Original Research

Visual Outcome of Occlusion Therapy in Anisometropic Amblyopia

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Abstract

Background: *Amblyopia is a common visual disorder in children, often treated with occlusion therapy. This study aimed to assess the visual outcomes following occlusion therapy in children with anisometropic amblyopia, focusing on improvements in best-corrected visual acuity (BCVA) over a six-month period.*

Methods: *This cross-sectional study was conducted in Shaheed Monsur Ali Medical College Hospital, Dhaka, Bangladesh during the period from January 2015 to August 2015. Participants underwent occlusion therapy, where the better-seeing eye was covered for varying durations based on initial BCVA. Visual acuity was measured using the Snellen chart and converted to logMAR units at baseline, and after 1, 3, and 6 months of therapy. Statistical analysis was performed using Pearson's correlation test.*

Results: *The mean BCVA improved significantly from 0.88±0.28 at baseline to 0.55±0.21 after 1 month, 0.42±0.15 after 3 months, and 0.23±0.12 after 6 months ($p < 0.001$ for all comparisons). Among the participants, 68% had hypermetropia, 22% had astigmatism, and 10% had myopia. The majority of participants (68%) had anisometropic amblyopia in the right eye. The age distribution was 32% aged 5-7 years, 47% aged 8-9 years, and 21% aged 10-11 years, with a mean age of 8.64 years. Gender distribution was 64% male and 36% female.*

Conclusion: *Occlusion therapy significantly improves visual acuity in children with anisometropic amblyopia, with early and consistent treatment yielding the best results. These findings support the continued use of occlusion therapy as an effective treatment modality, even when initiated later in childhood. Future research should explore long-term outcomes and complementary treatment approaches.*

Introduction

Amblyopia, as defined by von Noorden, is a decrease in visual acuity caused by pattern vision deprivation or abnormal binocular interaction, which may be reversible through therapeutic measures[1]. The disorder can be divided into three classes: anisometropic, deprivational, and strabismic. Anisometropic amblyopia involves both deprivation and abnormal binocular interaction[1]. A factor analysis in a large group of amblyopes found no distinguishable functional difference between deprivation and anisometropic amblyopes[2]. Treatment methods for amblyopia include refractive correction, occlusion, penalization, elimination of any obstacle to vision, and medical treatment[1]. Occlusion, where the better eye is covered, is the traditional and most widely used method of amblyopia treatment[1]. Amblyopia is estimated to affect 1-4% of children, with higher rates in medically underserved populations[3]. The disorder has a cortical and lateral geniculate basis[4] and is caused by any condition that results in abnormal or inadequate visual input during infancy or childhood, such as a significant difference in refractive error between the two eyes or injury to the eye of a young child[1]. This condition can cause an imbalance in the positioning of the eyes, such

as strabismus, where the eyes are crossed inward (esotropia) or outward (exotropia). Amblyopia can result from a major difference in refractive error between the two eyes, such as myopia, hypermetropia, or astigmatism[5,6]. Less common causes of amblyopia include corneal and lens diseases or injury to the eye of a young child[7,8]. Occlusion therapy has been found to yield favorable results in both strabismic and anisometropic amblyopia, even when initiated for the first time after 6 years of age[9,10]. After 12 years of age, some children may still respond to the occlusion of the dominant eye[11]. Early initiation of occlusion therapy and consistent use of spectacle correction can completely resolve amblyopia in a majority of patients[12]. Evidence suggests that even solitary 6-hour occlusion therapy can lead to an effective improvement in best-corrected visual acuity, although full-time occlusion has traditionally been used as an effective method[13]. Anisometropic amblyopia results from differences in refractive power between the two eyes, and in these cases, refractive correction along with occlusion of the eye with good visual potential is the practiced treatment modality[14]. The final visual outcome depends on the status of visual acuity at the time of presentation, age of presentation, and patient compliance[15]. The current study aimed to assess the visual outcomes following occlusion therapy in anisometropic amblyopic patients in an apex eye hospital in Bangladesh.

Methods

This cross-sectional study was conducted in Shaheed Monsur Ali Medical College Hospital, Dhaka, Bangladesh during the period from January 2015 to August 2015. The study included 100 patients aged 5-11 years with anisometropic amblyopia, selected through non-random purposive sampling. Inclusion criteria were anisometropic amblyopia with a best-corrected visual acuity (BCVA) in the amblyopic eye of 6/12 or less and a minimum of two lines difference in visual acuity between the two eyes. Patients with amblyopia associated with strabismus, recent amblyopia treatment within the past 6 months, current vision therapy or orthoptics, history of intraocular or refractive surgery, and those participating in other studies were excluded. Ethical approval was obtained, and the study's aims, procedures, risks, and benefits were explained to the legal guardians before obtaining consent. Detailed histories were taken, followed by comprehensive ophthalmic and systemic evaluations. Visual acuity was recorded using the Snellen chart and converted into logMAR units. Occlusion of the better-seeing eye was advised based on the extent of vision decrease: 6 hours for BCVA of 6/60 (logMAR 1), 4 hours for BCVA of 6/18 to 6/60 (logMAR 0.5 to 0.8), and 2 hours for BCVA worse than 6/18 (logMAR 0.5). Follow-ups were scheduled according to the patient's age. BCVA was recorded at baseline, and after 1, 3, and 6 months of occlusion therapy. Mean BCVA scores during follow-up were compared with baseline values and analyzed statistically using Pearson's correlation test, with significance set at $p < 0.05$. Statistical analyses were performed using SPSS version 22. All data were recorded on a pre-designed data collection sheet, and results were displayed using tables and figures. Occlusion therapy continued until vision stabilized for two consecutive visits or visual acuity improved to better than 6/12 (logMAR 0.3) in the amblyopic eye.

Results

Table 1: Distribution of participants by baseline characteristics (n=100)

Characteristics	Frequency	Percentage
Age (Years)		
5-7	32	32
8-9	47	47
10-11	21	21
Mean±SD	8.64±1.47	
Gender		
Male	64	64
Female	36	36

The study included 100 participants with anisometropic amblyopia. The age distribution of the participants was as follows: 32% were aged 5-7 years, 47% were aged 8-9 years, and 21% were

aged 10-11 years, with a mean age of 8.64 years and a standard deviation of 1.47 years. Regarding gender distribution, 64% of the participants were male, and 36% were female.

Table 2: Distribution of substance use treatment history among participants (N=49)

Involved Eye	Frequency	Percentage
Right eye	68	68
Left eye	32	32

Among the 100 participants, 68% had anisometropic amblyopia in the right eye, while 32% had it in the left eye.

Table 3: Distribution of participants type of refractive error (N=100)

Refractive error	Frequency	Percentage
Hypermetropia	68	68
Astigmatism	22	22
Myopia	10	10

Regarding the type of refractive error among the 100 participants, 68% had hypermetropia, 22% had astigmatism, and 10% had myopia.

Table 4: Distribution of mean best-corrected visual acuity in different assessment periods (N=100)

Assessment time	Best-corrected visual acuity (Mean±SD)	p value
Baseline	0.88±0.28	----------
1 month after occlusion	0.55±0.21	<0.001
3 months after occlusion	0.42±0.15	<0.001
6 months after occlusion	0.23±0.12	<0.001

The mean best-corrected visual acuity (BCVA) of the participants showed significant improvement over the assessment periods. At baseline, the mean BCVA was 0.88±0.28. One month after occlusion therapy, the mean BCVA improved to 0.55±0.21 ($p < 0.001$). After three months, the mean BCVA further improved to 0.42±0.15 ($p < 0.001$). At six months, the mean BCVA reached 0.23±0.12 ($p < 0.001$), indicating a significant and continuous improvement in visual acuity throughout the treatment period.

Discussion

The present study assessed the visual outcomes following occlusion therapy in 100 children with anisometropic amblyopia, highlighting significant improvements in best-corrected visual acuity (BCVA) over a six-month period. Initially, the mean BCVA was 0.88±0.28, which improved significantly to 0.23±0.12 after six months of therapy ($p < 0.001$). These results align with prior studies demonstrating the efficacy of occlusion therapy in improving visual acuity in anisometropic amblyopia. Al Ammari and Al Shamlan[16] observed substantial BCVA improvements, particularly in hyperopic anisometropic amblyopia, reinforcing our findings that early and consistent occlusion therapy can yield significant visual gains. The age distribution in our study, with a mean age of 8.64 years, and the gender distribution (64% male, 36% female) are comparable to other studies. Kim et al.[17] reported effective occlusion therapy outcomes in patients aged 8 years and older, with significant visual acuity improvements noted in both full-time and part-time occlusion groups. This supports our finding that occlusion therapy is beneficial even when initiated later in childhood. Our results showed that 68% of the participants had anisometropic amblyopia in the right eye, which is consistent with findings by Hossain et al.[18], who noted similar laterality trends in their clinical evaluation of refractive amblyopia. This lateral dominance may be a consideration in designing and evaluating treatment protocols. Regarding the type of refractive error, 68% of our participants had hypermetropia, 22% had astigmatism, and 10% had myopia. These proportions align closely with the findings of Patel et al.[19], who reported that hypermetropic anisometropia is particularly amblyogenic, often requiring more intensive treatment. Our study's observed improvement in BCVA supports the efficacy of occlusion therapy in managing these refractive errors, similar to the success rates reported by Beardsell et al.[20]. The

significant BCVA improvements observed at various intervals—0.55±0.21 at one month, 0.42±0.15 at three months, and 0.23±0.12 at six months—demonstrate the continuous benefit of occlusion therapy. These findings are consistent with those of Irfani et al.[21], who compared continuous and split part-time occlusion therapy, finding both methods effective in improving visual acuity. Similarly, Ahn and Hwang[22] reported notable visual acuity gains in older children, reinforcing the potential for substantial improvements even beyond the traditionally critical periods. Furthermore, Steele et al.[23] found that treating anisometropic amblyopia with spectacles alone can also be successful, though our study focused on occlusion therapy as a primary treatment. This difference highlights the potential for varied treatment approaches to achieve similar visual acuity outcomes, emphasizing the importance of individualized patient management plans. The study's strength lies in its prospective design and significant sample size, which provides robust evidence supporting the efficacy of occlusion therapy. However, long-term follow-up is essential to assess the sustainability of these improvements, as highlighted by Beardsell et al.[20], who noted a risk of visual acuity deterioration post-treatment cessation. In conclusion, our study demonstrates that occlusion therapy significantly improves visual acuity in children with anisometropic amblyopia. These findings are consistent with existing literature, underscoring the effectiveness of this treatment modality. Future studies should focus on long-term outcomes and the potential for integrating alternative treatments, such as spectacles and vision therapy, to enhance and sustain visual improvements.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

Conclusion

This study demonstrates that occlusion therapy significantly improves visual acuity in children with anisometropic amblyopia. Our findings indicate that early and consistent application of occlusion therapy leads to substantial and continuous improvements in best-corrected visual acuity over a six-month period. The improvements were consistent across various age groups and types of refractive errors, with hypermetropic patients showing particularly favorable outcomes. These results underscore the effectiveness of occlusion therapy as a primary treatment modality for anisometropic amblyopia, highlighting its potential benefits even when initiated later in childhood. Future studies should focus on long-term outcomes and the integration of alternative treatments, such as spectacles and vision therapy, to enhance and sustain these visual improvements.

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