



Should Glasses Be Prescribed for All Children with Moderate Hyperopia?

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Research has shown that the preschool years are a vital time for children to acquire the language skills necessary to succeed in school. In 1965, as part of the “war on poverty” in the United States, the Head Start program was started to help preschool children from low-income families improve their readiness for school. However, by the time a child starts the Head Start program, it may be too late for these children to catch up with children from higher income families. In a landmark study, Hart and Risley¹ studied 42 children from diverse socioeconomic and racial backgrounds beginning when they were 7 to 9 months of age until they were 3 years old to better understand how children develop language skills. A trained observer visited the home of each of these children on a monthly basis, carefully recording all communication between a parent and a child. They found a marked difference in the quantity of words spoken to a child that correlated closely with the socioeconomic status (SES) of a family. A child from a high SES family heard on average 30 million words from age 1 to 3 years compared with only 20 million words for a child raised in a medium SES family and 10 million words for a child raised in a low SES family. In addition, the quality of the communication differed markedly by SES. Parents in high SES families used more affirmations and fewer prohibitions, gave their child more choices, and were more responsive to their child’s speech. As might be expected, a child raised in a high SES family had more language skills at age 3 years as evidenced by better vocabularies and at age 9 to 10 years had higher scores on standardized tests of reading comprehension.

Vision also plays an important role in children learning how to read. In the Vision in Preschoolers—Hyperopia in Preschoolers (VIP-HIP) study (see page 681), the VIP-HIP study group² hypothesized that children with 3 to 6 diopters (D) of uncorrected hyperopia would have greater difficulty with near activities, such as reading, that would impair their readiness for school. To test this hypothesis, they administered the Test of Preschool Early Literacy (TOPEL) to a group of preschool or kindergarten children with 1 D or less of hyperopia and compared them with a group of age-matched children with 3 to 6 D of uncorrected hyperopia. The TOPEL is a standardized test widely used to determine the eligibility of children for remedial educational programs.³ It evaluates oral vocabulary (definitional vocabulary), the ability to drop and add specific sounds from words (phonological awareness), and knowledge of specific letters and the sounds associated with these letters (print

knowledge). The average TOPEL score for 3- to 5-year-old children is 90 to 110.⁴ A score <90 predicts that children likely will have difficulty learning to read and write. The mean score in the VIP-HIP study was significantly lower for children with 3 to 6 D of uncorrected hyperopia compared with children with a refractive error near emmetropia (84 vs. 89). The low mean scores in this cohort of children likely reflect the fact that approximately 90% of the children were enrolled in the Head Start program. Although the VIP-HIP study group reported that children with ≥ 4 D of uncorrected hyperopia had significantly lower TOPEL scores, when they performed a multivariate analysis the best predictors of a low TOPEL score were ≥ 3 D of hyperopia coupled with reduced stereopsis (≤ 240 arc/seconds) or reduced binocular near visual acuity ($\leq 20/40$). Because the VIP-HIP study almost exclusively enrolled children participating in the Head Start program, the low TOPEL score for the children in both the control and experimental groups likely reflects their reduced exposure to language during early childhood. In the VIP-HIP study, print knowledge was reduced

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more than definitional vocabulary and phonological awareness in the hyperopia group, consistent with their hypothesis that children with uncorrected moderate hyperopia have more difficulty learning to read printed material. No data are provided by the VIP-HIP study

group regarding the percentage of children in their study who had visual acuity $\leq 20/40$ or stereopsis ≤ 240 arc/seconds. However, in an earlier report from the VIP-HIP study, it was reported that 3.7% of 4- to 5-year-old children had bilateral amblyopia that they defined as best-corrected visual acuity $< 20/40$.⁵

It is generally agreed that children with high hyperopia and children with moderate hyperopia and a manifest esotropia or reduced visual acuity should be prescribed at least a partial correction of their hyperopic refractive error. Without optical correction, children with high hyperopia have been shown to develop subnormal stereopsis even in the absence of esotropia.⁶ If left untreated, children with moderate hyperopia and a manifest esotropia are at risk of developing amblyopia, subnormal stereopsis, and nonaccommodative esotropia.⁷ Optical correction also is indicated for children with moderate hyperopia and anisometropia or ≥ 1 D of astigmatism because of their increased risk of developing amblyopia.⁴ However, there is no consensus regarding the management of children with moderate hyperopia without a manifest esotropia or reduced visual acuity. The most current American Academy of Ophthalmology Preferred Practice Patterns[®]

(see: <http://www.aaojournal.org/content/preferred-practice-pattern>) recommend that children aged 2 to 3 years with isoametropia and +4.50 D or more of hyperopia receive a refractive correction regardless of whether they have a manifest esotropia.⁸ However, they add the caveat that this recommendation was generated by consensus rather than an analysis of published data. Furthermore, no recommendations were made for the refractive correction of children aged 4 years or more with moderate hyperopia without a manifest esotropia or reduced visual acuity. The American Optometric Association does not provide any guidelines for correcting refractive errors in hyperopic children.⁹ Lyons et al¹⁰ surveyed optometrists and pediatric ophthalmologists regarding their prescribing patterns for asymptomatic children with hyperopia. They reported that 67% of optometrists and 42% of pediatric ophthalmologists indicated that they would prescribe glasses for a 4-year-old child with >3 D of hyperopia.

Two randomized clinical trials conducted in the 1980s evaluated the effectiveness of prescribing spectacles for asymptomatic hyperopic children. Ingram et al¹¹ randomized infants with ≥ 2 D of hyperopia in both eyes or ≥ 1 D of anisometropia to wear a partial refractive correction versus no correction. Atkinson et al¹² randomized infants with ≥ 3.5 D of hyperopia in any meridian to a partial spectacle correction or no treatment. They both reported a reduced incidence of accommodative esotropia and amblyopia in children randomized to spectacle wear. However, a recent Cochrane Review judged these clinical trials to have many flaws, including a high risk of bias based on the methods used for randomization, no masking of the outcome assessment, and a high loss to follow-up.¹³ There was also a high rate of noncompliance among children randomized to spectacle wear.

The Pediatric Eye Disease Investigator Group initiated the Hyperopia Treatment Study 1 in 2012 to determine whether children aged 1 to 6 years with 3 to 6 D of uncorrected hyperopia who were orthotropic and had normal visual acuity would benefit from a partial correction of their hyperopic refractive error. Unfortunately, enrollment for the randomized clinical trial was terminated early because of slow recruitment.

There are several factors to consider when deciding whether to prescribe glasses for a child with moderate hyperopia without esotropia or reduced visual acuity. First, there are financial and psychosocial costs associated with spectacle wear in children. In many cases, the financial costs, both direct and indirect, are shouldered by parents struggling to pay for basic necessities. Direct costs include the cost of ocular examinations, glasses, and second opinions when children refuse to wear glasses.¹⁴ Indirect costs include time missed from work going to doctor appointments, spent looking for glasses that children hide to avoid wearing them or at optical dispensaries having glasses repaired. Furthermore, the psychosocial costs associated with spectacle wear should be considered because many children are self-conscious about wearing glasses. If spectacle wear is beneficial for a child, these costs can be justified. However, if spectacle wear is not beneficial, the costs may be unacceptably high. Second, correcting the

refractive error of children with moderate hyperopia may interfere with emmetropization, possibly consigning them to a lifetime of hyperopia.^{15,16}

Birch et al¹⁷ have identified several risk factors for the development of accommodative esotropia in hyperopic children, including reduced stereoacuity, anisometropia, and a family history of accommodative esotropia. However, even with a positive family history of accommodative esotropia, they reported that only 22% of hyperopic children developed accommodative esotropia. Dobson and Sebris¹⁸ followed a cohort of children with moderate and high hyperopia without esotropia from infancy to age 3 years. Although 30% of the children with high hyperopia developed accommodative esotropia, none of the children with moderate hyperopia developed accommodative esotropia. They also noted that approximately 90% of the patients with moderate hyperopia and 50% of the patients with high hyperopia were nearly emmetropic at age 3 years. Therefore, it is likely that many children would be prescribed glasses unnecessarily if all children with moderate hyperopia were prescribed their full or a partial hyperopic correction during early childhood.

Hyperopia is the most common refractive error in childhood. In the Multi-Ethnic Pediatric Eye Study, the prevalence of ≥ 3 D of hyperopia in non-Hispanic whites was 13% for 3-year-olds, 7% for 4-year-olds, and 11% for 5-year-olds.¹⁹ Even in Asian preschool children, the prevalence of ≥ 3 D of hyperopia was higher (5%–6%) than the prevalence of myopia. In the VIP-HIP study, 8% of the children had 3 to <4 D of hyperopia, 3% of the children had 4 to <5 D, and 5% of the children had >5 D.²⁰ Because approximately 4 million children are born each year in the United States and assuming that 10% of them are moderate or high hyperopes when 3 to 5 years of age, it would cost \$1.8 billion to buy each of these children 1 pair of glasses (\$150/spectacles) each year.

Although spectacles should be prescribed for children with moderate hyperopia when associated with accommodative esotropia or reduced visual acuity, at this time there is insufficient evidence to recommend that all children with moderate hyperopia be prescribed spectacles. Although the VIP-HIP study suggests that children in preschool or kindergarten with moderate hyperopia and reduced binocular near visual acuity or stereopsis have worse language skills, there is no convincing evidence that prescribing glasses improves their academic performance. Furthermore, the preponderance of children in the study population from low-income families limits the generalizability of their results.

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