REVIEW ARTICLE

Spectacles in Children- Do's and Don'ts

Reena Sharma, Vaibhav Jain, Meenu Babber, Anupama Tandon

Department of Ophthalmology, U.P. Rural Institute of Medical Sciences and Research, Saifai, Etawah, Uttar Pradesh, India

ABSTRACT

Purpose: To assess the best method to prescribe spectacles in children. **Source of Data:** References have been collected from a MEDLINE search from 1975 to 2014. Older articles deemed not to be very contributory and those with foreign languages without any translation were omitted. The search was done using the words – spectacles, children, glasses, and prescription. **Study Selection:** To help and decide a proper prescription of glasses in children. **Data Extraction:** Internet for indexed PubMed articles. **Conclusions:** Children have visual needs that differ from adults, and therefore, the prescription of glasses has to be given with utmost care. They are interested in their near world and the eyes are going through a process of emmetropization. A cycloplegic refraction cannot be avoided. Many guidelines have been given based on the experience of pediatric ophthalmologists/optometrists. The basic principles, however, remain the same and should be adhered to the treatment of myopia, hypermetropia, astigmatism, and anisometropia. It is equally important to look at the spectacle frame and lenses to ensure that the prescription is used by the child.

Keywords: Astigmatism, children, hypermetropia, myopia, prescription, spectacles

INTRODUCTION

Children are not "scaled-down versions of adults." Their visual needs are different, and the eye is going through the process of constant change in the form of emmetropization. So, the prescription of glasses in children is not as straightforward as in adults. The difference between uncorrected and corrected visual acuity which helps us to decide on the prescription of glasses in adults, cannot be used in children.

Another often neglected and yet important part of spectacle prescription is dispensing correct spectacle frame and lenses to ensure adequate wear of glasses by the child. Most practice patterns for prescribing spectacle to young children are based on experience, rather than evidence. They are obtained by surveys of practitioners, and are based upon experience acquired over many years.[1]

Address for correspondence
Dr. Reena Sharma, Department of Ophthalmology,
House No - 199, Civil Lines, Etawah, Uttar Pradesh, India.
E-mail: drreenasharma98@gmail.com

Access this article online

Quick Response Code

Website: www.nigerianjournalofophthalmology.com

DOI: 10.4103/0189-9171.170958

Unlike adults, there is a huge variability of visual acuity assessment even in a child who has started speaking. So, it is difficult to use visual acuity as a criterion for prescribing glasses. Moreover, the measured acuity often underestimates the true acuity, because the child quickly get tired and may not show interest in reading small letters on an eye chart. Therefore, it is very important to do a cycloplegic refraction to determine the amount of refractive error.[2]

EMMETROPIZATION

The cornea and the lens, along with the axial length, form the primary refractive components of the eye. The process by which a normal eye has coordinated growth of its refractive components during early childhood to reach refraction near plano is called emmetropization.[3] The average cycloplegic refractive error is approximately + 2.00 D with a standard deviation of approximately 2.00 D. The keratometry at birth is ~ 52 D, compared to 42–44 D in adulthood.

How to cite this article: Sharma R, Jain V, Babber M, Tandon A. Spectacles in children- Do's and don'ts. Niger J Ophthalmol 2015;23:31-4.

Axial length is ~ 17 mm at birth, enlarging to 20 mm by the end of the 1st year,[4] with continued rapid growth till 2 years, and then a slow increase to 24 mm by adulthood. As the cornea flattens, the lens also thins and flattens. This would create severe hyperopia if it were not for the simultaneous axial elongation that occurs. Therefore, it is the failure of emmetropization that causes development of refractive errors in a child.

The rate of emmetropization is generally proportional to the amount of initial refractive error. Higher the initial myopia or hypermetropia, faster is the rate at which it moves toward normal. However, the probability of emmetropization decreases with increase in the amount of refractive error and chances of residual refractive error increases.[5]

The rate of emmetropization differs between the two eyes, which results in a period of transient anisometropia which disappears with growth of the child.[6] However, a large anisometropia (3.00 D or more) is more likely to be permanent.[7] The process of emmetropization is essentially over by 4–6 years of age.[8]

WHEN TO PRESCRIBE GLASSES

Many guidelines have been given to guide the amount of spectacle prescription at each age. The American Academy of Ophthalmology has published guidelines based on consensus of opinion among an expert panel.[2] Similarly, Miller and Harvey suggested recommendations based on consensus among members of the American Association for Paediatric Ophthalmology and Strabismus (AAPOS).[9] The American Optometric Association also provides guidelines for correction of hyperopia and myopia based on consensus among expert optometrists.[10,11] Many guidelines have also been suggested by individual authors.[12-17]

The basic concepts for prescription of glasses remain the same. However, the upper limit for the prescription is variable, more so for hypermetropia. Many authors suggest monitoring the refractive error (hyperopia, myopia, or astigmatism) in infants and toddlers before prescribing glasses.[15-17] If the refractive errors are associated with amblyopia, they have to be prescribed.[17-19] However, if we find demonstrable amblyopia or heterotropia or nystagmus, we should give spectacles to the child.[17]

The prescription should be undercorrected in the preschool years because of active process of emmetropization. Emmetropization remains active up to 4–5 years for astigmatism and possibly up to 6 years for spherical ametropia,[20] and even until 9–10 years for some moderate hyperopes.[8,21]

The majority of the infants with myopia can just be monitored as emmetropization is active, the visual world of babies is close, and they do not need clear distance vision. Only very high refractive error has to be corrected.

For correction of hypermetropia in preschool kids, Susan J Leat has suggested that one should underprescribe so as to leave the uncorrected error just above the mean refractive error for the age, leaving enough stimulus for emmetropization.[8]

Guidelines for myopia

In infancy, only large amount of myopia needs to be corrected, as his world is confined to seeing near objects. As the child grows and begins to walk, he starts noticing farther objects, and hence his visual demands increase. So, the spectacle prescription should be based upon anticipated visual acuity needs of the child.

More than 5 D of myopia in infancy has to be corrected. Correct >2 D of myopia in children between 1 and 4 years of age. From 4 years to early school years, −1.00 D or even lower amount if it improves VA and the child appreciates it, should be corrected.[8] However, one should undercorrect by about 1 D to aid the process of emmetropization.[21]

Older school going children (>6-year-old), when acuity can be tested accurately, warrant full correction of myopia. Here, the prescription should be according to the visual acuity of the child. Myopic children who are found to have near esophoria and larger lag of accommodation (>0.43 D) or shorter habitual reading distances may be given a + 2.00 D addition progressive lens.[22,23]

Guidelines for hypermetropia

Uncorrected hypermetropia can produce accommodative esotropia, strabismic amblyopia, and isoametropic (refractive) amblyopia. The threshold for the treatment of hypermetropia, however, is controversial.

Many studies show that <1% of healthy children have >4 D of hypermetropia.[24] Atkinson *et al*. found that children with hypermetropia > 3.50 D had a 13 times greater risk of developing strabismus or amblyopia. These studies, therefore, suggest that hypermetropia > 4 D is definitely pathological and should be treated in all children of any age group.[25]

Susan J Leat has stated that >3.5 D of hypermetropia in children below 4 years, >2.50 D in 4–6 years, and >1.5 D in asymptomatic school goers (>6 years) should be prescribed.[8,26,27] Lesser than 1.5 D may be prescribed in school going children if they have associated symptoms (asthenopia, difficulty with focusing, and headaches), reduced uncorrected vision, esophoria or esotropia, and difficulty with close work.[13,16,28]

A partial prescription should be given to kids below 6 years of age to aid emmetropization. The undercorrection can be done based on Atkinson's protocol, which is based on the refraction in plus cylinder format. We should prescribe 1.00 D spherical correction less than the least hyperopic meridian and half of the astigmatism (if > 2.50 D).[21,29]

An exception to the above guidelines for prescribing for hypermetropia is in children with developmental delay or Down syndrome. Children with significant cortical visual impairment and developmental delay may not appreciate the improvement provided by the spectacles and will not tolerate them. On the other hand, children with Down syndrome are often hypoaccommodators, and have low accommodative amplitudes. Therefore, they may benefit from even lesser amounts of spectacle correction.

Guidelines for astigmatism

Symmetric astigmatism <1.5 D typically may not be corrected, unless it is associated with high myopia or high hyperopia. The AAPOS vision screening committee has set a threshold of 1.5 D of meridional cylinder as a target condition to detect with preschool vision screening.[30] The American academy guidelines suggest correcting >2.5 D of astigmatism in kids below 3 years of age. Give partial correction up to 3–4 years by which time emmetropization is largely completed, that is, decrease cylinder by 1.00 D or give 50%.[15,21]

Oblique astigmatism (compared to the other types) is a definite risk factor for amblyopia.[19] Therefore, even as less as 1 D needs to be corrected above 1-year of age.

In 3 to 4-year-old child, 1.50 D or more of astigmatism is associated with poorer recognition acuity, such that for every dioptre increase in cylinder, there was a half-line decrease in VA.[31] In older children (4 to <6 years) with 1.00 D or more of astigmatism, visual acuity is impaired.[32] In school going kids (above 6 years), >0.75 D cylinder should be prescribed in the absence of symptoms, and even lesser amounts if symptomatic.

Guidelines for anisometropia

If anisometropia is associated with amblyopia, it always has to be treated fully. Above 1-year of age, ≥3.00 D of anisometropia has always to be treated, because this is unlikely to be transient and is highly and likely to cause amblyopia.[33] The guidelines for prescribing lower amounts of anisometropia are very variable. If the child has <3.00 D of anisometropia after 1-year of age, we can monitor the child first over the next 4–6 months. If it persists, we should prescribe glasses.[6,33] For more than 1.00 D of spherical hyperopic anisometropia, >2.00 D of spherical myopic anisometropia or >1.50 D of cylindrical anisometropia after 3.5 years of age, they are likely to cause amblyopia at this age.[6,34,35]

SPECTACLES CHARACTERISTICS

It is equally important that a child should be given proper spectacle frame and lenses. Children with photophobia (albinism, aniridia, colobomata, corneal scarring, and treated retinopathy of prematurity) are prescribed glasses with dark tints (80 − 90% tint/10 − 20% transmission) for outdoors, and lesser tints for indoors (20 − 30% tint/70 − 80% transmission). Monocular patients should be given polycarbonate lenses to protect against inadvertent eye trauma.

The spectacle frame should be of a proper size and should follow basic requirements. The eye wire should cover both the eyes completely all around permitting the patient to view from the spectacle in various ocular positions. It should not come in contact of periocular skin. The nose pads should sit symmetrically on either side of the nose bridge and should neither be too tight or loose to prevent repeated slippage or skin marks. The temples should be parallel and should put mild and symmetric pressure on the forehead without causing serious imprinting on the skin. It should not project more than 2 mm out beyond the mastoid bone.

The spectacle frame should follow the "four point touch test." All four points on the spectacle frame (two points from each side of eye wire and one each from temple) should touch the flat surface simultaneously [Figure 1].

Figure 1: An ideal spectacle frame following the "four point touch test"

The spectacle lenses should be of correct power (within ≤ 0.25 D) and correct axis of astigmatism (error ≤ 5°). The optical center of the spectacle lens should be within 2 mm of visual axis. The surface of the lens should have no fractures/pitting/scratches, as they will affect the quality of vision thereby affecting the compliance of child wearing glasses.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Donahue SP. Prescribing spectacles in children: A pediatric ophthalmologist's approach. Optom Vis Sci 2007;84:110-4.
2. American Academy of Ophthalmology Pediatric Ophthalmology/Strabismus Panel. Preferred Practice Pattern Guidelines. Amblyopia. San Francisco, CA: American Academy of Ophthalmology; 2007. Available from: http://www.aao.org/ppp. [Last accessed on 2010 Aug 27].
3. Drack A. Refractive errors in children. In: Albert and Jakobiec's Principles and Practice of Ophthalmology. 3rd ed. W.B. Saunders: Elsevier; 2000. p. 4145-58.
4. Gordon RA, Donzis PB. Refractive development of the human eye. Arch Ophthalmol 1985;103:785-9.
5. Mutti DO, Mitchell GL, Jones LA, Friedman NE, Frane SL, Lin WK, *et al.* Accommodation, acuity, and their relationship to emmetropization in infants. Optom Vis Sci 2009;86:666-76.
6. Abrahamsson M, Fabian G, Sjöstrand J. A longitudinal study of a population based sample of astigmatic children. II. The changeability of anisometropia. Acta Ophthalmol (Copenh) 1990;68:435-40.
7. Abrahamsson M, Sjöstrand J. Natural history of infantile anisometropia. Br J Ophthalmol 1996;80:860-3.
8. Leat SJ. To prescribe or not to prescribe? Guidelines for spectacle prescribing in infants and children. Clin Exp Optom 2011;94:514-27.
9. Miller JM, Harvey EM. Spectacle prescribing recommendations of AAPOS members. J Pediatr Ophthalmol Strabismus 1998;35:51-2.
10. American Optometric Association. American Optometric Association: Care of the Patient with Hyperopia. Available from: http://www.aoa.org/documents/CPG-16.pdf. [Last accessed on 2010 Jul 14].
11. American Optometric Association. Optometric Clinical Practice Guideline; Care of the Patient with Myopia. Available from: http://www.aoa.org/documents/CPG-16.pdf. [Last accessed on 2010 Oct 09].
12. Blum HL, Peters HB, Bettman JW. Vision Screening for Elementary Schools: The Orinda Study. Berkeley, CA: University of California Press; 1968.
13. Leat SJ, Shute RH, Westall CA. Assessing Children's Vision: A Handbook. Oxford: Butterworth-Heinemann; 1999.
14. Leat SJ. Pediatric assessment. In: Rosenfield M, Logan N, Edwards K, editors. Optometry: Science, Techniques and Clinical Management. Edinburgh: Butterworth-Heinemann/Elsevier; 2009. p. 439-60.
15. Bobier WR. Evidence-based spectacle prescribing for infants and children. J Mod Opt 2007;54:1367-77.
16. Marsh-Tootle W. Infants, toddlers and children. In: Benjamin WJ, editor. Borish's Clinical Refraction. Philadelphia: WB Saunders; 1998. p. 1060-118.
17. Ciner EB. Management of refractive error in infants, toddlers and preschool children. Probl Optom 1990;2:394-419.
18. Abrahamsson M, Fabian G, Andersson AK, Sjöstrand J. A longitudinal study of a population based sample of astigmatic children. I. Refraction and amblyopia. Acta Ophthalmol (Copenh) 1990;68:428-34.
19. Gwiazda J, Thorn F, Bauer J, Held R. Emmetropization and the progression of manifest refraction in children followed from infancy to puberty. Clin Vis Sci 1993;8:337-44.
20. Jones LA, Mitchell GL, Mutti DO, Hayes JR, Moeschberger ML, Zadnik K. Comparison of ocular component growth curves among refractive error groups in children. Invest Ophthalmol Vis Sci 2005;46:2317-27.
21. Atkinson J, Braddick O, Nardini M, Anker S. Infant hyperopia: Detection, distribution, changes and correlates-outcomes from the Cambridge infant screening programs. Optom Vis Sci 2007;84:84-96.
22. Gwiazda J, Hyman L, Hussein M, Everett D, Norton TT, Kurtz D, *et al.* A randomized clinical trial of progressive addition lenses versus single vision lenses on the progression of myopia in children. Invest Ophthalmol Vis Sci 2003;44:1492-500.
23. Gwiazda JE, Hyman L, Norton TT, Hussein ME, Marsh-Tootle W, Manny R, *et al.* Accommodation and related risk factors associated with myopia progression and their interaction with treatment in COMET children. Invest Ophthalmol Vis Sci 2004;45:2143-51.
24. Robaei D, Rose K, Ojaimi E, Kifley A, Huynh S, Mitchell P. Visual acuity and the causes of visual loss in a population-based sample of 6-year-old Australian children. Ophthalmology 2005;112:1275-82.
25. Atkinson J, Braddick O, Robier B, Anker S, Ehrlich D, King J, *et al.* Two infant vision screening programmes: Prediction and prevention of strabismus and amblyopia from photo- and videorefractive screening. Eye (Lond) 1996;10:189-98.
26. Mutti DO. To emmetropize or not to emmetropize? The question for hyperopic development. Optom Vis Sci 2007;84:97-102.
27. French AN, Rose KA, Burlutsky G, Mitchell P. Does correction of hyperopia affect the pattern of children's activities, and does this differ from that of emmetropic children? Invest Ophthalmol Vis Sci 2009;50:3961 [E-Abstract].
28. Cotter SA. Management of childhood hyperopia: A pediatric optometrist's perspective. Optom Vis Sci 2007;84:103-9.
29. Ingram RM, Walker C, Wilson JM, Arnold PE, Dally S. Prediction of amblyopia and squint by means of refraction at age 1 year. Br J Ophthalmol 1986;70:12-5.
30. Donahue SP, Arnold RW, Ruben JB, AAPOS Vision Screening Committee. Preschool vision screening: What should we be detecting and how should we report it? Uniform guidelines for reporting results of preschool vision screening studies. J AAPOS 2003;7:314-6.
31. Dobson V, Miller JM, Harvey EM, Mohan KM. Amblyopia in astigmatic preschool children. Vision Res 2003;43:1081-90.
32. Harvey EM, Dobson V, Miller JM, Clifford-Donaldson CE. Changes in visual function following optical treatment of astigmatism-related amblyopia. Vision Res 2008;48:773-87.
33. Ingram RM, Traynar MJ, Walker C, Wilson JM. Screening for refractive errors at age 1 year: A pilot study. Br J Ophthalmol 1979;63:243-50.
34. Weakley DR Jr. The association between nonstrabismic anisometropia, amblyopia, and subnormal binocularity. Ophthalmology 2001;108:163-71.
35. Dobson V, Miller JM, Clifford-Donaldson CE, Harvey EM. Associations between anisometropia, amblyopia, and reduced stereoacuity in a school-aged population with a high prevalence of astigmatism. Invest Ophthalmol Vis Sci 2008;49:4427-36.