



## Full Time Occlusion: Still a Good Option in Older Age Amblyopia

Authors

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### Abstract

**Materials and Methods:** This was a retrospective consecutive case series analysis of children treated for amblyopia at a tertiary care center in squint clinic. All children were advised and received full time occlusion (FTO) for the dormant eye.

**Results:** Hundred children older than 6 years at the time of initiation of therapy were included. Age at initiation of ranged from 6 to 18 years (mean age 11yrs, SD 1.33) Forty-six children were between 6-10yr, 32 between 10-14yrs and 22 between 14-18yrs of age. 31% of children had severe amblyopia with BCVA ranging from counting fingers to 6/60 on Snellens chart, 64% had moderate amblyopia and 5% had mild anisometropic amblyopia. After six months of occlusion therapy seventy nine (79%) patients had improvement in visual acuity ( $p=0.017$ ). Out of 21 children older than 12 years, only 14 children (66.6%) had improvement in VA. Mean follow-up after complete stoppage of occlusion was  $8.57 \pm 1.76$  months.

**Conclusion:** Occlusion therapy yields favorable results in anisometropic amblyopia, even when initiated for the first time after 6 years of age. After 12 years of age, some children may still respond to occlusion of the dominant eye.

**Keywords:** Amblyopia, occlusion.

### INTRODUCTION

Occlusion of the non-amblyopic eye is the most commonly used treatment for children with amblyopia. The response to amblyopia therapy is related to type of amblyogenic stimulus, initial depth and duration of amblyopia, age at initiation of therapy, method of amblyopia treatment and compliance. Reports of children treated for anisometropic and strabismic amblyopia continue to suggest that occlusion therapy yields better response to treatment up to 6 to 7 years of age. Flynn *et al.* reviewed the results of amblyopia therapy using pooled data from 961 children described in 23 published studies between 1965 and 1994<sup>[5]</sup> and observed that the single factor

that most clearly related to a successful outcome was age at initiation of therapy.<sup>[5]</sup> Epelbaum *et al.* found that efficiency of treatment for strabismic amblyopia decreases with age and it is null by 12 years of age.<sup>[6]</sup> The purpose of this consecutive patient series studied retrospectively was to analyze results of occlusion therapy for anisometropic amblyopia in children above 6 years of age

### MATERIALS AND METHODS

This was a retrospective consecutive case series analysis of children treated for amblyopia in the squint clinic of the department of ophthalmology at a tertiary care center from March 2007 to

November 2008. A difference of 1 line or more on Snellen visual acuity chart was used as diagnostic criterion for amblyopia. A difference between the spherical equivalents of the two eyes exceeding 1.50 diopter (D) was considered anisometropia. Children who had been treated with occlusion or had undergone any eye muscle surgery in the past were excluded.

All children had complete ocular examination and orthoptic work-up prior to treatment. A cycloplegic refraction was carried out using atropine ointment 1% (children younger than 8 years) or cyclopentolate 1% (older than 8 years) in the first visit. Best-corrected visual acuity (BCVA) (line acuity) was measured in all children. Visual acuity (VA) was measured on Snellens chart at every visit. Children were deemed to have read the line if they read all letters.

All children were advised to undergo occlusion of the better eye with adhesive patch applied for at least 75-80% of all waking hours/day and this was termed 'full time occlusion' (FTO). Children were followed up monthly to document improvement and record compliance. The parents were asked to maintain a daily diary detailing the number of hours of occlusion achieved each day. At each follow-up visit, the same examiner used the same method to assess BCVA. This treatment was continued till there was no further improvement for at least three consecutive visits or attainment of VA equal to that of the initially dominant eye. Thereafter, maintenance patching (3 h/day) was used for further 6 months. After completion of maintenance patching, children were followed up at 3 to 6-month intervals to record visual activity.

## RESULTS

This study included 100 eyes of 100 consecutive children who were treated with occlusion between March 2007 and November 2008. Out of 21 children who did not improve 18 were non compliant to occlusion therapy and 3 children were in 17-18 yrs age group. The age at initiation of amblyopia therapy ranged from 6 years to 18 years with a mean age of  $11 \pm 2.11$  years. There

were 49 males and 51 females. 67% children had hyperopic anisometropic amblyopia, 36% had myopic and 16% had meridional amblyopia. Follow-up ranged from 6- to 20 months, with a mean follow-up of  $12.36 \pm 3.08$  months. The demographic profile and clinical characteristics of the children are given in Table 1. The initial VA of the amblyopic eye ranged from 3/60 to 6/9. Following therapy, the mean VA of the amblyopic eye improved to  $0.42 \pm 0.34$  ( $P < 0.001$ ). The mean time taken for vision to start improving was  $2.80 \pm 0.88$  months, whereas time taken to achieve final improvement was  $5.59 \pm 2.78$  months.

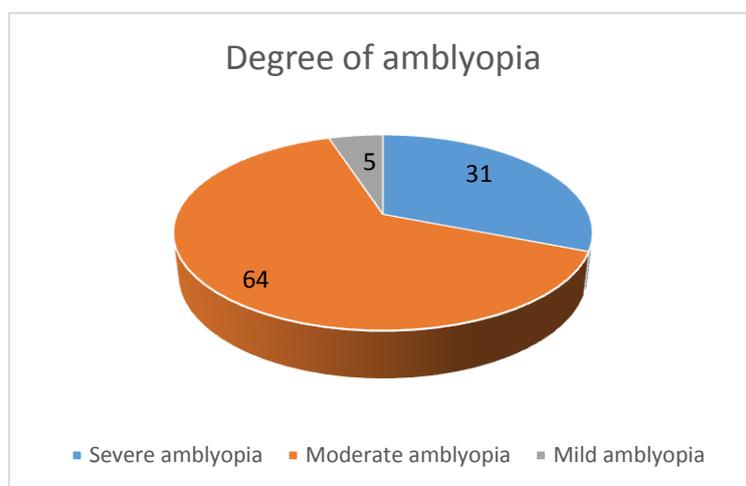
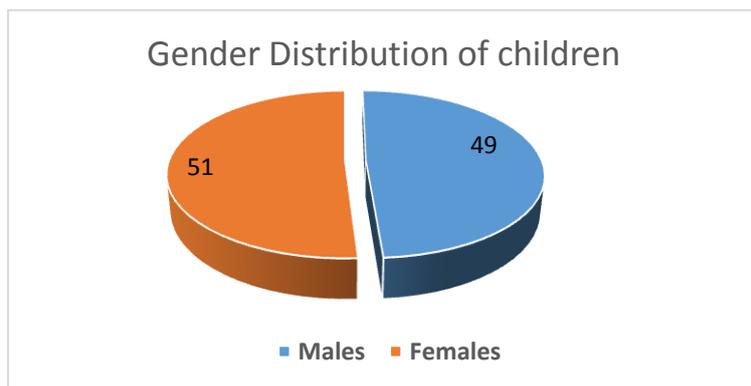
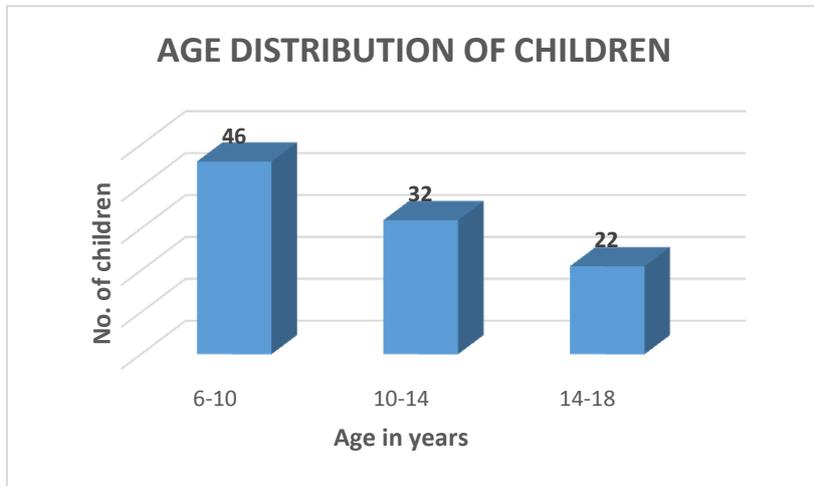
The initial cycloplegic retinoscopic values ranged from +9.50 to -11.50 D, with a mean value of  $3.39 \pm 4.23$  D. The mean anisometropia was  $2.53 \pm 2.59$  D. Mean cycloplegic retinoscopic values for children with hypermetropia was  $+5.01 \pm 1.07$  D for the amblyopic eye and  $+1.75 \pm 0.33$  D for the dominant eye. Similarly, mean cycloplegic retinoscopic value for children with myopia was  $-4.70 \pm 0.80$  D for the amblyopic eye and  $-1.50 \pm 0.31$  D for the dominant eye. Thirty-five eyes (94.5%) had at least 1 Snellen line improvement in VA, whereas 28 eyes (75.3%) improved by 2 lines or more. Mean time taken for VA to start improving was  $2.94 \pm 1.13$  months (range 1 to 4 months) and mean time taken to achieve final improvement was  $5.69 \pm 2.12$  months (range 2 to 9 months).

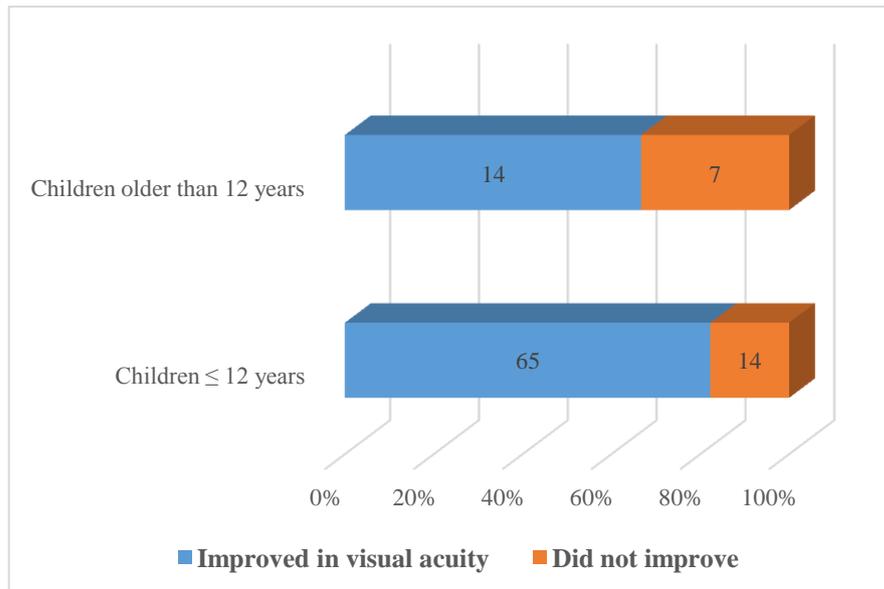
Seventy-nine (79%) out of total 100 children were younger than 12 years at the initiation of amblyopia therapy. Statistical analysis showed significantly better mean final VA ( $P = 0.045$ ) in children who were younger than 12 years. Mean improvement in children younger than 12 years was  $3.15 \pm 0.73$  Snellen lines, whereas it was  $1.78 \pm 0.46$  Snellen lines in children older than 12 years ( $P = 0.033$ ).

Out of 21 children older than 12 years, only 7 children (33.3%) had improvement in VA of the amblyopic eye following FTO: In the 14 children who did not show any improvement, 7 had high hyperopic anisometropia, 5 had compound astigmatism and 2 were non compliant. Mean

time taken to achieve final improvement was  $5.63 \pm 0.38$  months, which was comparable with children who were under 12 years of age at the initiation of amblyopia treatment ( $P = 0.388$ ). All children were kept under follow-up even after cessation of maintenance patching. The mean

follow-up after complete stoppage of occlusion was  $8.37 \pm 1.78$  months (range 5 to 12 months). None of the eyes had any deterioration of vision following cessation of occlusion treatment.





## DISCUSSION

The success of amblyopia therapy mainly depends on the age at initiation of treatment and initial depth of amblyopia in the affected eye.<sup>[5]</sup> Results of occlusion therapy have been found to be better in younger children,<sup>[5]</sup> but there is ample evidence in literature suggesting benefit of amblyopia therapy in older children.<sup>[2],[3],[7],[9],[10]</sup> In the present series, 79 out of 100 children had improvement in VA with FTO. The result showed that VA could be improved uniformly for anisometropic amblyopia in compliant children even in older children.

Oliver *et al*<sup>[11]</sup> studied the results of occlusion treatment in 227 compliant children (age range 2 to 11½ years). There were 37 children (16.3%) who were above 8 years of age and 190 children (83.7%) were under 8 years at the initiation of amblyopia therapy. They noted significant improvement in VA following FTO in both the groups. The mean initial VA values at the initiation of treatment in the both the groups were comparable; corresponding to about 20/100 on the Snellen chart. At the end of the study, the mean final acuity in the younger age group was 20/30, whereas older children achieved mean final VA of 20/40. The difference approached one line of the Snellen chart and was significant. In the present

series, we have analyzed the results of occlusion therapy in older children (age 6 to 18 years). Our result suggests that the children who were younger than 12 years had a significantly better chance of improvement in vision ( $P < 0.001$ ) and achieved better best-corrected final VA than older children. Even in children above 12 years of age, 7 out of 21 (33.33%) showed improvement in vision following occlusion and the amount of improvement was statistically significant when compared to presenting VA ( $P < 0.001$ ). Mintz-Hitner<sup>[2]</sup> reported the results of occlusion therapy in 36 children above 7 years of age. In their series, the initial VA ranged from 3/60 to 6/9. The final VA ranged from 6/6 to 6/9. They also noted uniform improvement in VA in the three different types of amblyopes. The oldest patient in their series was 10.3 years old, with anisometropic amblyopia. Following FTO, VA improved from 20/200 to 20/20 after 0.4 years of therapy. Our results also suggest that in compliant children, all three types of anisometropia amblyopia can be treated with equal success with FTO and age is only a relative bar to offering amblyopia therapy in older children. Children who were under 12 years showed improvement of VA in almost all cases (98.7%), among the 21 children who were

above 12 years at the initiation of therapy, only 7 (33.33%) had improvement in VA.

Vereecken and Brabant's<sup>[10]</sup> observations of improvement in vision of the amblyopic eye following the loss of the good eye in 28.5% of their patients suggest that upper age limit for response to amblyopia therapy may not be as rigid as previously understood. Recent evidence suggests that FTO leads to a significant improvement in VA of the amblyopic eye in compliant children as old as 15 years.<sup>[16]</sup> Early results from the Pediatric Eye Disease Investigator Group (PEDIG) also reveal that children, teenagers and even adults as old as 20 years may improve after occlusion therapy.<sup>[17]</sup> We had similar results whereby almost half of the children who were older than 12 years at the time of initiation of occlusion had significant and maintained improvement in VA with FTO. Most of the published reports suggest that following occlusion therapy, VA starts improving within the first 3 months,<sup>[11],[18]</sup> and maximal benefit occurs within the first 3-6 months.<sup>[19]</sup> In the present series, mean time taken for VA to start improving was  $1.80 \pm 0.88$  months, whereas time taken to achieve final improvement was  $5.59 \pm 2.78$  months. Four children took more than 3 months to show at least one Snellen line improvement in VA. This is an unusual observation and needs to be analyzed. We think it may be related to the older age at the initiation of amblyopia treatment.

It is yet not clearly known; however, whether the visual improvement in older amblyopes remains so after occlusion is discontinued.<sup>[11]</sup> In our series, all children received maintenance patching for 6 months following completion of FTO. None of the children had any deterioration of vision in the amblyopic eye even after a mean follow-up of more than 8 months after stopping occlusion.

There is limited literature available analyzing results of amblyopia therapy initiated for the first time after 12 years of age. Most studies suggest that 12 years of age is the upper limit as far as response to amblyopia therapy is concerned.

Birnbaum *et al*<sup>[13]</sup> reported positive results after sustained treatment of teenagers and a few adults who were affected by amblyopia. A randomized clinical trial carried out by the PEDIG<sup>[20]</sup> analyzed 507 patients aged 7 to 17 years with amblyopia, receiving optical correction and then randomized to receive treatment in the form of 2-6 h of occlusion of the dominant eye. In the 7-12 years age group, children on occlusion also received atropine sulfate 1% one drop daily in the dominant eye. They observed an improvement ( $> 2$  Snellen lines) with occlusion in 53% of children younger than 12 years of age and in 47% of children older than 12 years. Although the results of the present study cannot be directly compared to the randomized trial because we gave FTO to our patients, we did observe a greater chance of improvement in younger children. Sixty five out of 100 eyes (65.9%) in our study improved by more than 2 Snellen lines.

Our results suggest that almost half the children older than 12 years may benefit from amblyopia therapy. The retrospective nature of this study has its limitations; hence further studies are needed to analyze various parameters influencing response to therapy in these children. Although chances of success reduce with advancing age, a significant number of older amblyopes can be improved with FTO. Therefore, we recommend that a therapeutic trial of occlusion is advisable even in older children.

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