Amblyopia in Older Patients: Can Treatment Work?

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ABSTRACT

Aim: This paper aims to review the clinical outcomes of three patients with amblyopia who were treated beyond the critical period of 6 to 8 years of age.

Method: Three case studies are presented of patients with previously untreated monocular amblyopia, aged between 9 and 17 years. Guided by the active management and monitoring skill of an orthoptist, each patient undertook a combination of regular clinical visits for sensory and motor visual training, combined with home occlusion treatment.

Results: Each patient achieved improved visual acuity; the fastest and best result occurred in the oldest patient. All patients demonstrated the use of bifoveal fixation with a good level of sensory and motor fusion, with stereopsis in free space. Decompensation of orthophoria in one patient followed the occlusion treatment, however this then returned to binocular single vision following fusion training.

Conclusions: Amblyopia treatment in older children can result in improvement of visual acuity. Integral to the success of the process is the role of the orthoptist in motivating the patient to activate the amblyopic eye during the treatment procedures, including individual choice of the time and place for the use of the occlusion.

Keywords: amblyopia, older patients, motivation, orthoptic therapy

INTRODUCTION

Amblyopia is often seen in eye clinics[1-4] and is a condition of decreased vision that occurs following the basic mechanisms of stimulus deprivation and/or suppression.[5-7] In the presence of decreased acuity in an otherwise healthy eye it is important to note that not all patients can be treated. The vision may not respond to treatment because of secondary cortical anatomical changes[8-9] or if it does respond, there may be negative side effects, such as in older children the development of constant intractable diplopia due to lack of adequate sensory fusion.[10] In this latter situation, treatment is best not undertaken.

In order to treat amblyopia and achieve a good and stable outcome, the eye practitioner must have strong knowledge of the sensory and motor binocular interaction present in the patient, and be dedicated to an active management program to achieve and maintain the best possible visual acuity. An orthoptist in the therapeutic role has the knowledge and expertise to achieve this outcome.[11] Knowledge of binocular interaction includes appreciation of fusion tests, for both sensory and motor function as well as the appreciation of stereopsis. The ability to fuse and achieve binocular single vision indicates that improvement of vision in the amblyopic eye can occur without the complication of diplopia.[12-17]

It has been reported that amblyopia treatment can result in changes to the visual cortex, and improvement of vision can occur into adult years, though it is generally thought that treatment is most effective up to 6 to 8 years of age.[18] It is also suggested that if amblyopia is managed at a later age, treatment can take time and effort.[19] In general, a treatment program for amblyopia requires patient motivation and active practitioner supervision, both of which are vital in the successful treatment of the vision. If the patient is not motivated to achieve, or the guardian is not motivated to support the patient's effort and attendance, treatment may be unsuccessful. Unfortunately, whilst the ability to effectively motivate a patient is likely to increase as age increases and maturity develops, the ability of the vision to respond to treatment is considered to decrease.[20] Organised programs with regular supervision have been found to maximise clinical outcomes.[21] This may include occlusion therapy undertaken at home to maximise the acuity, and sensory and motor fusion training undertaken within the clinic.

This paper presents a review of the clinical outcomes of three patients with amblyopia who were treated beyond the critical period and were prescribed anti-suppression exercises to strengthen sensory fusion and vergence training to improve motor fusion. It aims to demonstrate the importance of active patient involvement and practitioner motivation in achieving a good outcome.

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CASE STUDIES

Three cases are presented (Table 1). Each patient was older than 8 years of age. When wearing their full optical correction each demonstrated a difference in vision between the two eyes of three to four lines, so were diagnosed with unilateral amblyopia. None had received previous treatment for amblyopia. All patients were confirmed to have bifoveal binocular single vision with sensory fusion demonstrated on Worth's Four Lights Test, and motor fusion demonstrated by prism fusional vergence. In all patients the accommodation near point was lower in the amblyopic eye as compared to the non-amblyopic eye. The denser the amblyopia, the lower the accommodation near point of the amblyopic eye. Treatment was introduced for each patient and is summarised in Table 2. The families of cases A and B were fully supportive of regular clinical attendance and the goal to improve the vision. Case C was enthusiastic about improving the vision. Each patient wore full optical correction and was initially prescribed 3 hours of occlusion a day, with weekly attendance at the clinic for active treatment. The orthoptic treatment involved both an active component of overcoming suppression and improving vergences, as well as a cognitive component of helping the patient to understand the process being undertaken. Once suppression was overcome and motor fusion improved the visits became fortnightly. When the vision was at a maximal level the visits were extended to once a month. There was a repetitive theme in all patients, that when the orthoptist emphasised the purpose of the treatment and the goal to be achieved, the patient motivation increased and the vision improved. Although it is difficult to scientifically measure patient motivation levels it was determined by the patient's willingness and effort to follow the instruction and exercises, as well as a measured improvement in the vision following the motivation session. In order to stimulate motivation it was found important to discuss with the patient the need to improve the vision by fully using the amblyopic eye and to convince them of the importance of the exercises.

In order to have patients actively involved in their treatment they were each asked to set a time and place for the occlusion and to undertake tasks with increasing details while actively trying to succeed in the task. Cases A and B were prescribed occlusion treatment which initially did not achieve improvement in the visual acuity (Table 2). Following a motivation session when the understanding had increased and motivation had improved the visual acuity started to increase. Case C, being older and highly motivated, responded quickly to the information and required activities from the first visit. Case B developed a

Table 1. Pre-treatment clinical test results

	Case A	**Case B**	**Case C**
Age	11 years	9 years	17 years
Diagnosis	L anisometropic & strabismic amblyopia	R anisometropic amblyopia	Refractive amblyopia
Presenting reason	Vision left eye blurred	Decreased right vision	Vision different in each eye
Ocular assessment	Fundus and media healthy	Small pinpoint cataract	Fundus and media healthy
Cycloplegic Refraction	RE +0.50 DS LE +4.00 DS	RE +2.50 DS LE +0.75/-0.25 x 180	RE -0.50 DS LE +0.50/-0.50 x 130
Prescription	RE plano LE +3.00 DS (3Δ base-out for BSV)	As above	As above
Visual acuity (with correction)	RE 6/6 LE 6/18	RE 6/30 LE 6/7.5	RE 6/7.5 LE 6/15
Fixation (visuscope)	Foveal fixation	Foveal fixation	Foveal fixation
Cover test: Near & distance	With prism: Esophoria, Without prism: L esotropia (3Δ BO)	Orthophoria	Orthophoria
Worth's Four Lights Test	With prism: 4 lights Without prism: Variable, 4 lights to left suppression	4 lights	4 lights
Stereopsis (Titmus test)	400 secs of arc	100 secs of arc	200 secs of arc
Convergence near point (RAF Rule)	5 cms	5 cms	5 cms
Accommodation to point of blur (RAF Rule)	Age normal = 14.3 D RE 20 D LE 15 D	Age normal = 15 D RE 10 D LE 15 D	Age normal = 12.3 D RE 12 D LE 11 D

tiny left esotropia and complained of associated diplopia following dissociation from the occlusion, however this resolved with fusion training. The cause of the strabismus was thought to be linked to accommodative convergence effort associated with clearing the blurred amblyopic image. The accommodation level improved as the acuity improved and achieved a level of normal for age.

DISCUSSION

These three cases demonstrated that patients between 9 and 17 years of age, therefore older children or teenagers, can successfully respond to amblyopia treatment. These cases also suggest that several factors are important to the success of the treatment. These include (i) the motivation of the patient and associated support of the family to ensure attendance at clinical sessions and to conduct treatment at home, (ii) the capacity of the visual apparatus to respond, and (iii) the role of the orthoptist to monitor progress and implement strategies to motivate the patient.

These case studies show that motivation of the patient is very important to maximise the clinical outcomes of treatment. In cases A and B when initially the patients did not fully participate, there was no improvement. When these patients became actively involved in their own treatment and gained a better understanding of the condition and its management, improvement in the visual acuity was noted. Conversely, in case C, where the motivation was high from the first visit, the response was rapid in spite of the older age and the lower potential to improve. It is suggested that attendance at the clinic for part of the treatment reinforces the ongoing training and enables strategies to be implemented to ensure the best outcome and related improvement. In order to be successful, this needs to be managed by the orthoptist.

The ability to respond to amblyopia treatment is dependent upon the plasticity of the cortical cells which is thought to be age-related, in that the cortex is more responsive when the affected person is young.[22] In these case studies the oldest patient at 17 years responded the fastest, suggesting that personal effort may be an important factor related to success. It also suggests that treatment should be considered with amblyopia patients, even when above the critical age of plasticity, of 6 to 8 years of age.

The presence of strabismus must be carefully considered when treating older patients. In case A the patient presented with a small strabismus which was controlled with a prism and in case B treatment resulted in temporary strabismus and diplopia, following the occlusion. The latter patient was managed with orthoptic fusion training which reinstated binocular single vision. In both cases the existence of a functional binocular relationship was essential to enable symptom-free single vision post treatment. Orthoptic expertise in the management of each case enabled the development of an appropriate and stable binocular relationship between the eyes to enable symptom-free single vision.

Overall, in this patient cohort the role of the orthoptist was integral to the success of the treatment. The orthoptist identified the patients whose clinical characteristics were ideal for treatment, and was involved in guiding and motivating the patients to undertake treatment and achieve set goals. Motivation is essential for the improvement of

Table 2. Treatment outcomes

	Case A	**Case B**	**Case C**
Age	11 years	9 years	17 years
Visual acuity Pre-treatment	RE 6/6 LE 6/18	RE 6/30 LE 6/7.5	RE 6/7.5 LE 6/15
Occlusion, total to light	RE 3 hours/day	LE 3 hours/day	RE 3 hours/day
Clinical treatment	Weekly clinical visits for sensory and motor training. Visits were extended to fortnightly once suppression was eliminated. Extended to monthly once vision was stabilised.	Weekly clinical visits for sensory and motor training. Visits were extended to fortnightly once suppression was eliminated. Extended to monthly once vision was stabilised.	Weekly clinical visits for sensory and motor training. Visits were extended to fortnightly once suppression was eliminated. Extended to monthly once vision was stabilised.
Initial intervention by orthoptist	Discussed the need for treatment at home and in the clinic	Discussed the need for treatment at home and in the clinic	Discussed the need for treatment at home and in the clinic
Advanced intervention by orthoptist	After 6 weeks of treatment and little change in vision: discussion about the importance of treatment; patient selected occlusion routine and agreed to try to improve.	After 4 weeks of no occlusion treatment and no change in the RVA; motivation discussion to improve vision. Patient selected time of day and place for occlusion and agreed to work.	Patient selected time of occlusion; concentrated on the image of the left eye and worked to improve it.
Outcome	Vision improved to RE 6/6, LE 6/7.5; esophoria with no suppression; stereopsis 80 secs of arc	Vision improved to RE 6/9, LE 6/7.5; orthophoria; stereopsis 100 secs of arc	Vision improved to RE & LE 6/6; orthophoria; stereopsis 60 secs of arc

clinical outcomes. This involves a thorough explanation of the condition, helping the patient to choose the activity they would use and the place of its application that would best assist the vision improvement. Additionally, the patient needs to become aware of the goal and the need to undertake the treatment on a regular basis. Following this process a positive outcome can be achieved.

CONCLUSION

Amblyopia treatment in older children can result in improvement of visual acuity. The patient's understanding of the condition and its management and setting goals for treatment is likely to be an important factor in the success of treatment. Further research should explore methods of motivation and the impact of in-clinic treatment of binocular functions on the visual outcomes of older children and teenagers treated for unilateral amblyopia.

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