Quick Note on CI

Rouse: Clinically significant CI (high suspect and definite categories) was identified in 17.6% of the children.[1]

On the Role of Hyperopia in Reading/Learning:

1) "The literature analysis of refractive error and reading performance includes only those studies that adhere to the rudiments of scientific investigation."
   - Hyperopia and anisometropia appear to be related to poor reading progress and their correction seems to result in improved performance.
   - Reduced distance visual acuity and myopia are not generally associated with reading difficulties.
   - Implications for school vision screening are discussed.[2]

2) Vision screening (attempt to) addresses the visual impairments that impact on child development.
   - Tests of long-sightedness are not found in most school screening programs.
   - METHODS: A total of 1298 children, aged 8 years, were screened for hyperopia on the basis of fogging test results. School test results (NFER and SATs) were compared between groups categorized by referral status and refractive error.
   - RESULTS: A total of 166 (12.8%) fogging test failures were referred for ophthalmic assessment. Ophthalmic tests on 105 children provided an accurate diagnosis of vision defects, for reference to their education scores.
   - Fifty per cent of the children examined by optometrists required an intervention (prescription change, glasses prescribed, or referral) – but criteria and interventions not specified.
   - Mean (95% CI) NFER (National Foundation for Educational Research) scores of children with refractive errors (summed for both eyes) >+3D or >+1.25D (best eye) were lower than the respective scores of children with a less positive refractive state, the non-referred group, and total sample.
   - The SATs results followed a similar trend.
   - A high proportion of the fogging test failures (16%) and confirmed hyperopes (29%) had been referred to an educational psychologist, and the latter group contributed substantially to the poor education scores.
   - CONCLUSIONS: The results of this study provide further evidence for a link between hyperopia and impaired literacy standards in children.[3]

3) Hyperopia is the most common refractive error of (Caucasian) children. Children with mild (or even moderate) levels of hyperopia usually do not experience visual problems resulting from this hyperopia. (?)
   - Children with moderate-to-high degrees of hyperopia are at significantly increased risk for the development of amblyopia and strabismus: <u>hyperopia in children is an important public health problem</u>.
   - Even lesser degrees of hyperopia may affect the child's ability to perform well in near-related tasks, such as reading.
     - Dependent on a variety of factors including the magnitude of hyperopia, the age of the individual, the status of the accommodative and convergence system, and the demands placed on the visual system.
   - Early detection and treatment of hyperopia may help prevention of potential complications from adversely impacting the child's vision. (And other behaviour.)
   - Although much is known about childhood hyperopia and its effects on vision, there is also much that is not known.[4]

4) Hyperopia of 1.00, 1.50, and 2.00 D was induced in 42 subjects by means of concave lenses. A significant decrease in performance on a standard intelligence test occurred with the highest-power lenses. Symptoms induced indicate that the results are applicable to hyperopia.[5]

See also: [6,7] and

http://www.aoa.org/documents/CPG-16.pdf

http://journals.lww.com/optvissci/Citation/2004/04000/The_Still_Neglected_Hyperope.1.aspx

On Astigmatism and Reading

1) PURPOSE: To examine the effect of uncorrected astigmatism in older adults.
   - METHODS: Healthy adult presbyopes had astigmatism of 0.00 to -4.00 diopters cylinder (DC) x 90 degrees and -3.00 DC x 90, x 180, and x 45 degrees induced with spectacle lenses, with the mean spherical equivalent compensated to plano, in random order.
   - Distance VA was assessed binocularly using a computerized test chart at 95%, 50%, and 10% contrast. Near acuity and reading speed were measured using standardized reading texts.
   - RESULTS:
     - Distance visual acuity decreased with increasing uncorrected astigmatic power and at lower contrasts.
     - Near visual acuity and reading speed also decreased with increasing uncorrected astigmatism power ($P < .001$).
     - Uncorrected astigmatism at the 45-degree or 180-degree orientation resulted in worse distance and near visual acuity and subjective-rated clarity than at the 90-degree orientation ($P < .05$).
   - CONCLUSIONS: Uncorrected astigmatism, even as low as 1.00 D, caused significantly decreased vision and if left uncorrected could significantly affect patients' independence, quality of life, and well-being.[8]

2) INTRODUCTION: Computer vision syndrome (CVS) is a complex of eye and vision problems related to computer use that has been reported in up to 90% of computer users. Ocular symptoms may include asthenopia, accommodative and vergence difficulties and dry eye. Previous studies have reported that uncorrected astigmatism may have a significant impact on symptoms of CVS. However, its effect on task performance is unclear.
   - METHODS: Recorded symptoms after a 10 min period of reading from a computer monitor either through the habitual distance refractive correction or with a supplementary -1.00 or -2.00D oblique cylinder added over these lenses in 12 young, visually-normal subjects.
   - Additionally, the distance correction condition was repeated to assess the repeatability of the symptom questionnaire.
   - Subjects' reading speed and accuracy were monitored during the course of the 10 min trial.
   - CONCLUSIONS: The presence of induced astigmatism produced a significant increase in post-task symptoms but did not affect reading rate or the number of reading errors. The correction of small astigmatic refractive errors may be important in optimizing patient comfort during computer operation.[9]
3) Kobashi et al: Eyes with OBL astigmatism had significantly lower visual performance than eyes with WTR or ATR astigmatism. Correcting the preexisting astigmatism to acquire excellent visual outcomes may be necessary, especially in eyes with OBL astigmatism.[10]

On Emmetropization

1) Does partial spectacle correction of infants' refractive errors, which has been shown to have beneficial effects in reducing strabismus and amblyopia, impede emmetropization? - longitudinal controlled trial in human subjects.

- METHODS: Children identified as having significant hyperopia in a population screening program at age 8 to 9 months were assigned to treated (partial spectacle correction) or untreated groups. + control group with no significant refractive errors. Retinoscopic refraction under cycloplegia taken at 4- to 6-month intervals up to the age of 36 months, and changes in refraction of 148 subjects were analyzed longitudinally.
- RESULTS:
    - Refractive error decreased toward low hyperopic values between 9 and 36 months in both hyperopic groups.
    - By 36 months, this reduction of hyperopia showed no overall difference between children who were treated with partial spectacle correction and those who were not.
    - Despite the improvement, both hyperopic groups' mean refractive error at 36 months remained higher than that of the control group.
    - When infants in all three groups were considered together, the rate of reduction of refractive error was, on average, a linear function of the initial level of hyperopia.
    - CONCLUSIONS: The benefits of spectacle correction for infants with hyperopia can be achieved without impairing the normal developmental regulation of refraction. [11]

On Intervention

1) Purpose: To provide an optometric perspective on the management of hyperopia in children without strabismus or amblyopia.
    - Variations in prescribing patterns for childhood hyperopia occur within optometry and within ophthalmology.
    - There are also differences in prescribing philosophies between the two professions.
    - These differences are probably due to a greater level of concern, more so among optometrists, about associated vision functions such as accommodation, vergence, and stereopsis, as well as concerns about the potential impact of uncorrected hyperopia on reading and school performance.
    - CONCLUSIONS: If indications for prescribing spectacles for children with hyperopia are to be validated, randomized controlled trials need to be performed.[12]

2) Rosner:
    - Most ODs would correct over-Rx'd myopia (-0.50 corrected to -1.50), many fewer would correct +1.00 hyperopia. This is a matter of philosophy, not clinical evidence.[6]
3) Grosvenor: Are visual anomalies related to reading ability? Review of Lit.
    - Myopia is consistently associated with good reading performance.
    - Hypermetropia, astigmatism, lateral phorias, poor fusional vergences, strabismus and color vision anomalies tend to be associated with poorer than average reading performance.
    - Well-designed and well-controlled studies are needed, particularly concerning the effect on reading ability of the correction of visual anomalies. Until such studies have been done, <u>any child who has a reading problem deserves a thorough optometric or ophthalmologic examination and the correction of any visual anomalies found</u>.[13]

<u>Choose to correct for prevention of amblyopia/ET, or for function/comfort AND ambly/ET.</u>

4. From PEDIG Study: 'GLASSES VERSUS OBSERVATION FOR MODERATE HYPEROPIA IN YOUNG CHILDREN' (http://clinicaltrials.gov/ct2/show/NCT01515475)

Target Completion Date: February 2018.

Study Objectives (NB)

To compare visual acuity outcomes and development of strabismus after a 3-year follow-up period in children age 12 to <60 months with moderate hyperopia (*spherical equivalent* +3.00D to +6.00D) who are prescribed glasses either immediately or only after confirmation of pre-specified deterioration criteria.

The prevalence of hyperopia population-based studies in 6- to 72-month-old children. In white children the prevalence of hyperopia was

1) 31.5% with ≥+2.00D
2) 13.2% with ≥+3.00D
3) 5.2% with ≥+4.00D
4) 2.4% with ≥+5.00D.

5) Hyperopia prevalence was lower for African-American children (relative prevalence white to African-American = 1.62).
6) The prevalence of hyperopia ≥+2.00D (in the better eye) was slightly higher in Hispanic children (19.6%) than in African American children (15.2%).
7) Moderate and high hyperopia are associated with the development of strabismus and amblyopia.
8) Atkinson et al. found that children with greater than **+3.50D** in any meridian at 6 to 8 months of age were 13 times more likely to develop strabismus by 4 years of age and 6 times more likely to have amblyopia, compared to infants with low hyperopia or emmetropia.
9) Similarly, a study by Ingram et al found that the presence of **+2.50D** or more of hyperopia at 1 year of age was significantly associated with the development of strabismus and/or amblyopia by 3.5 years of age.

The American Academy of Ophthalmology consensus guidelines state that hyperopia of ≥+6.00 D in 0- to 1-year olds; ≥ +5.00 D in 1-to 2-year olds; and ≥ +4.50 D in 2- to 3-year olds is amblyogenic. *A threshold of greater than +3.50 D in any meridian has been suggested as a referral criterion for vision screening.*

Nevertheless, the question of whether to prescribe glasses for hyperopia remains controversial. (Not really…)

Rationale for the Study

- The primary aims of treatment for asymptomatic moderate and high hyperopia in preschool children are to facilitate the development of normal visual acuity and to prevent the development of esotropia and amblyopia.
- For children with high hyperopia (>+5.00D) and without strabismus or amblyopia, there is general consensus that a correction (usually partial plus) should be prescribed.
- For children with moderate hyperopia (+3.00D to +5.00D) without strabismus or amblyopia, there is less consensus among pediatric eye care professionals.
  - For a 2-year-old child with hyperopia greater than +3.00D, 65% of optometrists would prescribe glasses compared to 25% of ophthalmologists.
  - For a 4-year old with hyperopia greater than +3.00D, 67% of optometrists would prescribe compared with 42% of ophthalmologists.
  - The American Association for Pediatric Ophthalmology and Strabismus (AAPOS) recommends correcting +4.00D or more in 2 to 7 year olds and the American Academy of Ophthalmology recommends a threshold of +4.50D for correction in 2-to 3-year olds.
  - Unlike ophthalmology, optometry does not provide specific recommendations based on age and level of refractive error (untrue).
  - Such variation in practice highlights the lack of rigorously collected scientific evidence for the management of this condition. (Not necessarily as OD's tend to take a functional approach.)

- Most ophthalmologists and optometrists usually prescribe less than the full cycloplegic refraction (71% in the Lyons survey) when no strabismus or amblyopia is present.

- The rationale for proactively correcting moderate hyperopia in an asymptomatic child is the prevention of esotropia, amblyopia, or asthenopia.
- The argument against correcting moderate hyperopia in an asymptomatic child is the expense and inconvenience of glasses that might be unnecessary and the potential disruption of emmetropization in infants and toddlers.
- At present, it remains uncertain whether correction of moderate hyperopia is beneficial in terms of visual acuity outcomes or strabismus development. There is some evidence that using partial correction of hyperopia allows emmetropization to take place.[11]

If refractive correction of moderate hyperopia does not reduce the incidence of amblyopia and/or esotropia compared to no refractive correction, then glasses can be avoided. However, if correcting moderate hyperopia does reduce the development of amblyopia and/or esotropia, then the benefits of preemptive refractive correction will have been identified.

It's not best to wait until there is a problem, especially over +2.00D. Study does not take into account functional issues and completely medicalizes visual function. If the child is struggling in school, OD's can usually help.

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