International Journal of Research in Medical Sciences
Nazir A et al. Int J Res Med Sci. 2017 Jul;5(7):3065-3070
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20172988

Original Research Article

Stability of visual acuity after cessation of occlusion therapy in patients of amblyopia

Arjumand Nazir[1], Fayaz A. Wani[2]*, Sumaya Shah[1], Saleema Dar[1]

[1]Department of Ophthalmology, Government Medical College, Srinagar, Jammu and Kashmir, India
[2]Department of Medicine, Government Medical College, Srinagar, Jammu and Kashmir, India

Received: 22 April 2017
Revised: 25 April 2017
Accepted: 18 May 2017

***Correspondence:**
Dr. Fayaz Ahmad Wani,
E-mail: wanifayaz.a@gmail.com

ABSTRACT

Background: It is generally recognized that most children with amblyopia have an improvement of visual acuity (VA) with treatment, little is known about the course of vision once treatment is decreased or stopped in a child. The treatment of amblyopia in children is frequently discussed in the literature; however, there is a lack of research into which method of treatment cessation is the most appropriate once therapy has been completed. We undertook this specifically designed prospective study to directly compare the potential relationship between the method of therapy cessation and the short-term (12-weeks) recurrence of amblyopia.
Methods: Fifty children of 5-14 years of age group with different types of amblyopia fulfilling the inclusion criteria were included in the study. Once BCVA was achieved, the subjects were randomized into one of two groups; abrupt cessation group or therapy tapering group. In subjects of tapered group occlusion was reduced from full-time occlusion to 50% of waking hours at BCVA and then additional by 50% at the 4-week's study visit with occlusion being discontinued completely at the 8-week's visit. All subjects in the abrupt cessation group stopped their full-time occlusion completely at the Best corrected visual acuity (BCVA). All subjects were followed for 3 consecutive 4-weeks intervals, for a total of 12 weeks, to assess the short-term recurrence rate of amblyopia.
Results: The overall results show that at 12-weeks study outcome visit, 9 of the 50 subjects developed recurrence. Out of the total of 9 recurrences, 5 (20%) occurred in abrupt cessation group and 4 (16%) occurred in gradual cessation group. Comparing the time of occurrence of recurrence of amblyopia between the 2 studied groups, the recurrence of amblyopia was more during first 4 weeks of study 60% in abrupt group, whereas in gradual group all the recurrences occurred between 8 and 12 weeks visits. The pre-treatment VA and BCVA had a significant impact on the recurrence of amblyopia.
Conclusions: In present study, the results demonstrate that the overall risk of amblyopia recurrence is 18% and the difference in the risk of amblyopia recurrence between the abrupt cessation group and the gradual cessation group (20% vs. 16%) is not statistically significant.

Keywords: Amblyopia, Occlusion therapy, VA

INTRODUCTION

Amblyopia is defined as unilateral or less commonly, bilateral reduction of visual acuity that cannot be explained on the basis of physical ocular abnormality.[1] Since 1722, occlusion of the sound eye has been the most effective therapy in the treatment of amblyopia.[2-6] There is neither a substitute nor a shortcut for full time

occlusion in the treatment of amblyopia. Recent study by Scott et al demonstrated that full time occlusion produced excellent visual acuity results, which has been supported by Dorey et al and Cleary et al.[7-9] In the study by Scott el al 88% of patients, who achieved visual acuity of 20/20 at the end of treatment maintained that level of visual acuity after an average follow up of 15 years. The success rate of occlusion therapy varies from 30% - 92% in various studies reported in literature. The variation in success rate is due to various factors like patient compliance, patient selection, treatment durations, age, definition of amblyopia used in the study and type of amblyopia. It is generally recognized that most children with amblyopia have an improvement of VA with treatment. Studies which have addressed the post treatment course of amblyopia patients have shown the mean recurrence rate varying widely between 6-75%.[10]

The treatment of amblyopia in children is frequently discussed in the literature; however, there is a lack of research into which method of treatment cessation is the most appropriate once therapy has been completed. Currently, there are only few published studies designed to determine the most appropriate and effective method to end amblyopia treatment. The two commonly utilized methods of cessation are too slowly taper therapy or to end it abruptly, but no pathophysiologic findings exist to indicate the superiority of one over the other.[11]

Tapering has been the preferred method of cessation since Kushner presented his findings that "a disproportionately large" number of patients experienced recurrence of their amblyopia following abrupt cessation, and therefore recommended tapering of occlusion.[12]

LA Walsh et al reported that, the recurrence risk appears to be similar amongst those patients that had their occlusion therapy discontinued abruptly and those who had therapy tapered in a gradual fashion. However, their study is limited by a very small sample size (17 patients only).[11]

So, we undertook this specifically designed prospective study to compare the potential relationship between the method of therapy cessation and the short-term (12-weeks) recurrence of amblyopia and to find out the overall recurrence rate of amblyopia after occlusion treatment.

METHODS

This was a hospital based; prospective and interventional study conducted in ophthalmology department of a tertiary care hospital. Fifty children of 5-14 years of age group (at the time of enrolment) with different types of amblyopia fulfilling the inclusion criteria were included in the study. A difference of two or more lines on Snellen's visual acuity chart was used for diagnosis of amblyopia. A difference between the spherical equivalents of the two eyes exceeding 1.5 diopter was considered anisometropia. Strabismic amblyopes who had constant esotropia or exotropia were included in this consecutive patient series. Fifty amblyopic eyes of 50 consecutive subjects attending the outpatient department of ophthalmology of our hospital were studied. Subjects were randomly divided into two groups, each group comprising of 25 subjects. In one group the occlusion was stopped abruptly and in another group occlusion was stopped gradually.

All children underwent complete ocular examination and orthoptic work up prior to treatment. A cycloplegic refraction was carried out using atropine 1 % (children less than 7 years age) or cyclopentolate 1% (older than 7 years) in the first visit. Best corrected visual acuity (BCVA), refers to the study enrolment visual acuity in the amblyopic eye, was measured in all children after they were treated with full time occlusion (FTO) using an adhesive patch (opticlude patch) worn over the fixating eye to gain maximal visual acuity. Visual acuity was assessed with the help of Snellen visual acuity chart, Landolts ring or pictorial cards. Children were followed up monthly to document improvement and record compliance. At each follow up visit, the same examiner used the same method to assess the visual acuity.

Once BCVA was achieved, the subjects were randomized into one of two groups: abrupt cessation group or therapy tapering group. For the purpose of this study, end point of treatment was defined as equal vision or no further improvement in visual acuity in the amblyopic eye despite 3 consecutive visits for 3 months.

In subjects of tapered group occlusion was reduced from full-time occlusion to 50% of waking hours at BCVA (i.e., from 16 hours/day to 8 hours per day); and then additional by 50% at the 4-week.

Study visit (i.e., from 8 hours/day to 4 hours), with occlusion being discontinued completely at the week 8 visit. All subjects in the abrupt cessation group stopped their full-time occlusion completely at the BCVA (i.e., from 16 hours/day to none). All subjects were followed for 3 consecutive 4-week intervals, for a total of 12 weeks, to assess the short-term recurrence rate of amblyopia. Recurrence was defined when BCVA deteriorated by two or more lines on snellen visual acuity chart.

For the purpose of this study, all of the subjects had visual acuity assessed using a standardized visual acuity assessment protocol. This standardized visual acuity testing protocol required subjects to be positioned in front of the visual acuity chart exactly at the distance calibrated for the test. Subjects were then asked to identify the middle (third letter from the left) optotype starting with the largest row of optotypes (6/60). Only the middle letter was correctly identified on each line as the subjects moved down the chart until the 6/12 level had been reached, at which point the entire row was read

progressing from left to right. If an error was made (incorrectly identified the middle optotype) prior to the 6/12 level then the entire row above the missing optotype was read progressing from left to right. If at any level the subject was not able to correctly identify 3 of 5 of the optotypes then testing proceeded to the previous line until 3 of 5 optotypes could be correctly identified. Occlusion compliance was based on the amount of time reported by the accompanying parents or guardian. All subjects were asked to report the total number of hours they were occluded per day. If the subjects were not compliant with their prescribed treatment, they were excluded from the study.

At enrollment, the data collected for analysis included the patient's age, sex, dwelling, type of amblyopia, initial and enrollment level of visual acuity, in both the amblyopic and non-amblyopic eye, total acuity gain in the amblyopic eye and inter-ocular acuity difference.

Inclusion criteria

- Children between 5 to 14 years of age during the trial of occlusion therapy
- A distance VA in the amblyopic eye of 6/ 12 or less.
- A diagnosis of amblyopia associated with strabismus, anisometropia mixed Strabismic and anisometric amblyopia, etc
- Full time occlusion therapy for amblyopia with an improvement in visual acuity (BCVA)
- Follow up until a recurrence of amblyopia or a minimum of 12 weeks after cessation of treatment.

Exclusion criteria

- Patients who had received therapy previously and not improved
- Any ocular opacity (corneal opacity, cataract, vitreous haemorrhage)
- Any congenital or acquired retinal disease
- Abnormal neurological examination.

Statistical analysis

Data was described as mean ± SD and percentage. Least significant difference for inter group and intra group variance of metric data was measured at 95% confidence interval by Mann Whitney U test. Non-metric data was analysed by Mann Whitney U test and Chi square test. SPSS, Minitab, Java Stat and MS Excel software was used for data analysis.

RESULTS

Fifty amblyopic eyes of 50 consecutive subjects attending the outpatient department of ophthalmology of our hospital were studied. Table 1 describes the major demographic variables, according to the treatment group, of our subjects on entry into the study. The age of subjects ranged from 5 years to 14 years at the time of enrolment in the study. The mean age of the subjects in sudden cessation group was 9.0 ± 3.1 years and the mean age of the subjects in gradual cessation group was 9.6 ± 2.5.

A total of 32 (61.4%) subjects had a diagnosis of Strabismic amblyopia, 11 (22.8%) had anisometropic amblyopia with the remaining 7 (15.8%) having mixed Strabismic and anisometric type of amblyopia. Comparison between different treatment groups is shown in Table 1.

Table 1: Patient demographics and types of amblyopia.

Characteristics		Abrupt	Gradual	Total	p value
Age	5 to 8	12 (48.0)	9 (36.0)	21 (42.0)	0.927 (NS)
	9 to 12	9 (36.0)	13 (52.0)	22 (44.0)	
	> 12	4 (16.0)	3 (12.0)	7 (14.0)	
Gender	Male	12 (48.0)	16 (64.0)	28 (56.0)	0.546 (NS)
	Female	13 (52.0)	9 (36.0)	22 (44.0)	
Dwelling	Rural	19 (76.0)	20 (80.0)	39 (78.0)	0.734 (NS)
	Urban	6 (24.0)	5 (20.0)	22 (22.0)	
Type of Amblyopia	Strabismic	18 (72.0)	14 (56.0)	32 (64.0)	0.380 (NS)
	Anisome-tropic	3 (12.0)	8 (32.0)	11 (22.0)	
	Mixed Strabismic + Anisome-tropic	4 (16.0)	3 (12.0)	7 (14.0)	

The initial visual acuity at commencement of full time occlusion (pre-treatment) and visual acuity in the amblyopic eye at the time of enrolment i.e. best corrected visual acuity (BCVA) is shown in Table 2. The difference in pretreatment visual acuity and BCVA between two groups was not statistically significant (p> 0.05). The overall results show that at 12-weeks study outcome visit, 9 (18%) of the 50 subjects developed recurrence and 41

(82%) remained stable. Out of the total of 9 recurrences, 5 (20%) occurred in abrupt cessation group and 4 (16%) occurred in gradual cessation group. There was no statistically significant difference in occurrence of recurrence between the abrupt cessation group and gradual cessation group.

Table 2: Pre-treatment and best corrected visual acuity (affected eye).

Visual acuity		Abrupt	Gradual	P value
Pre-treatment	6/18	4 (16.0)	8 (32.0)	0.414 (NS)
	6/24	2 (8.0)	3 (12.0)	
	6/36	8 (32.0)	4 (16.0)	
	6/60 to FC 6 mt	10 (40.0)	8 (32.0)	
	≤6 mt FC	1 (4.0)	2 (8.0)	
Best Corrected	6/6	10 (40.0)	13 (52.0)	0.268 (NS)
	6/9	8 (32.0)	9 (36.0)	
	6/12	4 (16.0)	1 (4.0)	
	6/18	3 (12.0)	1 (4.0)	
	6/24	0 (0.0)	1 (4.0)	

FC- Finger counting; NS- not Significant.

Out of total 9 (18 %) recurrences, 3 (6 %) occurred within the first 4 weeks of the study, 4 (8 %) between 4 and 8 weeks and 2 (4 %) between 8 and 12 weeks visit Table 3.

Table 3: Time of recurrence.

Visual acuity	Abrupt	Gradual	p value
4 Weeks	3 (12.0)	0 (0.0)	0.127
8 weeks	2 (8.0)	2 (8.0)	
12 weeks	0 (0.0)	2 (8.0)	
Total	5 (20.0)	4 (16.0)	

Table 4: Impact of pretreatment visual acuity and BCVA on recurrence of amblyopia.

Visual acuity		Stable	Recurrence	P-value
Pre-treatment	6/18	11 (91.7)	1 (8.3)	0.035 (Sig)
	6/24	5 (100.0)	0 (0.0)	
	6/36	11 (91.7)	1 (8.3)	
	6/60 to FC 6 mt	12 (66.7)	6 (33.3)	
	≤ 6 mt FC	2 (66.7)	1 (33.3)	
Best Corrected	6/6	21 (91.3)	2 (8.7)	0.033 (Sig)
	6/9	14 (82.4)	3 (17.6)	
	6/12	4 (80.0)	1 (20.0)	
	6/18	2 (50.0)	2 (50.0)	
	6/24	0 (0.0)	1 (100.0)	

Fc- finger counting.

Table 4 shows intra-group comparison of visual acuity for the affected Eye. Stability of visual acuity after occlusion therapy (FTO) of amblyopic eye is significant ($p < 0.05$) and the significance is maintained irrespective of the method of cessation of occlusion therapy (abrupt versus gradual).

DISCUSSION

In a prospective, randomized, controlled study of successfully treated children between 5 to 14 years of age, we determined the overall recurrence rate of amblyopia and compared the recurrence rate of amblyopia in 2 different methods of therapy cessation (abrupt vs gradual). The recurrence of amblyopia showed an inverse correlation with age at cessation or decrease of occlusion therapy. The recurrence was more common in age group of 5 to 8 years than in 9 to 14 years age group. However, the difference was not statistically significant (p value >0.05). Similar results were found by Bhola et al[1] and Supreet Juneja et al.[10,13]

Strabismic amblyopia was the most common type of amblyopia (64%) followed by anisometropic amblyopia (22%) and mixed Strabismic and anisometropic amblyopia (14%). There was no statistically significant difference between the recurrences of amblyopia among these different types of amblyopia. Levartovsky et al found that Strabismic amblyopia is more prone to deterioration than anisometropic amblyopia, but in this study, we found the same frequency of recurrence between Strabismic and anisometropic types.[14]

Of the 9 recurrences, 33.3% occurred within the first 4 weeks of the study, 44.4% between 4 and 8 weeks, and 22.2% between 8 and 12-week's visit. Comparing the time of occurrence of recurrence of amblyopia between the 2 studied groups, the recurrence of amblyopia was more during first 4 weeks of study 60% in abrupt group, whereas in gradual group all the recurrences occurred between 8 and 12 weeks visits. The difference in time of recurrence of amblyopia was statistically significant (p value <0.05). Similar observation was made by Walsh et al, who showed that in short term recurrences, abrupt group recurrence was seen at 4 weeks visit whereas in gradual group recurrence was observed at 8-week's visit.[11]

The pre-treatment VA and BCVA had a significant impact on the recurrence of amblyopia. Similar observations were made by Flynn et al and S Levartovsky et al who showed that low initial visual acuity was a risk factor for recurrence of amblyopia.[14-15]

The total recurrence rate at the short term (12 weeks) outcome study visit was 18%. Nine of 50 subjects were classified with an amblyopia recurrence by the final study evaluation (12-weeks).

The overall recurrence in this study was comparable to that found by pediatric eye disease investigator group (PEDIG), Flynn et al and Walsh et al.[11,15,16]

PEDIG in their prospective observational study of successfully treated amblyopic children, less than 8 years of age, found an overall amblyopia recurrence risk of 24% during 1 year of follow-up. Flynn et al reported a 1-year recurrence risk of 27% using retrospective analysis of 589 amblyopic children 10 years old or younger treated with occlusion. There is a wide discrepancy in the reported recurrence rates of amblyopia, following the cessation of treatment, from as low as 6% to as high as 75%.[15]

This study is a short-term follow-up study so the overall recurrence may have been more than what is observed in this study. However, as per the literature most of the recurrences occur during the first 3 months following cessation of occlusion therapy. As reported by Juneja S et al among the 28 recurrences, 20 (71%) occurred within the first 3 months after stopping the treatment, 4 (14%) occurred between 4th and 6th month and 4 (15%) occurred within 6 months and 1 year.[10] In the PEDIG[16] study the majority of the recurrences (69%) occurred within the first 13 weeks after cessation of treatment. As per their observation though 1 year follow up is needed, but follow-up visits during the first 3 months after stopping treatment might allow detection and retreatment of majority of recurrences that occur during the first year.

The recurrence of amblyopia in the abrupt group was 20% and that in the gradual group was 16%. The recurrence occurred more frequently in abrupt group than in gradual group, but the difference was not statistically significant. Our results are in agreement with Walsh et al who observed that the short-term recurrence rate of amblyopia was identical in each of the treatment groups and a similar rate of recurrence was noted after the 52-week's visit in the abrupt and tapered group at 22% and 25%, respectively.[11] Kushner stated that the number of patients I have seen in consultation who experience recurrence of their amblyopia when occlusion therapy was abruptly discontinued seems disproportionately large.[12] He therefore recommended tapering of occlusion therapy.

Stability of visual acuity after occlusion therapy (FTO) of amblyopic eye is significant ($p<0.001$) and the significance is maintained irrespective of the method of cessation of occlusion therapy (abrupt vs gradual). Together with other results showing that visual acuity is stable more than 10 years[17] and 20 years after cessation of treatment[18], this is good news. It seems like successful amblyopia therapy results in a lasting improvement in visual acuity, and that the short-term results of amblyopia treatment really are making a significant long-term difference to adult populations irrespective of the method of treatment cessation.

CONCLUSION

In this study, the results demonstrate that the overall risk of amblyopia recurrence is 18% and the difference in the risk of amblyopia recurrence in the two groups is not statistically significant. It is recognized that the smaller sample size and short-term follow-up in this study prevents us from making definitive conclusions on the potential role that abrupt cessation has on the regression rate of amblyopia. The sample size was too small to reach an acceptable level of statistical power; therefore, the generalizability of the findings to the broad population of all patients with amblyopia requires continuing research. This study therefore could be considered as a pilot study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Ciuffreda KJ, Levi DM, Selenow A. Amblyopia. Boston: Butterworth-Heinemann. 1991:1-64.
2. Wright KW, Walonker F, Edelman P. 10-Diopter fixation test for amblyopia. Arch Ophthalmol. 1981;99:1242-6.
3. Von Noorden GK. Binocular Vision and Ocular Motility. In: Theory and Management of strabismus. 6th ed. St Iouis Mosby; 2002:246.
4. Preferred Practice Pattern: Amblyopia. San Francisco, The American Academy of Ophthalmology; 2002.
5. Mazow ML, Chuang A. Vital MC' Outcome study in amblyopia; Treatment and practice pattern variations. JAAPOS. 2000;4:1-9.
6. Moseley MJ, Fielder AR, Irwin M, Jones HS, Auld RJ. Effectiveness of occlusion therapy; A pilot study Br J Ophthalmol. 1997;81:956-61.
7. Scott WE, Kutschke PJ, Keech RV. Amblyopia treatment outcomes JAAPOS. 2005;9107-11.
8. Dorey SE, Adams GG, Lee JP, Sloper JJ. Intensive occlusion therapy for amblyopia. Br J Ophthalmol. 2001;85:310.
9. Cleary M. Efficacy of occlusion for Strabismic amblyopia. Can optimum duration be identified? Br J Ophthalmol. 2001:84:572-8.
10. Juneja S, Rathore MK, Dwivedi PC, Agarwal S, Choudhury P, Tirkey E, et al. A Clinical Study evaluating the stability of visual acuity (VA) after full time occlusion therapy in patients with Strabismic and/or anisometropic amblyopia. AIOC proceedings, pediatric session. 2008.
11. Walsh LA, Hahn EK, LaRoche GR. The Method of Treatment Cessation and Recurrence Rate of Amblyopia. Strabismus. 2009;17(3):107-16.
12. Kushner BJ. Functional amblyopia: A purely practical pediatric patching protocol. In: Ophthalmol Annu. 1988;4:173-98.
13. Bhola R, Keech RV, Kutschke P, Pfeifer W, Scott WE. Recurrence of amblyopia after occlusion therapy. Ophthalmol. 2006;113(11):2097-100.
14. Levartovsky S, Oliver M, Gottesman N, Shimshoni M. Factors affecting long term results of

successfully treated amblyopia: initial visual acuity and type of amblyopia. Br J Ophthalmol. 1995; 79(3):225-8.
15. Flynn JT, Schiffman J, Feuer W, Corona A. The therapy of amblyopia: an analysis of the results of amblyopia therapy utilizing the pooled data of published studies. Trans Am Opthalmolo soc. 1998;96:431-53.
16. The Pediatric Eye Disease Investigator Group. Risk of amblyopia recurrence after cessation of treatment. JAPOOS. 2004;8:420-8.
17. Ohlsson J, Baumann M, Sjöstrand J, Abrahamsson M. Long term visual outcome in amblyopia treatment. Br J Ophthalmol. 2002;86(10):1148-51.
18. Leiba H, Shimshoni M, Oliver M, Gottesman N, Levartovsky S. Long-term follow-up of occlusion therapy in amblyopia. Ophthalmol. 2001;108(9):1552-5.

Cite this article as: Nazir A, Wani FA, Shah S, Dar S. Stability of visual acuity after cessation of occlusion therapy in patients of amblyopia. Int J Res Med Sci 2017;5:3065-70.