Effectiveness of Dichoptic Therapy for Treating Mild to Moderate Amblyopia in a Tertiary Eye Care Center in South India

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ABSTRACT

Purpose: To contribute evidence about the effectiveness of dichoptic therapy in patients with mild to moderate amblyopia.

Methods: A retrospective study was conducted in patients enrolled for dichoptic therapy on the Bynocs AmblyGo platform (Kanohi Eye Pvt Ltd) from January to August 2023. Data collected included logarithm of the minimum angle of resolution best corrected visual acuity, anterior and posterior segment examination, fixation pattern, dynamic and cycloplegic refraction, orthoptic evaluation, and number of dichoptic therapy sessions. Visual acuity, binocularity, and stereopsis before and after therapy were analyzed.

Results: Of 59 patients (median age: 11 years, range: 5 to 30 years) enrolled, 34 (57.6%) had anisometropic amblyopia, 12 (20.3%) had ametropic amblyopia, 10 (17.0%) had strabismic amblyopia, and 3 (5.1%) had deprivation amblyopia. All 6 (10.2%) and 15 (22.4%) patients who had no binocular single vision for near and distance before therapy, respectively, attained normal binocular single vision on completion, except one who suppressed at distance. Twenty-one (75.0%) had improved near stereopsis, and 21 (60.0%) had improved distance stereopsis. Of 74 eyes treated, 61 (82.4%) had improved visual acuity and 73 (98.6%) improved in at least one tested parameter. A majority of these eyes had residual amblyopia after occlusion therapy.

Conclusions: Dichoptic therapy improves visual acuity, binocularity, and stereoacuity in patients with amblyopia, including those older than 8 years, especially in partial deprivation, ametropic, and anisometropic amblyopia.

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INTRODUCTION

Amblyopia is among the most important causes of vision impairment worldwide among children and young adults. It is also the most common cause of monocular childhood vision loss.[1-3] The worldwide incidence (1% to 5%) varies, with the prevalence in South India reported at 1.1%.[4-6] Due to

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the abnormalities in visual processing in amblyopia, deficits in contrast sensitivity, accommodation, binocular vision, fixation, saccades, color, form, and motion perception occur. Therefore, untreated amblyopia reduces reading speed and stereoacuity and affects fine motor skills, causing a visual disability for the duration of life.[7]

Traditional amblyopia therapies (refractive adaptation, occlusion, or atropine penalization), based on reducing signal to a better-seeing eye while forcing the use of the amblyopic eye, have limitations that affect compliance.[2,8] Binocular amblyopia therapy based on perceptual learning and dichoptic training aims to eliminate patients' non-compliance and unsatisfactory results to traditional treatment in those diagnosed later in life.[9,10] In addition, binocular amblyopia therapy using a functional treatment approach can potentially improve binocular vision and provide faster visual acuity improvement because amblyopia is intrinsically a binocular problem.[11,12] Computer-based amblyopia treatment methods such as dichoptic therapy are yet to be widely accepted due to conflicting data on their effectiveness. Therefore, this study evaluated the effectiveness of dichoptic amblyopic treatment (Bynocs AmblyGo program; Kanohi Eye Pvt Ltd) in reversing the various types of amblyopia.[13]

PATIENTS AND METHODS

This retrospective cohort study was performed in the Department of Pediatric Ophthalmology and Strabismus of a tertiary eye hospital in South India. Data were collected from case records of patients diagnosed as having amblyopia and enrolled in dichoptic therapy (Bynocs AmblyGo platform) between January and August 2023. The inclusion criteria included patients diagnosed as having mild to moderate amblyopia (uniocular best corrected visual acuity [BCVA] of 6/60 or better) with bifoveal fixation and no tropia. All selected cases had completed the prescribed duration of dichoptic therapy. Patients with a history of prior occlusion therapy had abstained from patching for at least 3 months before starting dichoptic therapy. The number of hours of occlusion advised was according to Pediatric Eye Disease Investigator Group guidelines. Patients with deprivation amblyopia with pseudophakia had cataract extraction with intraocular lens implantation and refractive correction at least a year before enrollment for dichotic therapy. Those with strabismic amblyopia included in the study had undergone surgery for ocular alignment at least 3 months before enrollment, and orthophoria was ensured at enrollment. For all patients enrolled with refractive correction, glasses were worn for full waking hours and had been used for a minimum of 3 months before the commencement of the dichoptic therapy. Those with inconsistent follow-up, nonfoveal fixation, and uncorrected tropias were excluded from this study, because bifoveal fixation is a prerequisite for dichoptic stimulation.

An investigator-developed data extraction tool was used by trained research assistants to collect data from the patient's files. This included the patient's demographics (age and gender), ocular and systemic history, type of amblyopia, prior amblyopia treatment history, and number of dichoptic therapy sessions completed. All patients had undergone a complete baseline ocular examination that included assessment of BCVA using a logarithm of the minimum angle of resolution (logMAR) chart, ocular alignment status, anterior segment evaluation with a slit lamp, dynamic and cycloplegic refraction, orthoptic evaluation, dilated fundus examination, and fixation pattern evaluation using an ophthalmoscope. The orthoptic evaluation included binocular single vision measurement with the Worth 4-dot test, near stereopsis with Titmus (Stereo Fly Stereotest; Stereo Optical Co), distance stereopsis using polarized glasses with random-dot stereograms, prism cover test, and a four prism base out test to rule out microtropia.

We defined amblyopia as reduced BCVA lesAQ2 than 0.2 logMAR in both eyes or with a difference of greater than 0.2 logMAR units between the two eyes not attributed to any ocular pathology. Amblyopia was classified as strabismic, anisometropic, sensory deprivation, and ametropic.

At enrollment, all patients had the first session of the dichoptic treatment in the hospital to familiarize the patients and families with the dichoptic therapy platform (Bynocs AmblyGo).[14] The patients then continued with the therapy sessions at their homes via internet-connected devices with the guidance of an optometrist using a video call facility (Zoom platform). Each patient underwent at least five weekly sessions, each lasting an hour. The visual performance and therapy compliance were assessed online after every 10 sessions. Patients were called to the hospital after 20 to 30 sessions. The ocular

parameters recorded in clinic included stereoacuity, binocular single vision and logMAR visual acuity; their progress was evaluated to decide whether to stop or continue the therapy, depending on the test outcomes. The treatment was termed ineffective if there was no documented improvement in logMAR visual acuity levels/binocular single vision, or stereopsis even after continuing therapy for 2 months. In patients who showed improvement, therapy was discontinued if there was no improvement in acuity/binocular single vision stereopsis levels in two consecutive review visits, which are usually 3 to 4 weeks apart. At the end of therapy, the final BCVA with a logMAR chart, binocular single vision, and stereopsis were measured and recorded. In this study, we compared the values of the above parameters before and after treatment.

Dichoptic therapy uses complementary dichoptic stimuli (stimuli that balance the contrast between the amblyopic and fellow eye) to strengthen the nondominant eye.[11] It primarily targets visual aspects that require binocular integration to complete a visual task (eg, fusion and stereopsis).[12]

Bynocs Dichoptic Therapy is distinctively designed cloud-based software that enables the user to conduct therapy sessions as an office- and home-based therapy. The patient uses red-blue goggles for dissociation, and plays games on licensed software on a personal computer. The software is designed with active graphic components that can only be seen by the amblyopic eye and are filtered out for the other eye. Both eyes see some details to encourage fusion.

In Bynocs Dichoptic Therapy, two separate-colored stimuli of red and blue color are presented simultaneously in front of each eye using an anaglyph; the color contrast is adjusted in such a manner that the weaker eye perceives higher contrast by decreasing the contrast of the stimuli presented to the good eye. The stimuli presented undergo automated changes in size, frequency, and speed of the target presented along with changes in a crowded environment

Bynocs Dichoptic Therapy is designed in the form of video games (Super car, Super man, Super dragon, Super coin, Super jetski, and Super ball) for anti-supression, anti-crowding, contrast improvement, visual acuity improvement, form perception, and speed recognition. Super squad helps in anti-suppression and stereopsis and Super ee helps in stereopsis. Game presentations are dynamic in nature and change based on patients' response and with improvement in visual acuity, contrast function, figure ground perception skills, speed recognition, fusional capabilities, and depth perception. Thus the size of these stimuli and the games played are modified based on the visual acuity and binocularity of the patient. In addition, there are vergence games that help to improve the vergence amplitudes. Unlike Tetris games, Bynocs Dichoptic Therapy games have functionality to adjust contrast of the stimulus of each eye along with adjustment in spatial frequency, temporal frequency, and the size of the target. The program can run on any LED screen size more than 11 inches diagonally (ideal size would be 32 inches diagonally), uninterrupted internet connectivity at a minimum speed of 512 kbps, and recently upgraded Google Chrome browser (**Figure 1**).

Statistical Analysis

The primary outcome measures were the change in logMAR BCVA following therapy and the change in levels of binocular single vision and stereopsis for near and distance.

Data were cleaned, edited, and exported to STATA version 14.0 software (StataCorp) for analysis. Descriptive statistics were done by summarizing continuous variables into means and standard deviations for the normally distributed data and medians and interquartile ranges for non-normally distributed data. Categorical variables were summarized into frequencies and percentages. For statistical analysis, visual acuity Snellen equivalent values were converted into logMAR values. Visual acuities before and after the therapy were compared using the Wilcoxon signed-rank test. Binocular single vision and stereopsis were compared before and after the therapy using McNemar's chi-square test or Stuart-Maxwell test as appropriate. Bar graphs were drawn to visualize the levels of improvement on the near and distance stereopsis assessments. A P value less than .05 was considered statistically significant for all analysis.

Research assistants were adequately trained to use the data collection tool before the study commenced. The principal investigator and the trained research assistant pretested and standardized the data abstraction tool to extract relevant information from the patient files. The principal investigator was available for consultation and daily supervision. Data from case records were double-checked before

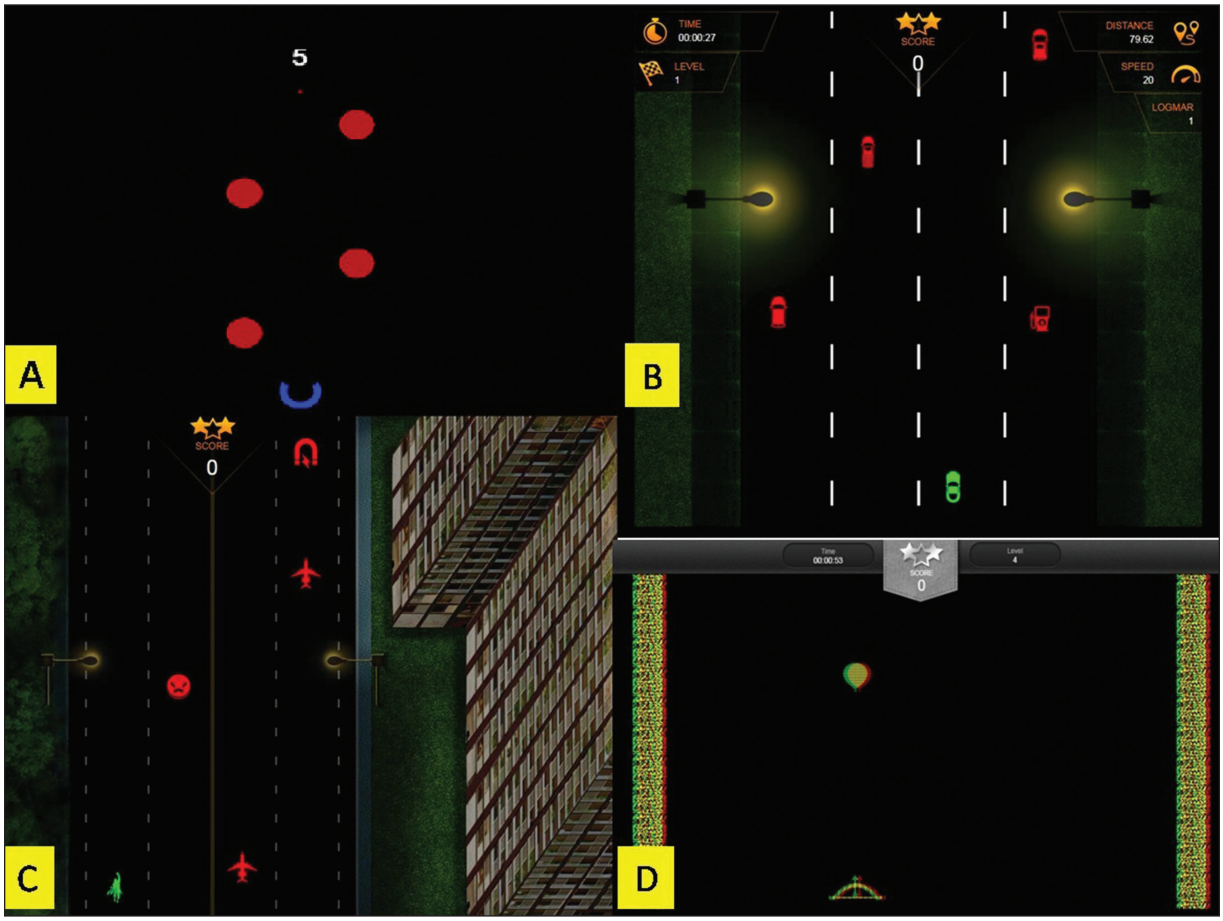

Figure 1. Images of different games on the Bynocs AmblyGo platform (Kanohi Eye Pvt Ltd). (A-C) Anti-supression games. (D) Fusion and stereopsis games.

being entered into Epidata Entry 4.2 software (EpiData) using the double-entry method. The principal investigator cross-checked the filled data extraction tool daily to ensure completeness, and any missing data were filled in as early as possible.

Ethical Consideration

This study was approved by the tertiary hospital's Institutional Review Board and Ethics Committee and conformed to the principles of the World Medical Association's Declaration of Helsinki. Due to the study's retrospective design and deidentified patient information, the review board waived the need for written informed consent.

RESULTS

The records of 59 patients (74 eyes) fit the inclusion criteria for this study. Of these, 53% were females. A total of 93.2% were younger than 20 years: 6 and younger = 6 (10.2%), 7 to 10 years = 21 (35.6%), 11 to 19 years = 28 (47.5%), and 20 years and older = 4 (6.8%). Their median age was 11 years (range: 5 to 30 years). Thirty-four patients (57.6%) had anisometropic amblyopia, 12 (20.3%) had ametropic amblyopia, 10 (17.0%) had strabismic amblyopia, and 3 (5.1%) had deprivation amblyopia.

Thirty-six (61.0%) patients had residual amblyopia after prior occlusion therapy and then started dichoptic therapy. Of the 36, 26 (72.2%) had anisometropic amblyopia, 5 (13.8%) had strabismic amblyopia, 3 (8.3%) had deprivation amblyopia, and 2 (5.6%) had ametropic amblyopia with unequal vision (hence the patching advice). As shown in **Table 1**, the median visual acuity before the start of occlusion therapy was 0.45 logMAR, which improved to 0.4 logMAR after occlusion therapy for a minimum period of 6 months (range: 6 to 60 months) and 0.2 logMAR after dichoptic therapy. This improvement in visual acuity following dichoptic therapy was statistically significant ($P < .001$) compared to that achieved in the same patients previously following occlusion therapy, and

TABLE 1

BCVA Comparison in Patients With Residual Amblyopia Before Occlusion, After Occlusion, and After Dichoptic Therapy Treatment[a]

Type of Amblyopia	BCVA Before Occlusion Median (IQR)	BCVA After Occlusion, Median (IQR)	*P*[a]	BCVA After Dichoptic Therapy, Median (IQR)	*P*[b]
Anisometropic amblyopia (n = 26)	0.40 (0.40 to 0.50)	0.40 (0.30 to 0.50)	.015	0.20 (0.10 to 0.40)	< .001
Ametropic amblyopia (n = 2)	0.30 (0.20 to 0.40)	0.30 (0.20 to 0.40)	–	0.10 (0.00 to 0.20)	–
Pseudophakia (n = 3)	0.30 (0.20 to 0.50)	0.30 (0.20 to 0.40)	.317	0.10 (0.10 to 0.10)	.109
Strabismic amblyopia (n = 5)	0.70 (0.50 to 0.70)	0.70 (0.50 to 0.70)	–	0.70(0.30 to 0.70)	.157
Total no. of eyes (n = 36)	0.45 (0.35 to 0.55)	0.40 (0.30 to 0.55)	.008	0.20 (0.10 to 0.40)	< .001

BCVA = best corrected visual acuity; IQR = interquartile range; SD = standard deviation
[a]Visual acuity values are reported using logarithm of minimal angle of resolution. A *P* value less than .05 is considered significant.
[b]Comparison of BCVA before and after occlusion therapy within each amblyopic type using the Wilcoxon signed-rank test.
[b]Visual acuity comparison after patching and after dichoptic therapy within each amblyopic type using the Wilcoxon signed-rank test.

TABLE 2

Comparison of Levels of BSV and Stereopsis Before and After Dichoptic Therapy

Characteristic, n (%)	Before Therapy, n (%)	After Therapy, n (%)
Near BSV W4DT		
Present	53 (89.8)	59 (100.0)
Suppression	6 (10.2)	0
Distance BSV W4DT		
Present	44 (74.6)	58 (98.3)
Suppression/absent	15 (25.4)	1 (1.7)
Near stereopsis (TNO with red and green glasses)		
Normal		
≤ 60	9 (15.2)	33 (55.9)
120 to 480	18 (30.5)	15 (25.4)
Gross	4 (6.8)	4 (6.8)
Absent	28 (47.5)	7 (11.9)
Distance stereopsis (random dot test with polarized glasses)		
Normal		
≤ 60	3 (5.1)	21 (35.6)
120 to 480	20 (33.9)	23 (39.0)
Gross	1 (1.7)	1 (1.7)
Absent	35 (59.3)	14 (23.7)

BSV W4DT = binocular single vision, Worth 4-dot test

improvement was most seen in those with anisometropic amblyopia. Due to the retrospective nature of the study, the exact hours of occlusion adhered to could not be quantified.

The average number of dichoptic sessions attended was 77 (range: 30 to 120). The average number of therapy sessions attended was 70 (range: 60 to 90) for ametropic amblyopia, 75 (range: 75 to 90)

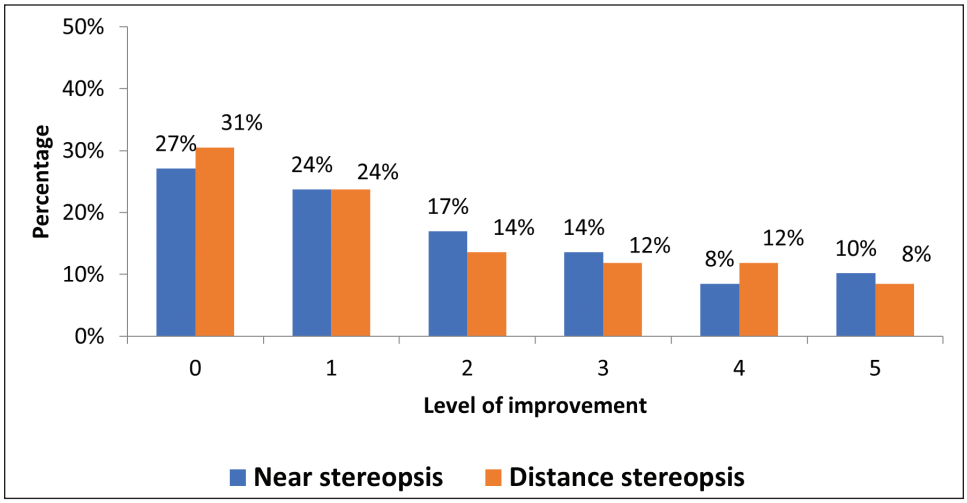

Figure 2. Comparison in the level of improvement in near and distance stereopsis after dichoptic therapy of patients with amblyopia who had dichoptic therapy treatment at a tertiary eye hospital in South India from January to August 2023. Levels are based on 0 = stagnant/same level, 1 = improvement by 1 level, 2 = improvement by two levels, and 5 = improvement by five levels.

for deprivation amblyopia, 75 (range: 30 to 120) for anisometropic amblyopia, and 70 (range: 60 to 100) for strabismic amblyopia.

Before starting dichoptic therapy, 6 (10.2%) patients did not have near binocular single vision, 15 (25.4%) did not have distance binocular single vision, 28 (47.5%) had no near stereopsis, and 35 (59.3%) had no distance stereopsis measured using the TNO and random dot tests.

On completing dichoptic therapy, 21 (75.0%) of the 28 patients with no stereopsis before treatment achieved some level of near stereopsis and 21 (60.0%) of the 35 patients with no distance stereopsis before treatment achieved distance stereopsis. Also, 24 patients (48.0%) attained normal stereopsis of 60 seconds of arc for near and 18 patients (32.1%) achieved stereopsis of 60 seconds of arc for distance, as shown in **Table 2**.

Six of 6 (100%) patients who had suppression for near regained binocular single vision after the therapy. Similarly, 14 of 15 (93.3%) participants who had suppression for distance regained binocular single vision, with only 1 (1.7%) persisting with left suppression. This relationship was statistically significant, with a *P* value of .001.

The average stereopsis grade achieved after therapy was 120 to 480 seconds of arc for near, and 20 patients (33.9%) were within 120 to 480 seconds of arc for distance. Thirty-three (55.9%) patients had near stereopsis of 60 seconds of arc or better, 15 had 120 to 480 seconds of arc, 4 had gross stereopsis, and 7 had no stereopsis. For distance stereopsis after therapy, 21 (35.6%) had 60 seconds of arc or better, 23 (39.0%) were within 120 to 480 seconds of arc, 1 (1.7%) had gross stereopsis, and 14 (23.7%) had no measurable stereopsis. Most patients improved by only one level of stereopsis (distance and near: 24.0%), although a few gained four to five levels of stereopsis, as shown in **Figure 2**. All patients with partial deprivation amblyopia (pseudophakia) had improved stereopsis following dichoptic therapy, followed by ametropic amblyopia (80.0%) and anisometropic amblyopia (near = 78.1%, distance = 75%), Strabismic amblyopia had the least improvement (near = 66.7%, distance = 44.4%).

In this study, anisometropic amblyopia was the most common etiology with 35 eyes (47.3%), followed by 24 (32.4%) for ametropic amblyopia, 10 (13.5%) for strabismic amblyopia, and 5 (6.8%) for deprivation amblyopia with pseudophakia. Of the 74 eyes with amblyopia, 82.4% (61 eyes) had improved visual acuity, with 55.7% (34 eyes) improving by at least two logMAR lines (0.2). All eyes of patients with ametropia and deprivation amblyopia had some visual acuity improvement, followed by 80% of eyes with anisometropic amblyopia and 40% with strabismic amblyopia. Thirteen (17.6%) eyes showed no improvement in visual acuity, as shown in **Table 3**. However, 5 (38%) of these with no acuity improvement had improvement in near and distance stereopsis (4 with anisometropic amblyopia and 1 with strabismic amblyopia). Two with strabismic amblyopia had improvement only in near stereopsis, 1 with anisometropic amblyopia improved only in distance stereopsis, and 1 with anisometropic amblyopia had no improvement in near and distance stereopsis. Three with strabismic amblyopia and one with anisometropic amblyopia had

TABLE 3

LogMAR Visual Acuity Improvement in Different Types of Amblyopia Following Dichoptic Therapy Treatment at a Tertiary Eye Hospital in South India From January to August 2023

		VA Lines of Improvement[a]				
Type of Amblyopia	n (%)	0	1	2	3	Overall Improvement, n (%)
Anisometropic	35 (47.3)	7	4	13	11	28 (80.0)
Ametropic	24 (32.4)	0	3	16	5	24 (100.0)
Deprivation	5 (6.8)	0	1	2	2	5 (100.0)
Strabismic	10 (13.5)	6	0	3	1	4 (40.0)
Total no. of eyes	74	13	8	34	19	61 (82.4)

[a]Levels are based on 0 = remained unchanged, 1 = change of 0.1, 2 = change of 0.2, and 3 = change of 0.3 in logMAR values when the initial value is compared with the final value.

TABLE 4

BCVA Comparison Before and After Dichoptic Therapy[a]

Age Classification	BCVA Before Therapy	BCVA After Therapy	*P*[b]
≤ 10 years	0.50(0.40 to 0.60)	0.30 (0.10 to 0.40)	< .001
> 10 years	0.40 (0.30 to 0.50)	0.20 (0.10 to 0.40)	.001
P[c]	.123	.590	

BCVA = best corrected visual acuity
[a]Visual acuity values were reported in logMAR using median and interquartile range (IQR). A *P* value less than .05 is considered significant.
[a]Comparison of BCVA before and after the dichoptic therapy for each age group using the Wilcoxon signed-rank test.
[b]Compariosn of BCVA between the age groups at before and after the dichoptic therapy using the Wilcoxon rank-sum test.

no improvement in stereopsis and binocular single vision. In summary, of all 74 eyes, only 3 eyes did not show an improvement in any of the three tested parameters after dichoptic amblyopia therapy.

On comparing the BCVA before and after dichoptic therapy in younger patients (10 years and younger) versus older patients (older than 10 years) in our study cohort, we found that they both improved by a statistically significant degree and there was no statistically significant difference in acuity improvement between the two groups (**Table 4**). This result is promising because it signifies significant treatment benefit with dichoptic therapy for older patients with amblyopia.

Twenty-seven patients (33 [44.6%] eyes) had follow-up data after cessation of dichoptic therapy (mean duration after stopping therapy: 5.5 months; range: 3 to 12 months). All maintained the same post-treatment values on all parameters except in 4 (12.1%) eyes (3 with strabismic and 1 with ametropic amblyopia), which showed a drop in visual acuity of one logMAR line. They restarted a short course of dichoptic therapy for 2 weeks.

DISCUSSION

We evaluated the changes in visual acuity, binocularity, and stereopsis among 59 patients (74 eyes) before and after dichoptic therapy for amblyopia.

The majority of the patients were males younger than 20 years, with an average age of presentation of 11 years. This is similar to study findings from India that show the mean age of amblyopia presentation to range between 10 and 11 years, with the majority being male.[15,16] Anisometropic amblyopia was the most common etiology in our patients (47.3%), and this is similar to a community-based study in Indian children that indicated that the most common cause of amblyopia was uncorrected refractive error (45.29%).[15] The slight difference in prevalence might be because of the small sample size in our study compared to the 39,651 patients in the above research and the difference in the study setting. However, this differs from another study in a tertiary eye care center that showed strabismic amblyopia as the most common type (53.7%).[16] This is because our research selected only those children who had undergone strabismus surgery prior to the

start of therapy, hence excluding many of the patients with strabismic amblyopia, because conventionally most surgeons would prefer to treat amblyopia before attempting strabismus surgery.

This study's average number of dichoptic therapy sessions attended by the patients was 77, translating to 11 weeks. Previous published studies have shown improvement in 12 weeks or less.[17] However, most of these studies with a shorter duration used mixed methods of amblyopia treatment or were including children younger than 8 years, whereas most (63.3%) of our patients had residual refractory amblyopia following prior occlusion therapy at enrollment and hence needed more therapy sessions.[17,18]

Similar to other published studies on dichoptic therapy for amblyopia, all 6 patients who had suppression of binocular single vision at near and 93.3% who had suppression at distance before treatment showed significant restoration of binocular single vision at the end of therapy.[19-22] Furthermore, 69.0% of the patients attained some stereopsis following therapy, with 44.4% and 35.3% achieving normal (60 seconds of arc) near and distance stereopsis, respectively, after therapy. The above studies agree with prior studies that show significant improvement in stereopsis due to stimulation of visual functioning using both eyes simultaneously in dichoptic therapy training with high-attention demand tasks in the amblyopic eye.[19]

Most patients with amblyopia had improved visual acuity of at least two logMAR lines, with 34 of 74 eyes attaining 0.2 log visual acuity, similar to other study findings.[17,22-24] However, a study on Chinese children 7 to 10 years of age showed an improvement of at least three logMAR lines, which was slightly higher than in our study.[25] The above study only included children with bilateral refractive amblyopia in a different setting. Their age was closer to the visual maturation age limits than ours, which included a wide age range. Similarly, patients with bilateral ametropia and deprivation amblyopia had the most significant improvement in our study. The patients with deprivation amblyopia had mild to moderate amblyopia postoperatively for partial cataracts with intraocular lens implantation, which could explain the good response to dichoptic therapy. This result might also be confounded because our study had smaller numbers in this group than the anisometropic amblyopia group. In addition, all patients with ametropia and most with deprivation amblyopia had similar involvement of both eyes; hence, most had binocular single vision compared to the patients with strabismic and anisometropic amblyopia in whom suppression was present.

In the current study, a significant percentage of patients who had failed to improve with conventional occlusion therapy showed improvement in visual acuity and binocular vision parameters following dichoptic therapy. Due to the retrospective nature of the study, we had no data on binocular single vision and stereopsis values before and after occlusion therapy because these were not routinely documented. The compliance with patching and exact duration of patching therapy could not be ascertained.

Due to the retrospective nature of this study, we did not have a control arm to ascertain that visual acuity improvement was only by dichoptic therapy and no other methods, such as refraction correction glasses. However, this limitation was controlled by ensuring all patients with refractive errors selected in this study had used correction lenses for at least 3 months before starting dichoptic therapy.

CONCLUSION

Dichoptic therapy training on the Bynocs AmblyGo platform improves visual acuity, binocularity, and stereoacuity in patients with amblyopia, including those above the visual maturation age (older than 8 years) and even in those patients with residual amblyopia following occlusion, especially in deprivation, ametropic, and anisometropic amblyopia. The results achieved after Bynocs Dichoptic Therapy were maintained over a 5-month follow-up period.

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AQ1 Please indicate how the author name Mohammed Sithiq Uduman should be indexed (Uduman MS or Sithiq Uduman M). Please also confirm that Jogitha is the full author name.

AQ2 Per journal style, visual acuity should be reported as better or worse than rather than more or less. Please edit the text as necessary.