

Correlation of isoametropic amblyopia and hyperopia

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Abstract

• **AIM:** To evaluate the relationship of isoametropic amblyopia with the prevalence of hyperopia in young children with hyperopia and orthotropia.

• **METHODS:** Fifty-six children with a mean age of 5.5 years and bilateral symmetric hyperopia were selected and assigned to the following two groups, children with bilateral hyperopia $\leq +4.0D$ spherical equivalent (Sph. Eq.) and those with bilateral hyperopia $> +4.0D$ Sph. Eq.. Prevalence of isoametropic amblyopia was estimated and compared between the two groups.

• **RESULTS:** Among the 32 children with bilateral hyperopia of $\leq +4.0D$ Sph. Eq., 4 children (13%) had isoametropic amblyopia, while among the 24 children with bilateral hyperopia of $> +4.0D$ Sph. Eq., 15 children (63%) had isoametropic amblyopia. Statistical analysis revealed a significant difference for prevalence of amblyopia between the two groups of isoametropic children ($P < 0.05$).

• **CONCLUSION:** Isoametropic amblyopia is not rare among children with bilateral hyperopia, especially when hyperopia is more than $+4.0D$ Sph. Eq. On the bases of this investigation, children with bilateral hyperopia $> +4.0D$ have a risk of 13%-63% developing isoametropic amblyopia. Thus, indicating that children with hyperopia of $> +4.0D$ have an increased risk of isoametropic amblyopia.

• **KEYWORDS:** isoametropic amblyopia; ametropic amblyopia; bilateral hyperopia; amblyopia

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INTRODUCTION

Amblyopia is an unilateral or bilateral reduction of best-corrected visual acuity (BCVA) that can not be directly attributed to the effect of any structural abnormality of the visual system^[1]. Amblyopia is due to abnormal visual system development during the first decade of life, resulting from

strabismus, anisometropia or isoametropia and visual deprivation^[1]. With an overall prevalence of 2% to 4%, amblyopia is the most frequent cause of visual impairment in children and young adults^[2].

Isoametropia may cause mild to moderate amblyopia in both eyes^[1]. Isoametropic or ametropic amblyopia is usually a mild to moderate bilateral reduction of BCVA because of large, approximately equal, uncorrected refractive errors in both eyes, since childhood^[1]. Its mechanism is presumed to be pattern vision deprivation; which is failure of either eye to achieve a clear foveal image results in abnormal cortical development^[3]. According to a study on the cortical thickness of children with ametropic amblyopia by brain magnetic resonance imaging (MRI), the cortical thickness of the lingual and pericalcarine areas in the left hemisphere and of the cuneus, lateraloccipital and lingual areas in the right hemisphere in the amblyopic group were significantly thinner than those in the control group^[4].

Hyperopia of more than 4.0-6.0D and myopia of more than 6.0-10.0D have a risk of inducing bilateral amblyopia^[1,2]. Uncorrected bilateral astigmatism of more than 2.0D cylinder may cause meridional amblyopia^[1]. Isoametropic amblyopia is more common in high bilateral hyperopia than bilateral myopia, because myopic children are able to achieve clear near vision with at least one eye^[3]. Children without optical correction for severe astigmatic refractive error in childhood sometimes show persistent impairment of corrected vision that is confined to the more ametropic meridian, which is known as meridional amblyopia. It can be unilateral or bilateral^[2,3]. The degree of bilateral hyperopia which may carry a risk of ametropic (bilateral) amblyopia is usually $+4.0D$ or more, but bilateral amblyopia is less likely to develop in high hyperopic patients when accommodative esotropia is present. In such cases, the accommodation that causes excessive convergence, has the beneficial effect of bringing the fixating eye's retinal image into sharp focus, whereas non-esotropic, highly hyperopic patients may not accommodate sufficiently to have a clear vision with either eye^[2]. Usually in such cases bilateral mild to moderate amblyopia develops. The eyes of a child with anisometropic amblyopia look normal to families and primary care physicians, thus causing a delay in detection and treatment^[1]. Children with mild to moderate myopia or mild myopic anisometropia ($< -3.0D$) usually do not develop amblyopia^[1]. Modest degrees (i.e. $+1$ to $+3$) of unilateral excess hyperopia may cause mild to moderate amblyopia, especially when there is significant hyperopia in the less

ametropic eye^[2]. Mild degrees of hyperopic or astigmatic anisometropia (1.0-2.0D) may induce mild amblyopia^[1], but unilateral high myopia typically causes a severe form of amblyopia^[3].

According to previous studies, rates of isoametropic amblyopia in children with more than +4.0D hyperopia in both eyes is less than 20%, but may increase with higher degrees of hyperopia^[5,6]. This study was performed to estimate the prevalence of isoametropic amblyopia among Iranian children with bilateral symmetric hyperopia and orthotropia. Significance of doing this study is to estimate the rate of isoametropic amblyopia among children with high bilateral hyperopia, which indicates that close follow-up of these children in early childhood is necessary to prevent amblyopia.

MATERIALS AND METHODS

In this descriptive study, 56 children with bilateral hyperopia, orthotropia and a mean age of 5.5 years were selected. All children were isoametropic, with hyperopia ≤ 4.0 D spherical equivalent hyperopia, ≤ 1.5 D anisometropia and ≤ 1.5 D cylinder in either of the eyes were assigned to one group and the rest of hyperopic children with > 4.0 D spherical equivalent hyperopia, ≤ 1.5 D anisometropia and ≤ 1.5 D cylinder in either of the eyes were assigned to another group. Isoametropia was defined as bilateral refractive error (hyperopia), when the difference between the two eyes was ≤ 1.5 D and cylinder was less than 1.5D in either of the eyes. Isoametropic amblyopia was defined as BCVA ≤ 0.8 and variance < 2 chart lines in both eyes. All patients underwent complete eye examinations including cycloplegic refraction (achieved with atropine), funduscopy and diagnostic tests to rule out any type of strabismus.

RESULTS

Among the 32 children (18 boys and 14 girls) with ≤ 4.0 D spherical equivalent hyperopia in the first group, 4 children (13%) had isoametropic amblyopia, and mean spherical equivalent hyperopia among these children was +3.5D. The other children in this group either had no amblyopia (8 cases, 25%) or some degrees of unilateral amblyopia (20 cases, 63%). In the second group, among 24 children (13 boys and 11 girls) with > 4.0 D spherical equivalent hyperopia, 15 children (63%) had moderate (BCVA 4/10 to 7/10) isoametropic amblyopia and the mean spherical equivalent hyperopia among these amblyopic children was +6.25D. The other children had unilateral amblyopia (3 cases, 13%) or bilateral amblyopia with large difference in vision between the two eyes (6 cases, 25%). There was no significant relationship between the mean age and gender among the two groups with amblyopia. Statistical analysis using the Chi-square test indicated $\chi^2 = 13.15$ and $P < 0.0003$ and using the Fisher's exact test indicated $P < 0.0001$. Thus, a significant difference for the prevalence of amblyopia was observed between the two groups of isoametropic children ($P < 0.05$).

DISCUSSION

Although anisometropic amblyopia is one of the most common causes of amblyopia in children, isoametropic amblyopia is

relatively common in children with high bilateral refractive errors. In our study prevalence of isoametropic amblyopia among children with bilateral symmetric hyperopia was relatively common, and may increase significantly, when the amounts of hyperopia exceeds 4.0D. Results of current study indicates that in children with bilateral hyperopia less than +4.0D, unilateral amblyopia is more common (63%).

Ziylan *et al* in a study of 160 Turkish children with high hyperopia with a spherical equivalent of at least 5.0D, anisometropia less than 1.5D and cylinder less than 1.5D in either of the eyes, reported that 31 (19.37%) had isoametropic amblyopia^[5]. Based on the study conducted by Klimek *et al*, in America, among the 418 children with $\geq +4.5$ D spherical equivalent hyperopia, who did not have ≥ 1.5 D anisometropia, 36 cases (8.61%) had isoametropic amblyopia^[6]. In a US study conducted by Fem K. D., 87% of children with ≥ 5.0 D isoametropic hyperopia showed aided acuity poorer than 6/6 at the initial correction of the refractive error. However, if the full hyperopic correction was worn for 1 year or longer, only 43% of these patients demonstrated acuity poorer than 6/6, and none showed acuity poorer than 6/12^[7,8].

Statistically, rate of isoametropic amblyopia among children with bilateral symmetric hyperopia of $< +4.0$ D is low, but it is common in children with hyperopia of $> +4.0$ D. Results of current study shows that there was a significant difference ($P < 0.0003$) between prevalence of amblyopia and hyperopia among children with ≤ 4.0 D and children with > 4.0 D bilateral symmetric hyperopia.

In our study, the prevalence of isoametropic amblyopia was estimated to be approximately 13% among children with less than +4.0D bilateral hyperopia and 63% in children with $> +4.0$ D bilateral hyperopia, which are higher than those reported in other studies. This may be due to genetic or other unknown factors, although in some studies amblyopia has been considered to be a condition with BCVA of less than 20/40 or 20/50^[5,6], whereas in our study, amblyopia was defined as visual acuity of less than 20/25 in each eye. Hence if we consider amblyopia as visual acuity of 20/40 or less, the rate of isoametropic amblyopia among children with hyperopia $\leq +4.0$ D will be 3% and among the children with hyperopia more than +4.0D will be 13%. These findings are similar to other studies. The number of patients in our study may be insufficient. Therefore, future investigations with a larger sample size of all isoametropia types (hyperopia, myopia and astigmatism) and influencing factors in children from all societies are necessary.

CONCLUSION

Findings of the present study as well as previous studies suggest that isoametropic amblyopia may be relatively common among children with high bilateral hyperopia, and periodic examinations of children, correction of ametropia and timely follow-up, can prevent bilateral low vision in these children.

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REFERENCES

- 1 Liesegang TJ. " Basic and clinical science course" San Francisco: American Academy of Ophthalmology; Section 6: Paediatric Oph. and Strabismus 2007-2008;67-71
- 2 Greenwald MJ, Parks MM. Amblyopia. In: Tasman W, Jaeger, EA, editors, Duane's ophthalmology volume 1 Ocular Motility and Strabismus Lippincott Williams & Wilkins 2008;101-119 {4.4 参考文献リストに必要な情報が欠落しています}
- 3 Wallace DK. Amblyopia. In: Wilson ME, Saunders RA, Trivedi RH, editors. Pediatric Ophthalmology Heidelberg;Springer-Verlag Berlin 2009;34-45
- 4 Du H, Xie B, Yu Q, Wang J. Occipital lobe's cortical thinning in ametropic amblyopia. *Magn Reson Imaging* 2009;27(5):637-640
- 5 Ziyilan S, Yabas O, Zorlutuna N, Serin D. Isoametropic amblyopia in highly hyperopic children. *Acta Ophthalmol Scand* 2007;85(1):111-113
- 6 Klimek DL, Cruz OA, Scott WE, Davitt BV. Isoametropic amblyopia due to high hyperopia in children. *JAAPOS* 2004;8(4):310-313
- 7 Fern KD. Visual acuity outcome in isometropic hyperopia. *Optom Vis Sci* 1989;66(10):649-658
- 8 Friendly D, Jaafar M, Morillo D. A comparative study of grating and recognition visual acuity testing in children with anisometropic amblyopia without strabismus. *Am J Ophthalmol* 1990;110(3):293-299

双眼屈光不正性弱视和远视的相关性研究

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摘要

目的:探讨在远视、眼正位儿童中双眼屈光不正性弱视与远视患病率的关系。

方法:选取 56 例两眼对称远视儿童,平均年龄 5.5 岁,分为两组,双眼远视 $\leq +4.0D$ 等效球镜组和双眼远视 $> +4.0D$ 等效球镜组。评估两组双眼屈光不正性弱视的患病率,并进行比较。

结果:在 32 例双眼远视 $\leq +4.0D$ 等效球镜组中,4 例 (13%) 患双眼屈光不正性弱视;24 例双眼远视 $> +4.0D$ 等效球镜组中,15 例 (63%) 患双眼屈光不正性弱视。统计学分析显示 两组双眼屈光不正的儿童中弱视患病率有显著性差异 ($P < 0.01$)。

结论:双眼屈光不正性弱视在双眼远视的儿童中并不罕见,尤其是当远视度数大于 $+4.0D$ 等效球镜时。基于本次调查,双眼远视 $> +4.0D$ 的儿童有 13% ~ 63% 发展成两眼屈光不正性弱视。由此说明远视 $> +4.0D$ 的儿童患两眼屈光不正性弱视的几率较大。

关键词:双眼屈光不正性弱视;屈光不正性弱视;双眼远视;弱视

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