

Patching Therapy in Patients with Strabismic Amblyopia and Refractive Amblyopia

(Terapi Pengatupan pada Pesakit dengan Ambliopia Strabismik dan Ambliopia Refraktif)

SHARANJEET-KAUR*, WAHEEDA AZWA, NORLIZA MOHD. FADZIL & AZRIN E. ARIFFIN

ABSTRACT

This study was conducted to compare the treatment outcome using patching in patients with strabismic amblyopia and refractive amblyopia. The treatment outcome was measured by visual acuity and refractive error. A total of 28 patients participated in this study. One group comprised of strabismic amblyopes who had either congenital esotropia or intermittent exotropia and spherical equivalent refractive error of less than -3.00 DS. Another group of patients were purely refractive amblyopes. Patients were first corrected with the best correction for a month. When the VA in the amblyopic eye did not improve over the month, then patching treatment was started. Patching was done daily for 2 h together with near activity. The treatment was carried out for 4 months, with the patients reviewed once every month. The results of the study revealed that VA improved by 17 alphabets or 3 lines after patching treatment for patients with strabismic amblyopia. In the refractive amblyopia group, the VA only improved by 8 alphabets or 1 line 3 alphabets. The mean spherical equivalent refractive error changed by less than -0.50DS and therefore was clinically not significant in both groups. This present study showed that patching treatment was better at improving the VA of patients with strabismic amblyopia.

Keywords: Refractive amblyopia; refractive error; strabismic amblyopia; visual acuity

ABSTRAK

Kajian ini dijalankan untuk membandingkan keputusan rawatan menggunakan cara pengatupan pada pesakit dengan ambliopia strabismik dan ambliopia refraktif. Keputusan rawatan diukur dengan akuiti visual dan ralat refraksi. Seramai 28 pesakit mengambil bahagian dalam kajian ini. Satu kumpulan terdiri daripada pesakit yang mempunyai ambliopia jenis strabismik dengan strabismus sama ada jenis esotropia kongenital atau eksotropia sekali-sekala dan ralat refraksi sfera setara kurang daripada -3.00 DS. Kumpulan yang lagi satu pula terdiri daripada pesakit yang mempunyai ambliopia jenis refraktif sahaja. Pesakit pada mulanya diberi pembetulan ralat refraksi terbaik selama sebulan. Sekiranya VA pada mata ambliopia tidak meningkat, barulah rawatan pengatupan dimulakan. Pengatupan dilakukan setiap hari untuk 2 jam semasa melakukan aktiviti dekat. Rawatan ini dilakukan selama 4 bulan. Pesakit diperiksa semula sekali setiap bulan. Keputusan kajian ini menunjukkan VA meningkat sebanyak 17 huruf atau 3 barisan selepas rawatan pengatupan bagi pesakit dengan ambliopia strabismik. Untuk kumpulan pesakit dengan ambliopia refraktif, VA hanya meningkat sebanyak 8 huruf atau 1 baris 3 huruf. Ralat refraksi sfera setara berubah sebanyak kurang daripada -0.50 DS pada kedua kumpulan. Oleh itu, ia tidak signifikan secara klinikal pada kedua kumpulan pesakit. Kajian ini menunjukkan rawatan pengatupan lebih berkesan dalam meningkatkan VA pesakit dengan ambliopia strabismik berbanding pesakit dengan ambliopia refraktif.

Kata kunci: Akuiti visual; ambliopia refraktif; ambliopia strabismik; ralat refraksi

INTRODUCTION

Amblyopia is a developmental abnormality that results from anatomical and physiological alterations in the visual cortex and impairment of form vision. It is a consequence of abnormal binocular visual experience during the sensitive period early in life. Amblyopia is clinically important because, aside from refractive error, it is the most frequent cause of vision loss in infants and young children; and it is of basic interest because it reflects the neural impairment which can occur when normal visual development is disrupted. Although its prevalence varies

by visual acuity level, amblyopia affects at least 1% of all people irrespective of country or ethnic origin (Attebo et al. 1998; Thompson et al. 1991). It is estimated to affect 1% to 4% of children (Simons 2005). Another study has reported that the prevalence of amblyopia is between 1.6 and 3.6% (William et al. 2001).

The damage produced by amblyopia is generally expressed in the clinical setting as a loss of visual acuity in an apparently healthy eye. Even with appropriate optical correction, there is a range of neural, perceptual, and clinical abnormalities seen (Kiorpes 2006; Levi 2006).

Currently amblyopia is diagnosed by exclusion: in patients with conditions such as strabismus and anisometropia, a diagnosis of amblyopia is made through exclusion of uncorrected refractive error and underlying ocular pathology.

The natural history of amblyopia is relatively unknown. Strabismic amblyopia can occur in the deviated eye of a strabismic patient and is due to eccentric fixation and long term suppression of that eye. On the other hand, refractive amblyopia is due to a refractive factor, for example anisometropia, astigmatism and ametropia. Several different treatment modalities exist but opinions vary on the appropriate treatment regimens for amblyopia. Some reports indicate that visual acuity deteriorates further without treatment (Hasse & Wenzel 1997; Simons & Preslan 1999). If treated early, its effects are completely or nearly completely reversible for many patients (Arikan et al. 2005). Amblyopia can be treated by several methods such as prescribing the best refractive correction, occlusion (by using conventional patching or using opaque contact lenses), penalisation together with vision therapy and other methods. However, conventional patching of the fellow good eye is the most common type of amblyopia treatment administered. Patching is aimed at improving the visual acuity to the most optimum in the amblyopic eye, equalise visual acuity in both eyes and maintain central fixation (Rowe 1997).

In all previous studies on amblyopia treatment, patients were assigned treatment randomly and no distinction was made whether patient had strabismic or refractive amblyopia (Collins et al. 2004; Pediatric Eye Diseases Investigator Group 2002, 2006; Repka et al. 2003). Psychophysical studies on small numbers of amblyopes have reached diverse conclusions about whether anisometropic and strabismic amblyopes have different patterns of visual loss (Birch & Swanson 2000; Bradley & Freeman 1985b; Hess & Holliday 1992; Holmes et al. 2005; Levi & Klein 1985; McKee et al. 2003). This could probably be due to different causal factors of the amblyopia. Different causal factors may need different types of treatment.

The objective of this study was to compare the treatment outcome of patching in patients with strabismic amblyopia and refractive amblyopia. The treatment outcome considered was visual acuity and refractive error before and after treatment.

MATERIALS AND METHODS

This study was conducted at the Ophthalmology Clinic Hospital Raja Perempuan Zainab II, Kota Bharu, Kelantan from January 2007 to May 2007. The patients were referred from many health clinics and district hospitals in the state of Kelantan. The patients were first screened by an ophthalmologist at the Ophthalmology Clinic during which systemic and ocular history was taken. This was followed by the examination of the anterior and posterior segment of

the eye in order to rule out any pathology. Patient consent form was then given to the patient or parent/guardian of the patient before any vision assessment was done. Approval from the Research Committee of the Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia was obtained, which also looked into the ethical aspects of the study. The study was conducted according to the tenets of Declaration of Helsinki.

A sample size calculation was done and it was found that 15 patients in each group were required. Due to difficulty in finding patients who met the inclusion criteria and due to time constraint, in total only 28 patients were recruited who had either strabismic amblyopia or refractive amblyopia. The patients with strabismic amblyopia had either congenital esotropia or intermittent exotropia with some refractive component. The patients with refractive amblyopia had either anisometropia, ametropia or astigmatism. Patient inclusion criteria were: age between 3 and 8 years, unilateral amblyopia of either strabismic type with spherical equivalent less than -3.00D or refractive type with best habitual visual acuity of between 6/12 and 6/60 in the amblyopic eye and 6/9 or better in the fellow good eye, and no previous amblyopia therapy or eye surgery. Patients were only selected if the parents agreed to give full cooperation in administering the therapy prescribed.

On recruitment, patients underwent cycloplegic refraction and the vision was corrected to the best with spectacles. Patients wore the prescription for 1 month prior to the commencement of the patching treatment. Treatment was only started if the vision did not improve after 1 month of wearing the prescription. Patients were required to come for eye examination at the clinic every once a month, although in the analysis only the outcomes of the first and last visit are reported, compared and discussed. The patient was required to undergo occlusion treatment of the good eye for 2 hours each day whilst doing some stimulating activity like reading, writing, drawing and colouring. The treatment was carried out for 4 months (Repka et al. 2003). Parents were given written instructions as to the method of treatment to be administered for their child and a recording sheet of number of occlusion treatments done.

RESULTS

Twenty eight patients were involved in this study of which the mean age was 5.1 ± 2.1 years. In the strabismic amblyopia group, 7 patients had congenital esotropia (mean age 5.30 ± 1.4 years) and 4 patients had intermittent exotropia (mean age 6.0 ± 1.2 years). In the refractive amblyopia group, 8 patients had astigmatism (mean age 7.0 ± 0.7 years), 5 patients had ametropia (mean age 5.6 ± 1.5 years) and 4 patients had anisometropia (mean age 6.4 ± 1.6 years). Mean visual acuity in the amblyopic and fellow good eye before and after occlusion therapy for the 2 groups of patients are shown in Table 1. The results of the study are discussed descriptively and no statistical analysis is done as the sample size is small.

TABLE 1. Mean visual acuity in the amblyopic and fellow good eye before and after occlusion therapy for the strabismic and refractive amblyopes

Groups	VA Amblyopic eye (log MAR)			VA fellow good eye (log MAR)		
	Before treatment	After treatment	Change in VA	Before treatment	After treatment	Change in VA
Strabismic Amblyopia (n = 11)	0.68 ± 0.36	0.34 ± 0.27	0.34	0.14 ± 0.19	0.00 ± 0.00	0.14
Refractive Amblyopia (n = 17)	0.40 ± 0.18	0.23 ± 0.29	0.17	0.19 ± 0.17	0.10 ± 0.09	0.09

The results of the study showed that the strabismic amblyopia group experienced an increase in mean LogMAR VA of 0.34 log units in the amblyopic eye after occlusion treatment which was equivalent to 17 alphabets, thus representing an improvement of 3 lines and 2 alphabets on the log MAR chart. In the refractive amblyopia group, the mean LogMAR VA increased by 0.17 log MAR only, which was equivalent to about 8 alphabets, representing an improvement of 1 line and 3 alphabets on the log MAR chart. Occlusion treatment was found to be more effective in strabismic amblyopes compared to refractive amblyopes. In the case of the fellow good eye, the strabismic amblyopia group showed an increase in the mean LogMAR VA of 0.14 log MAR. This was equivalent to 7 alphabets, that is an improvement of 1 line and 2 alphabets on the log MAR chart. On the other hand, for the refractive amblyopes, the mean LogMAR VA only improved by 0.09 log units, being equivalent to about 4 alphabets on the log MAR chart.

The refractive errors in the amblyopic and fellow good eye before and after occlusion treatment in the strabismic amblyopia and refractive amblyopia groups are shown in Table 2.

Before treatment, the mean spherical equivalent refractive error in the amblyopic eye for the strabismic amblyopia group was -0.55 ± 2.43 DS, and for the refractive amblyopia group was -1.22 ± 2.93 DS. Similarly, before treatment, the mean spherical equivalent refractive error in the fellow good eye for the strabismic amblyopia group was -0.65 ± 2.03 DS and for the refractive amblyopia group was -0.72 ± 2.92 DS. After treatment, the mean spherical equivalent refractive error in the amblyopic eye for the

strabismic amblyopia group increased to -0.85 ± 2.60 DS, and for the refractive amblyopia group was -1.50 ± 3.49 DS. The change in the mean spherical equivalent of the amblyopic eye after treatment was almost the same, that is -0.30 DS for the strabismic amblyopia group and -0.28 DS for the refractive amblyopia group. Similarly, after treatment, the mean spherical equivalent refractive error in the fellow good eye for the strabismic amblyopia group was -0.85 ± 2.60 DS, and for the refractive amblyopia group was -1.00 ± 3.06 DS. In the case of the fellow good eye, the change in spherical equivalent from before treatment to after treatment in the strabismic amblyopia group and refractive amblyopia group was almost the same, that is -0.20 DS and -0.28 DS, respectively.

DISCUSSION

This study showed that patching treatment increased the mean VA of the amblyopic eye in the strabismic amblyopia group by 17 alphabets or 3 lines. This could be due to several factors. In strabismus, there is misalignment of the visual axes of the 2 eyes which results in eccentric fixation. In order to avoid diplopia, there is suppression from conscious perception of one of the 2 eyes conflicting views. With esotropia, unilateral fixation is much more common than with exotropia. Strabismic suppression is traditionally considered to be the cause of strabismic amblyopia (Sengpiel & Blakemore 1996), a hypothesis that is supported by the findings that the strength of suppression and the severity of amblyopia are correlated (Sireteanu & Fronius 1981). Moreover, suppression is stronger in

TABLE 2. Mean spherical equivalent refractive errors in the amblyopic and fellow good eye before and after occlusion treatment in the strabismic amblyopia and refractive amblyopia groups

Groups	Mean spherical equivalent refractive error in amblyopic eye (DS)			Mean spherical equivalent refractive error in fellow good eye (DS)		
	Before treatment	After treatment	Change in refractive error	Before treatment	After treatment	Change in refractive error
Strabismic Amblyopia (n = 11)	-0.55 ± 2.43	-0.85 ± 2.60	-0.30	-0.65 ± 2.03	-0.85 ± 2.60	-0.20
Refractive Amblyopia (n = 11)	-1.22 ± 2.93	-1.50 ± 3.49	-0.28	-0.72 ± 2.92	-1.00 ± 3.06	-0.28

the nasal hemiretina of amblyopic esotropes than in the temporal hemiretina (Sireteanu & Fronius 1981), as one would expect because an object present in the fovea of the fixating eye will be imaged in the nasal hemiretina of the deviating eye. There is more evidence now that the strabismic suppression occurs at the primary visual cortex area (Sengpiel et al. 2006).

Strabismic amblyopes have also been shown to have severe distortions of perceived visual location (Levi et al. 1985). The localization errors of the strabismic amblyope are also abnormal (Pople & Levi 2005). This probably happens because of eccentric fixation in patients with strabismic amblyopia. There are several theories of amblyopia, which include topological disarray of receptors in the primary visual cortex, undersampling from the amblyopic eye compared with normal eyes, and the presence of multiple cortical representations of the strabismic fovea. It is thought that in the present study, patching the fellow good eye improved the mean VA of the strabismically amblyopic eye by virtue of the amblyopic eye (that is eccentrically fixated under normal circumstances) being forced to use the fovea for fixation, perhaps also in doing so stimulating the primary visual cortex, thereby increasing its VA. In refractive amblyopia, patching does not improve the VA as much as it does in strabismic amblyopia. Refractive amblyopes has foveal fixation. Patching does not alter their fixation habits. It is possible that a different type and intensity of foveal stimulation is needed to improve vision of refractive amblyopes.

This present study is different from another multicenter study by the Pediatric Eye Diseases Investigator Group (2006). Being a multicenter study, more patients were able to be recruited and monitored. In the present study, only one hospital was used to conduct the study and thus there was a problem with recruiting large number of patients who met the inclusion criteria. The other difference between the present study and the study by the Pediatric Eye Diseases Investigator Group (2006) is that in the study all amblyopic patients (strabismic and anisometropic) were group together and given patching therapy with near activity. The outcome of visual acuity with treatment was not analysed separately for the strabismic and anisometropic amblyopes. In the present study, the outcome of the therapy was reviewed separately for the strabismic and anisometropic amblyopes.

In the present study, there was no doubt a change in the spherical equivalent refractive error before and after patching treatment for both the amblyopic groups. However, the change which was an increase in myopia, was less than -0.50 DS and therefore clinically not significant. The spherical equivalent refractive error in the strabismic amblyopia group was from a combination of patients with congenital esotropia and intermittent exotropia whereas in the refractive amblyopia group, it was from a combination of patients with astigmatism, anisometropia and ametropia. As the change in spherical equivalent was almost equal in both eyes (amblyopia and fellow good

eye) of each group and almost equal for both groups, it appears in the present study that patching treatment does not change the spherical equivalent refractive error of the patients with either strabismic amblyopia or refractive amblyopia. When two types of amblyopia are compared, that are, strabismic and refractive types, it was found that patching treatment of the fellow good eye improved the visual acuity of the strabismic amblyopic eye only, with clinically no significant change in refractive error.

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Sharanjeet-Kaur* & Norliza Mohd Fadzil
 Department of Optometry
 Faculty of Allied Health Sciences
 Universiti Kebangsaan Malaysia
 Jalan Raja Muda
 50300 Kuala Lumpur, Malaysia

Waheeda Azwa
 Department of Ophthalmology
 Hospital Raja Perempuan Zainab II,
 15586 Kota Bahru, Kelantan, Malaysia

Azrin E Ariffin
 Faculty of Optometry & Vision Sciences
 SEGI University College
 No 9, Jalan Teknologi
 Taman Sains Selangor
 Kota Damansara, PJU5
 47810 Petaling Jaya, Selangor
 Malaysia

*Corresponding author; email: sharan@medic.ukm.my

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