

PAIRED POLARIZING FILTERS

AN ALTERNATIVE METHOD FOR TREATING AMBLYOPIA

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Abstract

The purpose of this study was to evaluate the efficacy of amblyopia therapy utilizing a pair of rotating polarized filters to attenuate the light reaching the non amblyopic eye, and thus reduce its acuity, while still enabling binocular vision. Six amblyopic children between the ages 1 and 6 years were enrolled in the study. They were fitted with glasses that included a pair of polarizing filters in the normal eye and a tinted appropriate optical correction for the amblyopic eye. Three children completed one year's use of the device and they are discussed in this report. In all three cases visual acuity improvement was obtained in the amblyopic eye. In one patient full stereopsis was obtained on the Titmus Stereotest. This pilot study indicates that paired polarizing filters may be used as a mode of treatment in amblyopia.

Key Words

amblyopia, polarized lenses, stereopsis, suppression of vision

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There have been numerous studies published on various methods and success rates in treating amblyopia.¹⁻⁴ The classic management involves occlusion of the normal eye for varying time periods. Two major problems with this approach are the possible deterioration of the visual acuity in the normal eye (especially in non strabismic patients) and the further disturbance to binocular vision in patients who are already strabismic.⁵ An additional drawback is the refusal of the child to allow patching of the normal eye because of the resultant poor vision, social pressures and/or the physical discomfort.⁶ In the present study we examined the possibility of utilizing an optical device to diminish the amount of light (and hence the visual acuity) entering the non-amblyopic eye while minimally disrupting binocular vision. We hypothesized that this would enhance both the outcome and the compliance. The device is less physically disturbing and more socially acceptable than the standard patching techniques.⁷

Patients and Methods

The six patients, aged 1-6, who were evaluated for the program all received the polarizing filter glasses. However, three of them actually used the device for more than one month. All the children were at high risk for developing or maintaining amblyopia. The children enrolled in the trial were strabismics who had refused to cooperate with the standard occlusion or children who had a good potential for binocular vision and, therefore, standard oc-

clusion was a questionable option. The Goldschleger Eye Institute's Committee for Protection of Human Research Subjects approved the study. The goal and mechanism of the glasses were explained to the parents and informed consent was obtained. Each subject underwent an evaluation of the following areas: visual acuity with and without correction, anterior and posterior segments, cycloplegic refraction, subjective refraction, ocular alignment at distance and near and ocular motility. Sensory binocularity was evaluated utilizing the Titmus Stereotest^a and the Worth 4 Dot Flashlight Test.^b Pre-verbal patients were tested for visual acuity using the Teller Acuity Card System.^c

In all cases the rotating polarizing filters were placed before the better eye in order to reduce its visual acuity. This allowed for photic stimulation in the "occluded" eye at a level of visual acuity that was less than that of the amblyopic eye. In order to achieve this, two polarizing filters^b (HN#38,.03 inch thickness) were cut to fit into a round metal frame. The two filters were placed in apposition so that it was possible to rotate them. The amount of light entering the eye varied as a function of the angle between the two filters: the larger the angular difference between the filters, the smaller the amount of light entering the eye. At 90° rotation between the two filter layers, virtually no light enters the eye. For this study, the reduction in light was set in order to reduce the visual acuity in the normal eye to two lines less than that of the amblyopic eye. The

lens placed in front of the nonamblyopic eye was manufactured with a 10% gray tint in order to improve the cosmetic appearance (and acceptability) of the glasses.

CASE REPORTS

Case #1

A 9-year-old girl received a perforating injury of the right eye at age 7. She underwent suturing of the wound and within one week had developed a traumatic cataract. Subsequently, an extracapsular cataract extraction (ECCE), posterior vitrectomy, endolaser, and 360° band were all performed. At the close of these procedures her corrected visual acuities were, OD:20/200 and OS: 20/20. The cycloplegic refraction was OD: +11.00-2.00x90 and OS: -0.75 DS. At a test distance of 6 meters she had a constant right exotropia of 25 prism diopters (PD) and at 33cm a constant right exotropia of 14PD. She complained of diplopia and did not report stereopsis on the Titmus Sterotest. Testing with the Worth 4 Dot Flashlight demonstrated alternate suppressions.

We prescribed standard occlusion of her left eye for the entire day except two waking hours for a period of six months. This resulted in an improvement in the visual acuity of the right eye to 20/25 with a contact lens correction and visual acuity in the fellow eye was 20/25. There was 15PD of exotropia at distance and an exotropia of 10PD at near. While these tropias were basically confined to the OD, there was some evidence of alternation. This was confirmed by the Worth 4 Dot test. However, she could still not perceive any stereopsis on the Titmus test.

At this point, in order to facilitate binocular vision, the treatment regimen was changed to polarized patching for a period of one year. She wore the polarized filters, as described above, all day except for two waking hours. At the end of this treatment period her results on the Titmus test were 8/9 on the Wirt Circles, she was orthophoric at near and had 8PD of esophoria at distance. The visual acuity remained at 20/25.

Case #2

This subject was a 4-year-old female who was born with a congenital cataract in her right micro-ophthalmic eye. At age four months she underwent ECCE, anterior vitrectomy and posterior

capsulotomy. At 9 months a cycloplegic refraction showed OD:+20.00 DS, OS: +1.00 DS. Visual acuity of the OD, using the Teller Cards at the age of 9 months, was 20/400 with the indicated contact lens correction. The expected monocular visual acuity range for this age is 20/80-20/300.⁸ She was orthophoric at 33 cm as measured by the Hirschberg test. The media was clear and the fundus was intact.

By the age of 4 years she had developed a constant right esotropia of 25PD accompanied by a right hypertropic component of 25PD on both distance and near cover testing. She showed right eye suppression at all distances with the Worth 4 dot test. At this point she underwent a medial rectus recession of 5mm combined with a superior rectus recession of 5mm. Due to non-compliance with occlusion and the large difference in the visual acuity between the two eyes (OD: 20/200, OS: 20/20), polarized spectacle occlusion was inaugurated and continued for the period of one year. At the end of this time visual acuity in the affected eye had improved to 20/100 with correction. The cycloplegic refraction was +15.00-1.00x180 in that eye. The corneal reflection as tested by the Hirschberg test was central (orthophoria) but suppression of the right eye was found on the Worth 4 dot test.

Case #3

This case was a 5-year-old boy with strabismic amblyopia of the right eye. The visual acuity was 20/40 in the OD and 20/20 in the OS with a cycloplegic refraction of Plano in both eyes. At a distance of 6m he had a constant mostly right esotropia of 8PD, and at 33cm, a constant, mostly right esotropia of 10PD. The ocular examination was otherwise normal.

We prescribed standard occlusion of his left eye on an increasing time basis. However, as the daily time of occlusion was increased, the amount of esotropia also increased along with complaints of diplopia when the patch was removed. The esotropia had increased to 2PD at 33cm and 6m. Further testing indicated a lack of central and peripheral stereopsis along with suppression of the right eye at all distances.

The polarized occlusion regimen was then instituted on an eight-hours-per-day basis for a period of one year. At the con-

clusion of this time period his visual acuity was 20/20 in each eye. The angle of deviation was 14PD of intermittent esotropia at 33cm and 6m. At near, stereopsis was measured as 60 seconds of arc using the Titmus test and 70 seconds of arc using the Randot test.

Results

Three of the six children originally enrolled in this pilot study actually completed one year's use of the device. This entailed a strict program of follow-up visits and reduction of light intensity utilizing polarizing filters. The other three subjects did not use the device for the mandated one year or did not return for the follow-up visits. All those who completed the study had improvement either in their visual acuity, binocular vision (stereoacuity) or both. In no case did this regimen appear to result in findings that would have been less than expected of a similar trial with standard occlusion techniques (passive patching).

Comments

Although patching the "good eye" is probably the most prevalent form of amblyopia therapy today, we believe that this form of treatment has numerous shortcomings. Among these are disruption of binocular vision (especially important because a large number of amblyopes are also strabismic) and non-compliance. Other forms of treatment such as drug penalization using atropine may overcome the non compliance problem but entail the disadvantage of having a long lasting effect introducing the danger of deviation and amblyopia in the normal eye.^{9,10} In addition, atropine penalization is only effective in very deep amblyopia since otherwise the child will still use his normal eye for fixation. One of the main advantages of the polarizing method is that it allows binocular vision in non-strabismic cases as opposed to standard occlusion therapy.⁷ In studies performed on cats it was found that alternate patching results in cortical cells which react to stimuli from either the right or left eye but a complete absence of binocular cortical cells.¹¹ Using light attenuation with polarizing filters in the future may prove to be most advantageous since it allows a degree of binocular vision (especially peripheral fusion), is completely and immediately reversible (as opposed to drug penalization),

penalization), and has a better cosmetic appearance than standard occlusion therapy.

We are aware that this study includes a very small sample and additional, and that larger samples are required to explore and validate this treatment method. It may be also somewhat more costly than other currently available methods. However, it is possible that if this method had been used as our primary treatment approach, the results would have been more impressive.

None of the authors have a proprietary interest in any of the devices used in this study.

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Date accepted for publication:

September 21, 2001