- Know which tests to perform depending on the child's age and development
- Identify amblyogenic factors and be able to apply in a prescribing environment
- Understand the normal development of refractive errors and how it applies to binocularity and prescribing
- Explain and apply prescribing for all types of refractive errors to pediatric patients of varying ages
-
-

5 EPIDEMIOLOGY

6 WHY DO PEDIATRIC EYE EXAMS MATTER?

- 80% of classroom learning is visual
- 1/3 preschool children have a vision problem
- 1/4 school age children have a vision problem that can interfere with learning
- 60% of students identified as problem learners have an undetected vision problem
-

7 WHY DO WE CARE?

- These problems can lead to:
 - Problems in normal development
 - School performance
 - Social interactions
 - Self esteem
 -
- Long term problems:
 - Level of education
 - Employment

- Social interactions

-

-

8 CURRENT RECOMMENDATIONS: PEDIATRICS EXAMINATIONS FROM AOA

9 WHAT AGE IS PEDIATRICS?

Age

- Infants and Toddlers (newborn through 2 years)
- Preschool Children (3 years through 5 years)
- School aged children (6-11 and 12-18)

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10 PEDIATRIC CASE HISTORY

11 PEDIATRIC HISTORY

- Chief complaint
- Visual and Ocular History
- ROS
- Birth History
 - Prenatal, perinatal and postnatal history
 - Types of births
 - Apgar score
- Developmental History
- School performance

-

12 VISUAL AND OCULAR HISTORY

- Parents?
- Teachers?

Not just flashes or floaters.....

- Does the child close one eye? Both eyes?
- Close one eye when in sun?
- Head turn? Head tilt? Eye crossing or wandering?
- Be careful when asking about "lazy eye"
- History of patching?
- Squints?
- Rubs eyes?
- Eyes tear?
- Get too close to TV or electronics?
-
- Time of onset
 - Longstanding vs acute vs chronic

13 PEDIATRIC HISTORY

- Chief complaint

- Visual and Ocular History
- ROS
- Birth History
 - Prenatal, perinatal and postnatal history
 - Types of births
 - Apgar score
- Developmental History
- School performance
-

14 **BIRTH HISTORY**

- Mom's health
 - Preeclampsia ? Gestational DM? Drugs while pregnant?
- Birth Type
 - Natural birth? C-Section? Forceps delivery?
- Any complications during delivery?
 - NICU
- Apgar Score
 - Method to summarize the health of a newborn child
 - Done at 1 min, after birth, and again at 5
 - Appearance (skin color), Pulse (heart rate), Grimace (reflex irritability), Activity (muscle tone), Respiration
 - Score out of 10
 - 7 and above is typically normal
 - 4-6 fairly low
 - 3 and below are generally low
-
-

15

16 **PEDIATRIC HISTORY**

- Chief complaint
- Visual and Ocular History
- ROS
- Birth History
 - Prenatal, perinatal and postnatal history
 - Types of births
 - Apgar score
- Developmental History
- School performance
-

17 **DEVELOPMENTAL HISTORY**

- Developmental Delays?

- Crawl
 - 9-12 mos
- Walk
 - 13 -18 mos
- Talk
 - 12 mos
-
- Are they in any therapies?

-

18 **PEDIATRIC HISTORY**

- Chief complaint
- Visual and Ocular History
- ROS
- Birth History
 - Prenatal, perinatal and postnatal history
 - Types of births
 - Apgar score
- Developmental History
- School performance
-

19 **SCHOOL PERFORMANCE**

- Grade level
- Reading level
- Academic Performance
- While reading
 - Skipping lines
 - Words double
 - Re-read line
 - AVOIDS reading
-

20 **HISTORY CONTINUED**

- Medications
- Allergies
- Child's Last Physical
- FMHx
- FOHx, including Myopia (parents and siblings)
- Other questions?

21 **VISUAL ACUITY**

22 **VISUAL ACUITY**

- VEP: Visually Evoked Potential

- Measures change of electrical activity within the visual cortex in response to patterned stimuli
- Very sensitive test
 - 2 months 20/200
 - 6 months 20/20 - 40
 - Keep this in mind when you see preterm babies
-
- Resistance to occlusion
-
- Fix and Follow / Central, Steady & Maintain (no sound)
-
- Vertical Prism Test (aka 10 BU test)
-
- OKN Drum
 - Test object moves one direction
 - Observe infant's pendular eye movements
 - Slow following phase, followed by rapid recovery phase
-

23 **VISUAL ACUITY**

24 **VISUAL ACUITY**

25 **PEDIATRIC OPTOTYPES**

26 **PEDIATRIC OPTOTYPES**

27 **CROWDING**

Also known as "contour inhibition" or "contour interaction"

Crowding describes a type of spatial interference where the identification of a target is impaired by neighboring ones

- It is more pronounced in amblyopic vision
- Occurs because the receptive fields of neurons in the striate cortex of amblyopic eyes are abnormally large
- Single isolated letters will often show improved acuity

28 **VISUAL ACUITY TIPS AND TRICKS**

- Be engaging
- Be fast...but also patient
 - You only have their attention for a short period of time
- Use the arrow function!
- Be excited when they get it right (or wrong!)
- Keep consistent VA types (full line...etc) unless going from symbols to snellen when age appropriate
- In your chart, record how you took VA
 - Need to be able to compare findings
-

29 **BINOCULAR TESTING**30 **OCULAR ALIGNMENT**

-
-
- Hirschberg
 - 1mm of decentration of the corneal light reflex = 22pd misalignment
- Bruckner
 - If strabismus is present, the deviated eye will have a lighter and brighter reflex than the fixating eye.
 - Detects, but does not measure, the deviation.
 - This test also identifies opacities in the visual axis
- Krimsky
 - Quantifies the strabismus
-
-

31 **BRUCKNER (FOR RE)**

- Bruckner

32 **COVER TEST**

-
-
-
-

33 **BINOCULAR TESTING**

- NPC
 - NPC move slowly as you move closer, move slower
 - Objective responses compared to subjective responses
- Ocular Motility
 - After 2 months of age should cross midline
 - Quality of eye movements
-
-

34 **STEREOPSIS**

- Lang
 - Toddler
 - No glasses required
- Stereo Fly
- RDS

- Animals/Wirt Circles
- Worth 4 Dot

35 **RANGES: POSITIVE AND NEGATIVE FUSIONAL VERGENCE**

36 **ACCOMMODATIVE TESTING**

- Minus Lens
- Push Up
- Pull Away
- MEM
-

37 **COLOR VISION**

- Waggoners: Color Vision Made Easy
- Ishihara
- HRR

38 **CONFRONTATION FIELDS**

- Light/ Lea Wand
 - Keep child's attention
 - Behind the chair
- Finger Wiggle
- Finger Counting
-

39 **REFRACTION**

40 **REFRACTION**

- Dry Retinoscopy
 - Distance
- Wet Retinoscopy
 - Cycloplegic
 - Damp
- Loose lenses vs Lens Racks
-
- Autorefraction?
-
- Use videos to your advantage!

41 **DROPS**

- 0.5% Cyclopentolate for infants less than 12 months
- 1% Cyclopentolate concentration for older children
 - Max loss of accommodation = 30-40 minutes
- 1% Tropicamide
- 2.5% Phenylephrine
- Combination Sprays

42 **TRIAL FRAMES AND REFRACTION**43 **AMBLYOGENIC FACTORS**44 **OCULAR HEALTH**45 **SLIT LAMP**46 **TONOMETRY**

- Digital
 - Soft and Equal
- iCare
- Goldmann
- Perkins
- TonoPen
-

47 **DILATED FUNDUS EXAM**48 **CLINICAL PEARLS**

- Building rapport with child
- Early morning or after nap depending on age
- Begin with less threatening procedures
- Modification of instructions and targets
- Singing
- Showing the test on a parent/caregiver first
- Have an order of how you like to do tests so you're not fumbling during the exam
- Free space testing
- "Unable to assess" vs. "inability to obtain the information"
- Answer questions: can the child see... are the eyes aligned....are the eyes healthy
-

49 **PRESCRIBING**50 **INTRODUCTION**51 **WHY IS REFRACTION IMPORTANT?**52 **RATIONALE FOR CORRECTION OF RE IN YOUNG CHILDREN**53 **GENERAL FEATURES OF EMMETROPIZATION**

- Emmetropization takes place during postnatal development
 - It is largely complete in children by 4-5 years of age
 - Largest changes occur during first 12-18 months of life
- Refractive development on average is slightly hyperopic and age dependent
-

54 REFRACTIVE ERROR IN INFANCY

- There is a wide distribution of refractive error in infancy
 - Most infants are hyperopic (average +2.00D)
 - About 25% are myopic
 - About 50% have astigmatism
 - About 25% have anisometropia
 - By the end of the first year, there is less variability

55 REFRACTIVE ERROR IN YOUNG CHILDREN

- Most Common Vision Disorders in a Clinical Population of Children 6 months to 6 years of Age (Scheiman M, 1996)
 - Refractive error
 - Hyperopia (33%)
 - Astigmatism (22.5%)
 - Myopia (9.4%)
 - Strabismus (21.1%)
 - Amblyopia (7.9%)
 - Binocular and Accommodative Problems (6%)
 - Peripheral Retinal Abnormalities (0.5%)

56 REFRACTIVE ERROR AND ETHNICITY IN CHILDREN

- CLEERE Study Group (2003)
 - 4 ethnic groups
 - 2523 children (534 AA, 491 Asian, 463 Hispanic, 1035 White)
 - 5-17 yo
 - Cyclopleged
 - Significant differences in RE prevalence as a function of ethnicity
 - Myopia: Asians has highest prevalence (18.5%) followed by Hispanic (13.2%)
 - Astigmatism: Hispanic (36.9%) Asian (33.6%)
 - Hyperopia: White (19.3%) Hispanic (12.7%)
 - Emmetropia: African American (67%) White (49.9%)

57 AMBLYOGENIC FACTORS

58 CONSIDERATIONS ON WHETHER TO RX IN CHILDREN

- Is the amount/type of refractive error normal for the child's age?
 -
- Is the refractive error stable?
 -
- Is the refractive error amblyogenic?
 -
- Will choosing not to correct the refractive error affect development of binocularity?
 -

59 HYPEROPIA

60 **HYPEROPIA**

- Most common refractive error in infants and children
 - High amounts are associated with astigmatism

- Amblyogenic Hyperopia
 - Isometropic $\geq 5.00D$
 - Anisometropic $\geq 1.00D$

- Classification
 - Low Hyperopia $< +2.00 D$
 - Moderate Hyperopia $+2.00 D$ to $+5.00 D$
 - High Hyperopia $> +5.00 D$

61 **HYPEROPIA – NATURAL HISTORY**

- Infants with greater than $+3.50D$ are
 - 13x higher risk for developing strabismus by the age of 4
 - More likely to have reduced vision than emmetropic children

- Benefits of partial correction:
 - Partial correction may reduce the risk for developing strabismus and amblyopia in patients who have $> +3.25D$ of hyperopia
 - Does not alter emmetropization

62 **HYPEROPIA – PRESCRIBING CONSIDERATIONS**

-
- Total magnitude of hyperopia
 - Is it amblyogenic?
- Significant phoria/tropia
 - Eso
 - Exo
- Ability to accommodate
- Age
- Symptoms

63 **HYPEROPIA MANAGEMENT**

- Survey of clinical prescribing philosophies for hyperopia (Lyons SA et al)
 - Prescribing philosophies vary widely
 - A majority of practitioners would consider prescribing glasses for bilateral, asymptomatic hyperopia stable over 2 visits when
 - $> +5.00 D$ in 6 mos old
 - $> +3.00$ to $+5.00 D$ in 2 year olds
 - $> +3.00$ to $+5.00 D$ in 4 year olds
 -
- Most practitioners do NOT correct the full amount of hyperopia when glasses are prescribed in these age groups

64 **3 X 3 RULE**

Rule for prescribing in infants

- Visit 1 – high/amblyogenic Rx found
 - Do not prescribe*
- Visit 2: 3 mos later
 - Did Rx change?
- Visit 3: 3 mos later
 - Did Rx change?
 - If Rx is same, consider prescribing

*Exceptions to rule?

65 **HYPEROPIA – MANAGEMENT**

- Infants and Toddlers
 - Bilateral high hyperopia (>5.00D with no associated esotropia)
 - Monitor for stability at 2-3 month intervals
 - When stable, consider partial correction
 -
 - Bilateral Moderate Hyperopia (+2.00 D to +5.00 D with no associated esotropia)
 - If +2.00 D to +3.00 D, considered relatively normal for this age
 - If +3.00 D to +5.00 D, at risk for development of esotropia
 - Monitor 3-6 month intervals, depending on risk factors
 - When stable, consider partial correction

66 **HYPEROPIA – MANAGEMENT**

- Young children (3-5 year olds)
 - Bilateral high hyperopia (>5.00D with no associated esotropia)
 - Partial correction recommended
 - Consider binocular status when determining prescription
 -
 - Bilateral Moderate Hyperopia (+2.00 D to +5.00 D with no associated esotropia)
 - Likely to prescribe if stable and > +3.00 D
 - Consider partial correction depending on signs, symptoms, and ability to compensate for hyperopia
-

67 **ESOTROPIA**

- If esotropia is present
 - Regardless of age, prescribe to achieve ocular alignment to facilitate development of binocular vision
- Generally, full cycloplegic prescription is prescribed or cut up to 0.50D of full cycloplegic prescription
 -
 - If residual esotropia at near, may need to prescribe bifocal add

- Bifocal bisecting lower pupil margin

68 HYPEROPIA AND STRABISMUS

69 HYPEROPIA: PRESCRIBING (ROUGH GUIDELINE)

Only when alignment and accommodation are normal

- Ages 5 and younger
 - Cut ~2.00 D (rarely cut more)
- Ages 5-7
 - Cut 1.25 – 2.00D
- Ages 8-10
 - Cut 0.75 – 1.25D
- Above age 10
 - Cut 0.50 – 0.75D

Always cut from the WET RET

70 ASTIGMATISM

71 NATURAL HISTORY OF ASTIGMATISM

- Magnitude
 - Astigmatism (>1.00D) common in infants and toddlers
 - Greatest prevalence in first 6 months
 - Magnitude decreases over first 3 years of life
 - Adult levels being reached at about 3.5 years
 -
- Axis
 - ATR is more common in Caucasian infants
 - After age 5, WTR more common
 - WTR more common in Asian and American Indian infants
 -
- Not commonly present in high amounts in first 2 years of life
-

72 PREVALENCE AND TYPE OF ASTIGMATISM : BIRTH TO 2 YEARS

Mayer DL, Moore B et al 2001

73 NATURAL HISTORY OF ASTIGMATISM

- Meridional Amblyopia
 - Decreased acuity in the orientation of maximum blur caused by astigmatic refractive error
 -
 - Not commonly present in high amounts in first 2 years of life
 -
 - Amblyogenic Astigmatism
 - Isoametropic astigmatism: ≥ 2.50 D
 - Anisometropic astigmatism: ≥ 1.50 D
 -

74 **MANAGEMENT OF ASTIGMATISM**

- Full vs Partial Correction
 - Full astigmatic correction is prescribed in most cases
 - Occasionally, partial correction in infants/toddlers to promote emmetropization
- Adaptation
 - Most young children will have little difficulty adapting to full correction of astigmatism
 - In older children (>10 y.o.) with significant astigmatism that have never worn glasses, consider a partial prescription based on subjective responses before cycloplegia

75 **MANAGEMENT OF ASTIGMATISM**

- Full-time vs part-time wear
 - Generally, prescribe full time wear
 - If no amblyopia is present and acuity is acceptable without correction for certain activities, then part-time prescription is OK
 -
- Recall schedules
 - Children under 5 years of age
 - RTC in 3 mos after astigmatism is identified to show stability before prescribing
 - Exception: if a 3-5 year old has amblyopia due to uncorrected astigmatism, then prescribe at first visit
 - After prescribing, rtc in 3-6 months to monitor stability
 - Once stable, annually
 - Older children without amblyopia or other complications, can be seen annually
 -

76 **ASTIGMATISM AXIS**

- Usually symmetric
 - x180 OU
 - x165 OD, x015 OS
 - x005 OD, x175 OS
 - x080 OD, x100 OS
- Small inaccuracies in axis can have a big impact on vision
 - Autorefraction
 - Narrowing your retinoscopy beam
 - Axis scale on retinoscopy paddles
 - Lensometry of new glasses
 -

77 **ANISOMETROPIA**78 **NATURAL HISTORY OF ANISOMETROPIA**

- Normal Findings
 - >1.00 D of aniso common in infants
 - By school age, only 3-4% remain anisometric

- Very unstable in infants and toddlers
-
- Amblyogenic if:
 - Hyperopia: ≥ 1.00 D
 - Astigmatism: ≥ 1.50 D
 - Myopia: ≥ 3.00 D

79 **NATURAL HISTORY OF ANISOMETROPIA**

- Anisometropia >3.00 D at 1 year of age is likely going to persist in childhood and cause amblyopia
- 2/3 of children with strabismus and/or amblyopia have >1.00 D of anisometropia
- A majority of children with >2.00 D of anisometropia will have some level of amblyopia
-
-
-

80 **MANAGEMENT OF ANISOMETROPIA**

- What to prescribe?
 - Prescribe entire anisometropic difference in spherical refractive error
 - If esotropia, prescribe maximum amount of hyperopic correction
 - If no strabismus, can undercorrect both eyes equally
 - Always keep the anisometropia the same

81 **MYOPIA**

82 **NATURAL HISTORY OF MYOPIA**

- By teenage years, 20-25% of children are myopic
 - Average progression is ~ 0.50 D/ year
 - Stabilizes during late teens
- Juvenile onset myopia onset usually around 8 years old
- Rapid progression is more commonly found in those with:
 - Younger age of onset
 - Higher degree of myopia at onset
 -
 -

83 **NATURAL HISTORY OF MYOPIA**

- Amblyogenic Myopia
 - Isoametropic: ≥ 8.00 D
 - Anisometropic: ≥ 3.00 D
-

84 **PREVALENCE & INCIDENCE**

- Prevalence of myopia depends on age and other factors
 - Prevalence is increasing!

- Myopia prevalence is high in premature infants
- Overall, myopia prevalence is lower in the kindergarten population compared to any other age group and increase with school age and young adults
-

85 PREVALENCE AND INCIDENCE

- In some Asian countries, the prevalence is reported to be as high as 70-90%
-
- A study was done in the US to compare prevalence in myopia from 1971-72 to 1999-2004:
 - 25% of people in the US were nearsighted in the 70's
 - 30 years later, the prevalence increased to 41.6%
 - This is an increase prevalence of 66.4%
-

86 GENETICS AND MYOPIA

- Family History
 - 33-60% prevalence of myopia in children whose both parents have myopia
 - 23-40% prevalence of myopia in children who have one parent with myopia
 - 6-15% prevalence of myopia in children with neither parent having myopia
-

87

88 RISK FACTORS

- Children who are emmetropic or low hyperopes (0.50D)
-
- Children/young adults who do extensive amounts of near work on a regular basis
 - Less outdoor time/ UV light
-
- Patients with a higher education level and jobs that require greater near demands
-
- Certain binocular characteristics
 - Esophoria, low positive relative accommodation
-
- Increased retinal defocus
-

89 OUTDOOR ACTIVITY

- Human studies show significantly fewer new cases of myopia development in children who spend recess outside the classroom
 - Myopia *development* was 52% less likely in children with recess outside
 - *Progression* of myopia was 34% less in children that spent recess outside
 - Only variable significantly associated with myopia progression was the child's year in school
 - More progression when children were in higher grade levels
-

90 PRESCRIBING

- Prescribe full amount!

91 **PRESCRIBING GUIDELINES OVERVIEW**

- Proper Refractive correction:
 - Eliminating optical blur and providing an optimal environment for amblyopia therapy is essential
- Anisometropia
 - The anisometric difference between the two eyes **MUST** always be maintained in the glasses
- Astigmatism
 - The FULL amount needs to be corrected
 -
- Hyperopia
 - If/when reduced for children *without* strabismus, done symmetrically
- Hyperopia *with* Esotropia
 - Full amount of hyperopia or undercorrecting by +0.50D based on cycloplegic refraction
- Myopia
 - The full amount is corrected

92 **PRESCRIBING EXAMPLE 1**

- 4 yo white female presents for first eye exam
- VAsc: OD 20/50, OS: 20/60 with snellen full line
- CTsc: ortho @ D, 4EP'
- Stereo: 100" wirt circles, RDS 500"
- Dry Ret:
 - OD: +4.50-1.00x160
 - OS: +5.00 sph
 -
- Wet Ret:
 - OD: +6.50-0.75x170
 - OS: +7.50-0.50x10
- Prescribe?

93 **PRESCRIBING EXAMPLE 2**

- 6 yo hispanic male presents for annual exam but has a history of refractive amblyopia
- VAsc: OD 20/25, OS: 20/20 with snellen full line
- CTsc: ortho @ D, 8 XP'
- Stereo: 30" wirt circles, RDS 250"
- Current Rx:
 - OD: +3.25-3.75 x180
 - OS: +4.50-4.25x180

-
- Wet Ret:
 - OD: +4.00-4.00x180
 - OS: +5.00-4.00x10
- Prescribe?

94 PRESCRIBING EXAMPLE 3

- 5 yo caucasian male presents for failed school screening
- VAsc: OD 20/25, OS: 20/40 with snellen full line
- CTsc: ortho @ D and N
- Stereo: 70" wirt circles, RDS 250"
- Dry Retinoscopy:
 - OD: +0.50-0.75 x180
 - OS: +2.00-1.25x180
-
- Wet Ret:
 - OD: +1.00-0.75x180
 - OS: +2.75-1.25x180
- Prescribe?

95 PRESCRIBING EXAMPLE 4

- 9 yo Asian female presents for annual exam but has a history of myopia. First time to your office.
- VAcc: OD 20/30-2, OS: 20/30 with snellen full line
- CTcc: ortho @ D, 6 XP'
- Stereo: 30" wirt circles, RDS 250"
- Current Rx:
 - OD: -2.00-0.75 x165
 - OS: -2.50-0.25x15
-
- Wet Ret:
 - OD: -3.00-0.75x165
 - OS: -3.25-0.25x15
- Prescribe?

96 PRESCRIBING EXAMPLE 5

- 6 yo AA male presents for annual exam and has a h/o IXT OD, hyperopia OU
- VAsc: OD 20/25+2, OS: 20/20 with snellen full line
- CTsc: 12pd RIXT @ D, 20pd RIXT' control score 1
- Stereo: 30" wirt circles, RDS 250"
- Current Rx:

- OD: +2.25-1.00 x180
- OS: +3.00-1.25x180
-
- Wet Ret:
 - OD: +4.25-1.00x180
 - OS: +5.00-1.25x180

- Prescribe?

97 **PRESCRIBING EXAMPLE 6**

- 4 yo Asian female presents for first time exam
- VAsc: OD 20/25, OS: 20/30 with LEA full line
- CTsc: ortho @ D, and N
- Stereo: 50" wirt circles, RDS 250"
- Dry Rx:
 - OD: +1.00-0.75 x180
 - OS: +1.25-0.75x180
 -
- Wet Ret:
 - OD: +1.75-0.75x180
 - OS: +2.00-0.75x180

- Prescribe?

98 **QUESTIONS?**

THANK YOU!!!