Clinical Ophthalmology

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REVIEW

Efficacy of Dichoptic Treatment vs Eye Patching in Pediatric Patients with Amblyopia: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Reem O Nughays[1,2], Enar A Almazroy[1,2], Shahad K Elyas[1,2], Anas Alamoudi[3], Waleed Talib Batais[1,2], Asim Marwan Bogari[1,2], Ahmed Alnabihi[1,2], Dania Hamad Alkharboush[2,4], Hashem Almarzouki[1,2,4]

[1]College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Jeddah, Saudi Arabia; [2]King Abdullah International Medical Research Center, Jeddah, Saudi Arabia; [3]Department of Ophthalmology, Jeddah Eye Hospital, Jeddah, Saudi Arabia; [4]Department of Pediatric Ophthalmology, King Abdulaziz Medical City, Jeddah, Saudi Arabia

Correspondence: Ahmed Alnabihi, College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Jeddah, 21423, Saudi Arabia, Tel +966569493360, Email Alnabihi.ahmed@gmail.com

Objective: This systematic review and meta-analysis compares the efficacy and safety of dichoptic therapy vs traditional patching in treating pediatric amblyopia. The primary focus was on improvements in visual acuity (VA) and stereoacuity (SA), with an evaluation of adverse events and treatment compliance.

Methods: A comprehensive search was conducted across PubMed, Scopus, Cochrane, and other databases up to August 2024. Randomized controlled trials (RCTs) comparing dichoptic therapy with eye patching in children (aged 0–18) with amblyopia were included. Studies reporting VA and SA outcomes were analyzed. The primary outcome was VA improvement; secondary outcomes included changes in SA and adverse events. Meta-analysis was performed using RevMan software, with random-effects models.

Results: Eleven studies involving 902 children with amblyopia were included. Patching resulted in a statistically significant improvement in VA, with a pooled standardized mean difference (SMD) of 0.27 logMAR lines (95% CI: 0.07–0.48, $p = 0.008$), favoring patching over dichoptic therapy. Stereoacuity improvements were not significantly different between the two approaches (SMD: 0.28, 95% CI: −0.11–0.68, $p = 0.16$). Adverse events were more common in the patching group, with skin irritation being the most frequently reported issue. Both treatments showed moderate to high levels of compliance.

Conclusion: While patching demonstrated a modest advantage in improving visual acuity, dichoptic therapy provides a promising alternative, particularly due to its interactive nature and potential to improve treatment compliance. Given no significant difference in stereoacuity outcomes and the mild adverse events associated with both methods, dichoptic therapy should be considered a viable option for amblyopia treatment in children.

Keywords: amblyopia, dichoptic therapy, eye patching, visual acuity, stereoacuity

Introduction

Amblyopia, commonly known as "lazy eye", is a developmental neuro-ophthalmic disorder that impacts the visual processing pathways and ultimately manifests as diminished visual acuity. It is characterized by neurodevelopmental deviations that affect the visual pathways' structural and functional maturation during early childhood, leading to unilateral or, less commonly, bilateral visual impairment. In the pediatric population, amblyopia is the predominant cause of unilateral visual loss, with an estimated prevalence of 2% to 4% among children.[1] The etiology of amblyopia is linked to disruptions in normal binocular visual maturation, commonly attributed to conditions such as strabismus or anisometropia. These disruptions, occurring within the critical period of visual system development, interfere with

Received: 11 January 2025
Accepted: 26 May 2025
Published: 26 June 2025

normal synaptic development and cortical organization, ultimately causing amblyopia.[2] The optimal time to treat amblyopia is during the critical period of visual development, an early childhood phase when the visual cortex exhibits heightened plasticity and is highly responsive to sensory input. During this period, visual stimuli from each eye contribute to the refinement and functional connectivity of the visual cortex. If disruptions extend beyond this stage, visual impairment may become irreversible due to decreased cortical plasticity, emphasizing the need for early diagnosis and intervention.[3] Although refractive correction with glasses is a necessary first step in managing amblyopia, studies have shown that it alone is often insufficient to fully restore visual acuity, particularly in cases of moderate to severe amblyopia.[4] Untreated amblyopia may lead to permanent functional deficits, underscoring the importance of therapeutic intervention during this window.[3] Occlusion therapy, the traditional treatment modality for amblyopia, involves patching the dominant eye for several hours daily, thereby stimulating the weaker eye and promoting cortical plasticity. This therapeutic strategy aims to induce visual input through the amblyopic eye, encouraging neuroplastic adaptation and enhancing visual acuity. In one study that demonstrated the efficacy of occlusion therapy, with 74% of patients maintaining stable or improved visual acuity even 12–15 years post-treatment. However, adherence remains a prominent challenge, as factors such as child distress during patching, family relationship pressures, and the lack of engaging support strategies contribute to suboptimal compliance, thereby potentially diminishing therapeutic success.[5] In response to these limitations, dichoptic therapy has emerged as an innovative therapeutic option with a binocular focus, aiming to alleviate interocular suppression—a phenomenon wherein the visual input from the dominant eye suppresses the weaker eye. Dichoptic therapy involves the simultaneous presentation of distinct visual stimuli to each eye, counteracting the inhibitory influence of the dominant eye over the amblyopic eye. This dual-eye approach is thought to address the core mechanism underlying amblyopia, particularly in cases associated with anisometropia.[6] By attenuating interocular suppression, dichoptic therapy not only promotes visual acuity improvements but also seeks to restore stereoacuity, an essential component of depth perception often compromised in amblyopic patients. Additionally, alternative approaches such as perceptual learning—a paradigm involving repetitive practice of visual discrimination tasks to enhance neural processing—have demonstrated potential in improving visual function in amblyopic patients.[7] Therefore, this systematic review and meta-analysis aims to thoroughly compare the effectiveness of dichoptic therapy and traditional eye patching in pediatric patients diagnosed with amblyopia. The primary focus will be on evaluating the degree of improvement in visual acuity and stereoacuity achieved with each treatment modality, as these outcomes are critical for functional visual development. Additionally, this study will assess the occurrence and nature of adverse events associated with each treatment approach to provide a clear understanding of their safety profiles. By offering a comprehensive evaluation of both dichoptic therapy and eye patching, this analysis seeks to clarify the clinical implications of these options, assisting clinicians in making evidence-based treatment recommendations that optimize patient outcomes in pediatric amblyopia.

Methods

This systematic review and meta-analysis of randomized clinical trials was registered with PROSPERO online database (identifier: CRD42024577564) and performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist.

Search Strategy

The authors conducted a comprehensive search to identify relevant studies for inclusion in this systematic review and meta-analysis. The search was performed across the following electronic databases: PubMed, Medline, ScienceDirect, Web of Science, Cochrane Central Register of Controlled Trials, Google scholar, and Scopus from their inception until August 2024. The search strategy was developed using a combination of Medical Subject Headings (MeSH) terms and relevant keywords to ensure the inclusion of related studies. It was conducted using the following terms: (pediatric OR children) AND (amblyopia OR lazy eye) AND (dichoptic treatment OR dichoptic therapy OR binocular therapy) AND (patching OR occlusion therapy OR eye patching). The search was restricted to English language publications. No restrictions were placed on study design, population, or setting to capture all relevant studies.

Study Selection

Search results from all above-mentioned electronic databases were exported as RIS or CSV files, depending on the database, and inserted into Rayyan software to resolve duplicates. We focused on including randomized controlled trials (RCTs) and controlled trials that involved pediatric patients aged 0 to 18 years with amblyopia. We specifically looked for studies that compared the dichoptic treatment to eye patching and assessed outcomes related to visual acuity and stereoacuity. Only studies published in English were included. We excluded studies that were not published in English or that used methods we were not interested in, such as meta-analyses, systematic reviews, economic analyses, animal studies, cadaver studies, narrative reviews, case reports, or case series. Studies that included adults or mixed-age groups without separate data for children, or those that did not compare dichoptic treatment with eye patching, were also left out. Additionally, we excluded studies involving pediatric patients with other ophthalmological conditions besides amblyopia. Two reviewers screened the titles and abstracts of the retrieved records independently. Full-text articles of potentially eligible studies were then assessed independently by two other reviewers according to the above-mentioned criteria. In the event of any disagreements, a third author was designated to resolve the conflicts and achieve a consensus.

Data Extraction and Risk of Bias Assessment

One reviewer established the data extraction sheet, which included detailed information from each study. We noted the first author's last name, the publication year, and the journal in which the study appeared. We also recorded the country of the research, and the study design used. For each study, we documented the total number of patients in both the study and control groups, including their mean age and standard deviation. We detailed the sex distribution, specifying the number of males and females in each group. Visual acuity was measured at baseline and after treatment for both the dichoptic and patching methods. We extracted stereoacuity measurements at both baseline and after treatment for each method. The duration of treatment was recorded in minutes, days, or weeks for both the dichoptic and patching methods. Additionally, we noted the last follow-up, any complications, and patient compliance. Information on the device used, the method of intervention, and outcome measures was documented. Finally, we recorded any associations with amblyopia and summarized the conclusions of the studies. The extraction process was conducted by two authors, with the same one who established the data extraction sheet assigned to ensure the consistency and accuracy of the extracted data. The risk of bias assessment was carried out by two authors. To minimize bias, each author independently evaluated the articles using the Cochrane Risk of Bias Tool for RCTs. This tool assesses several domains, including the randomization process, intervention process, missing data, outcome measurement, and selection of reported results. Each domain detects specific types of bias, such as selection, performance, detection, attrition, and reporting bias. In case of discrepancies, the two authors discussed their assessments to achieve a consensus.

Outcome Measures

In this research, we aim to compare the effectiveness of dichoptic treatment versus eye patching by evaluating several key outcomes. The primary outcome is the improvement in visual acuity, which will help determine which treatment provides better enhancement in visual performance. Secondary outcomes include changes in stereoacuity. We also addressed adverse events to compare the safety profiles of the two treatments, ensuring a thorough evaluation of both efficacy and potential risks.

Data Synthesis and Analysis

The data synthesis was performed using RevMan software. We calculated standardized mean differences with 95% confidence intervals (CIs) for continuous outcomes. To assess the heterogeneity between studies, we used the I^2 statistic and its associated p-value. A random-effects model was applied using the DerSimonian and Laird approach, where weights were calculated using the inverse variance method to balance the influence of different studies. To ensure the robustness of our findings, we conducted sensitivity analyses specifically for outcomes that exhibited high heterogeneity. Additionally, we performed qualitative assessments to enrich our overall understanding of the evidence. Statistical significance was determined with p-values, considering a threshold of $p < 0.05$. Lastly, we visually analyzed the asymmetry of funnel plots when at least 10

https://doi.org/10.2147/OPTH.S513329

studies were obtained. This thorough approach allowed us to provide a detailed and reliable analysis, accounting for the variability across studies and ensuring that the study quality was thoroughly evaluated.

Results

Study Selection

The initial literature search yielded a total of 1329 articles. These articles were screened for duplicates, and 345 duplicate articles were identified and removed. The remaining 984 articles were then assessed for eligibility based on title and abstract screening, resulting in the exclusion of an additional 943 articles. Of the 41 studies that underwent full-text review, 30 articles did not meet the inclusion criteria. Ultimately, 11 articles were included in the systematic review.[8–19] The study selection process is illustrated in detail in Figure 1.

Trial Characteristics

All included studies were conducted between 2016 and 2024 across various countries, including the United States, The United Kingdom, the Netherlands, China, and Japan. These studies aimed to examine the comparison between dichoptic treatment and patching in pediatric patients with amblyopia. In the analysis, all studies were designed as randomized controlled trials (RCTs) except for one which was a pilot prospective study. The characteristics of the included studies are summarized in Table 1.

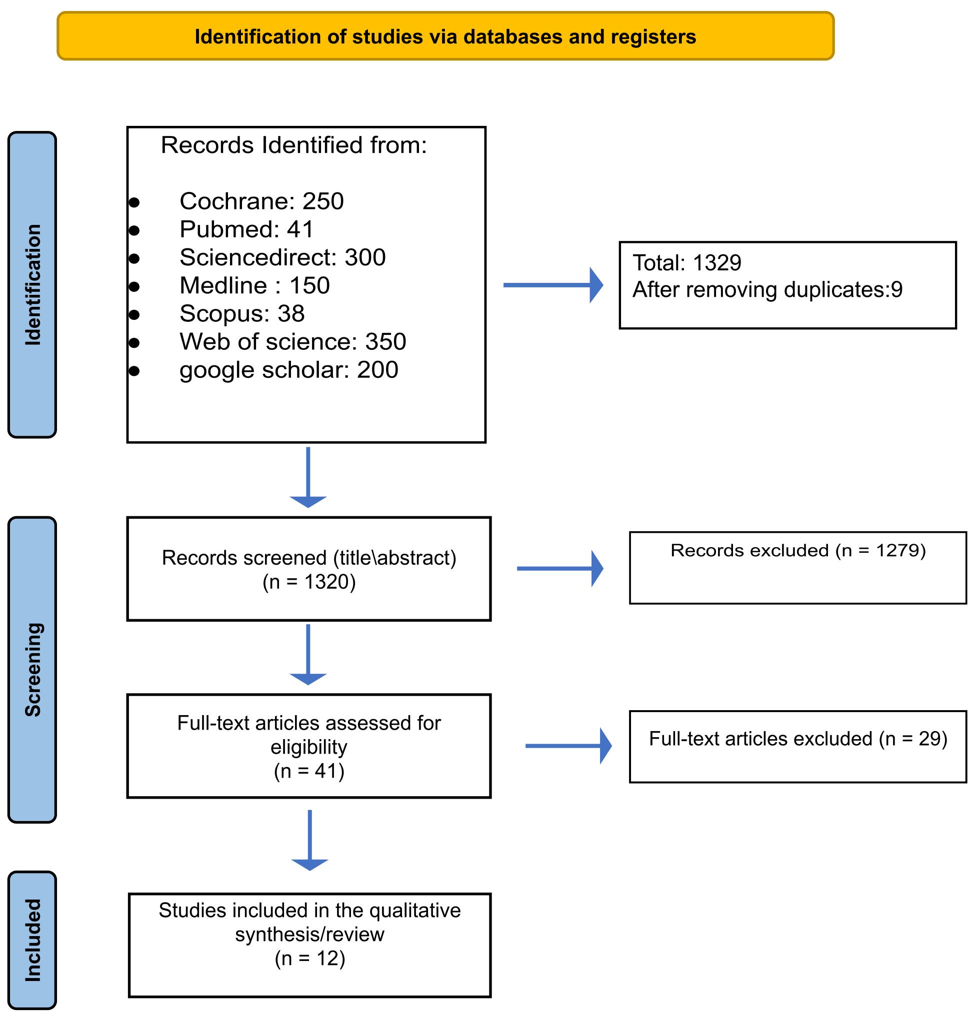

Figure 1 Flow diagram of the studies selection based on PRISMA.

Table 1 Studies and Participants Characteristics

Included Studies	Country	Study Design	Amblyopia Associated with	Total Number of Participants			Age (Mean, SD)		Gender	
				Dichoptic	Patching	Total	Dichoptic	Patching	Male	Female
Holmes 2016[9]	The United States	RCT	Strabismus, Anisometropia, or Both	182	188	370	8.4 ± 1.8	8.6 ± 2.0	198	187
Kelly 2016[14]	The United States	RCT	Strabismus, Anisometropia, or Both	14	14	28	6.60±1.39	6.95±1.51	21	7
Manh 2018[10]	The United States	RCT	Strabismus, Anisometropia, or Both	40	60	100	14.3 ± 1.1	14.3 ± 1.1	58	42
Birch 2020[12]	The United States	RCT	Strabismus, Anisometropia, or Both	24	24	48	6.71 ±1.83	6.95±1.77	32	18
Yao 2020[13]	China	RCT	Anisometropia	36	38	74	6.5± 2.81	5.95 ± 2.28	34	40
Jost 2022[17]	The United States	RCT	Strabismus, Anisometropia, or Both	28	30	58	6.0 ±1.4	6.1 ±1.5	26	34
Iwata 2022[15]	Japan	RCT	Anisometropia	24	34	58	4.5 ± 1.0	4.8 ± 1.0	–	–
Kadhum 2023[5]	Netherlands	RCT	Strabismus, Anisometropia, or Both	7	14	21	5.8	4.9	17	16
Zhu 2023[8]	China & Israel	Pilot RCT	Anisometropia	12	14	26	6.42 ± 1.44	5.71 ± 1.33	15	11
Wygnanski-Jaffe 2023[11]	Israel	RCT	Small- Angle Strabismus, Anisometropia, or Both	51	52	103	6.63 ± 1.34	6.94 ± 1.43	51	52
Dahlmann-Noor 2024[16]	The United Kingdom	RCT	Strabismus, Anisometropia, or Both	11	9	32	4.81 ± 0.83	5.13 ± 0.96	16	16

Patient Demographics

This systematic review includes 11 studies encompassing a total of 902 patients with amblyopia.[8–19] The total number of male participants (N = 468), constituting a greater proportion of the research population, while female participants accounted for (N = 421). One study did not report detailed gender information of their sample. The age range across these studies spans from 4.5 years to 14.3 years. Detailed information on gender distribution, age, and demographics are provided in Table 1.

Meta-Analysis

Visual Acuity (VA)

The pooled standardized mean difference (SMD) using the random-effect model was 0.27 with significant p-value (95% CI: 0.07 to 0.48, p= 0.008), favoring patching. Heterogeneity was moderate (I^2 = 44%, p = 0.06), suggesting some variability across the studies. Despite this, the overall effect consistently favored patching for visual acuity improvements. Figure 2

Stereoacuity (SA)

The pooled standardized mean difference (SMD) using the random-effect model was 0.28 with non-significant p-value (95% CI: −0.11 to 0.68, p= 0.16), favoring patching. Heterogeneity analysis revealed an I^2 statistic of 53% with a p-value of 0.08, suggesting more variability across the studies. Figure 3

Qualitative Analysis

Visual Acuity (VA)

Overall, the included studies suggest that dichoptic treatment generally shows better or comparable outcomes in improving visual acuity (VA) compared to patching in amblyopia. Zhu et al (2023) found no significant differences between the two treatments at 12 weeks, with VA improvements of 0.37±0.19 for dichoptic and 0.26±0.1 for patching,

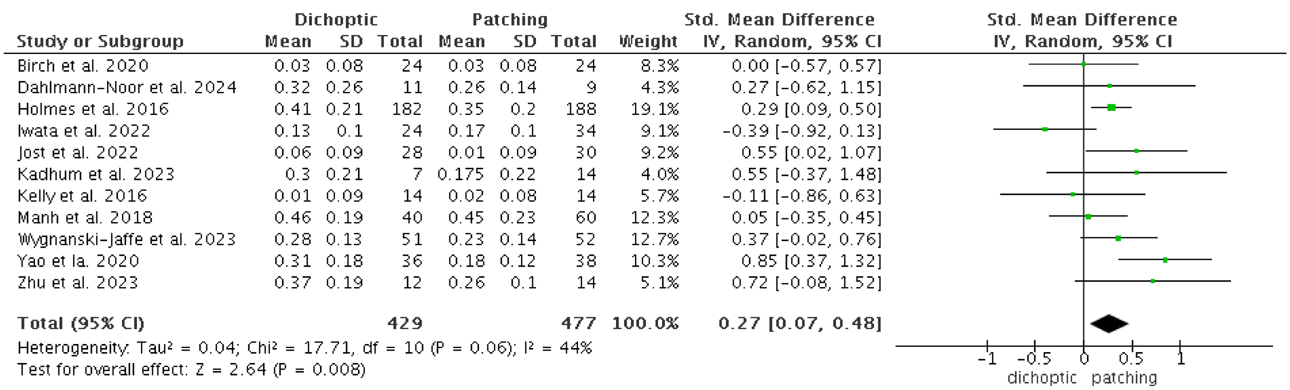

Figure 2 Forest plot comparing VA after dichoptic treatment and patching treatment.
Abbreviations: Chi², chi-square statistic; CI, confidence interval; IV, inverse variance; I², I-square heterogeneity statistic; Z, Z statistic[5,8–17].

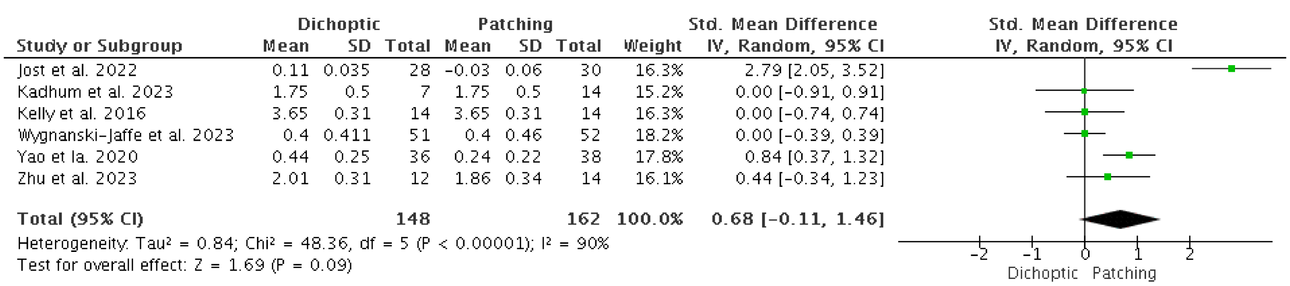

Figure 3 Forest plot comparing stereoacuity after dichoptic treatment and patching treatment.
Abbreviations: Chi², chi-square statistic; CI, confidence interval; IV, inverse variance; I², I-square heterogeneity statistic; Z, Z statistic[5,8,11,13,14,17].

indicating similar therapeutic effects.[8] However, Holmes et al (2016) reported slightly better outcomes with patching (0.35±0.2) than dichoptic (0.41±0.21), although dichoptic treatment still showed significant VA improvement.[9] In teenagers, Manh et al (2018) revealed nearly equal results between dichoptic (0.46±0.19) and patching (0.45±0.23).[10] Kadhum et al (2024) demonstrated that VR gaming, as a form of dichoptic treatment, offered similar efficacy to patching (0.3±0.21 vs 0.175±0.22) in older children with refractive amblyopia.[5] Additionally, Wygnanski-Jaffe et al (2023) confirmed that dichoptic treatment (0.28±0.13) was non-inferior to patching (0.23±0.14) in younger children.[11] Moreover, Birch et al (2020) highlighted the greater efficacy of binocular treatment in orthotropic children with moderate amblyopia.[12] However, Yao et al (2020) revealed that patching (0.18±0.12) was more effective than dichoptic treatment (0.31±0.18) in Chinese children with anisometropic amblyopia, though dichoptic treatment still showed notable improvement.[13] Kelly et al (2016) found dichoptic treatment to be more successful than patching over 2 weeks (0.01 ±0.09 vs 0.02±0.08).[14] Moreover, Iwata et al (2022) reported better compliance and VA improvement with polarizing film (0.13±0.10) compared to patching (0.17±0.10).[15] Dahlmann-Noor et al (2024) suggested that dichoptic (0.32±0.26) was as safe and effective as patching (0.26±0.14).[16] In contrast, Jost et al (2022) showed continued VA improvement with binocular movie treatment at 6 weeks, outperforming patching (0.06±0.09 vs 0.01±0.09).[17]

Stereoacuity (SA)

Both dichoptic and patching treatments demonstrated significant improvements in stereoacuity (SA). However, when comparing the two treatments, results varied across studies. Zhu et al (2023) reported that the dichoptic group showed a statistically significant improvement in SA at week 12, with SA improving from baseline to 2.01 ± 0.31 log arcseconds ($P < 0.001$), while the patching group improved to 1.86 ± 0.34 log arcseconds ($P = 0.007$) over the same period.[8] Despite these findings, several studies reported no significant differences in SA improvements between the dichoptic and patching groups.[5,9–11,13] Moreover, Kelly et al (2016) showed no significant improvement in SA for both groups, with unchanged median values before and after treatment ($P = 0.48$ for both).[14] Similarly, Dahlmann-Noor et al (2024) found no significant difference between the occlusion and dichoptic groups at 16 weeks ($P = 0.70$), although Frisby SA improved significantly from baseline to week 16 in the occlusion group ($P = 0.013$), but not in the dichoptic group ($P = 0.118$).[16] Also, Jost et al (2022) found no significant association between baseline SA (nil vs ≤ 3.3 log arcseconds) and VA improvement at the 2-week primary outcome visit in either the movie or patching groups ($P = 0.37$ and $P = 0.38$, respectively), suggesting that initial SA did not influence VA outcomes in either group.[17]

Adverse Events

Mild to moderate skin irritation was the most frequently noted adverse event, particularly in the patching group, where it was observed in multiple studies.[9,10,13] Another noteworthy adverse event was the worsening of heterotropia, which was reported in both the dichoptic and patching groups.[10] Additionally, transient symptoms such as double vision and headaches were reported in dichoptic group, all of which resolved spontaneously after the treatment was discontinued.[16]

Risk of Bias Assessment

Overall, the studies exhibited a low risk of bias in most domains, such as random sequence generation, blinding of outcome assessment, and incomplete outcome data. However, allocation concealment and selective reporting were categorized as having an unclear risk of bias in several studies due to a lack of detailed information on these processes. Notably, one study was identified as having a high risk of bias in the blinding of participants and personnel, which raises concerns about potential performance bias. Figure 4

Publication Bias

The funnel plot illustrates the distribution of studies based on their effect sizes (SMD) and their precision (SE). Overall, the plot looks fairly symmetrical, which reduces the likelihood of major publication bias. However, there is a slight imbalance with a few studies leaning to one side, suggesting potential small-study effects or methodological variations. While the overall plot suggests that publication bias is not a significant concern, the slight asymmetry should be noted and considered when interpreting the findings. Figure 5

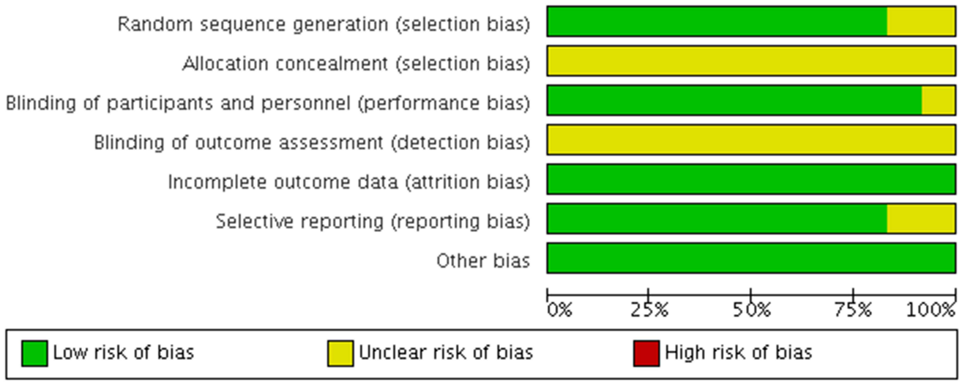

Figure 4 Diagram showing an assessment of the quality of individual trials.

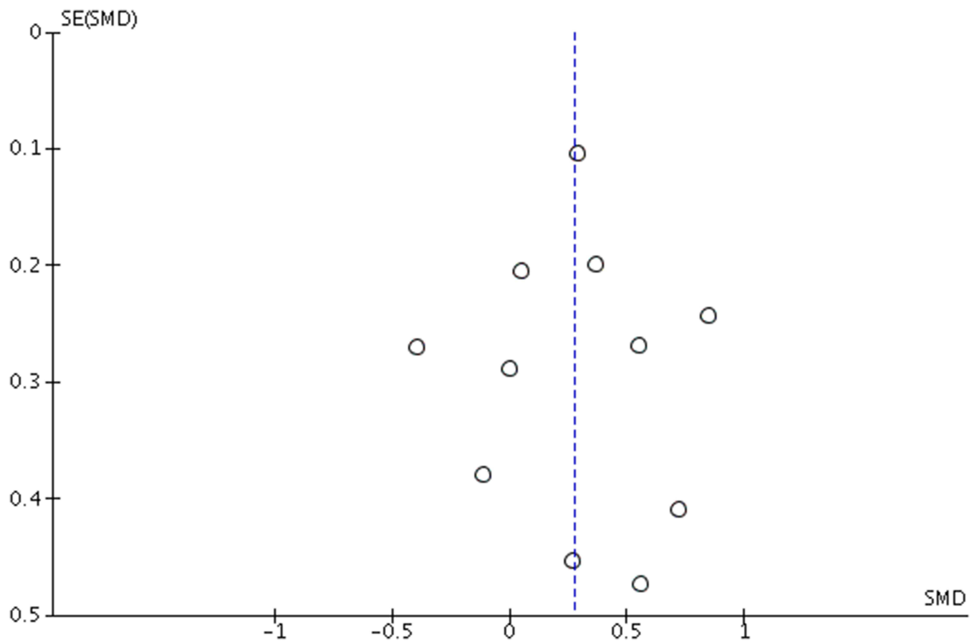

Figure 5 Funnel plot for the assessment of publication bias in the included studies.

Discussion

Our systematic Our systematic review and meta-analysis provides a robust evaluation of dichoptic therapy compared to traditional eye patching methods for amblyopia management in children. According to the data, it would appear that both treatment techniques bring a marked improvement in visual acuity, although that improvement seems to be greater with the use of patches (SMD 0.27, p=0.008). What makes the present study interesting is that it combines the results from multiple recently conducted randomized trials from different countries and different patient populations to evaluate these novel dichoptic compared to traditional patching treatment approaches rather standardly. This broad approach increases the applicability of our results to the real settings and fills the gap that exists in literature pertaining to the comparative effectiveness of these procedures.

Appraisal of the findings indicates that dichoptic therapy which uses separate images in each eye is likely to be a satisfactory replacement for patching as far as patient compliance and engagement are concerned. The results coincide with our question which aimed at finding out whether dichoptic therapy can be as effective if not more than patching for treating amblyopia. While our meta-analysis evidenced a clear advantage in the improvement of visual acuity through the

 https://doi.org/10.2147/OPTH.S513329

standard approaches of patching, the results still recognized the dichoptic approach in some other studies suggesting that it would be especially appropriate for the children who are non-compliant with patching measures.

Several studies support the same conclusions as ours as shared within literature, and it is always helpful to weigh our results against existing literature. For example, one of such study was a randomized controlled trial performed in several centers across the United States where there was a higher improvement of 1.8 lines of visual acuity in the dichoptic treatment group compared to 0.8 lines of improvement in the no-treatment group.[18] Also, a systematic review published by Yeritsyan et al (2024) compared the available amblyopia treatments to wearing a patch and determined that dichoptic treatment is a practical approach that achieves similar aims as patching when used on amblyopic patients.[19] Besides the possible effectiveness of the dichoptic treatment, it has to be once again pointed out that this treatment is compliant to a greater degree. Iwata et al (2022) revealed that compliance rates were much greater in the dichoptic treatment group than in the patching group.[15] Such a strong compliance to the dichoptic treatment, as it is assumed because of the less invasive nature of the treatment, resulted in better visual acuity than traditional patching procedures.[15] Better compliance is one of the prerequisites, which ensures capturing the patient's attention more regularly and limiting the negative features of patching, such as discomfort or sociocultural issues.

An important attention in this evaluation is engaged towards the effects of each of the treatments on stereoacuity (SA), which comes from binocular vision. Patching had more or less moderate benefits in visual acuity improvement. However, no significant discrepancy in SA improvement was found in the two treatment methods. This implies that dichoptic therapy offers some particular advantage of binocular vision deficits through providing histological images to each eye separately which is usually not optimally addressed by patching. Some studies advocate this idea by demonstrating that children can easily tolerate dichoptic methods and maintain proper adherence in the course of treatment, thus making it more effective than patching.[15] Better adherence increases the chances of achieving the treatment effects, which is very important in the management of amblyopia disease. It has also been demonstrated that dichoptic therapy works effectively to produce a binocular improvement, especially among children who cannot stand wearing patches because of social reasons or simply discomfort.[19] Therefore, even though visual acuity improvement is

Table 2 Methods of Dichoptic Therapy

Method	Description	Advantages	Limitations	Studies
Red-Blue Anaglyph	Uses colored filters (eg, red/green or red/blue glasses) to separate stimuli.	- Low cost- Simple setup- Widely studied for amblyopia.	- Limited color perception- Potential crosstalk between eyes.	Holmes et al; (2016)[9] Yao et al, (2020)[13]
Polarized	Polarizing filters or films to isolate images for each eye.	- Minimal crosstalk- Maintains color accuracy- Effective for amblyopia.	- Requires precise alignment- Higher cost than anaglyphs.	Iwata et al, (2022),[15] Kelly et al, (2016)[14]
VR Headset	Uses head-mounted displays to present distinct stimuli to each eye.	- Immersive environment- High spatial/temporal control- Gamified therapy.	- Expensive- Limited accessibility- Potential discomfort.	Xiao et al, (2022)[18] Dahlmann-Noor et al, (2024)[16]
Autostereoscopic	Screen-based 3D displays (no glasses) for dichoptic viewing.	- No additional eyewear- Fast testing (eg, PDI Check).	- Limited resolution- Suppression may affect accuracy in amblyopia.	Yeritsyan et al, (2024)[19]
Eye-Tracking-Based	Adjusts stimuli dynamically based on real-time gaze data.	- Personalized therapy- Addresses fixation instability- High compliance	- Requires calibration- Higher technical complexity.	Wygnanski-Jaffe et al, (2023)[11] Zhu et al, (2023)[8]
Degrading Sound Eye	Reduces input to the non-amblyopic eye (eg, filters, blur, or contrast reduction).	- Balances interocular input- Enhances amblyopic eye use.	- May reduce overall visual comfort- Variable patient adaptation.	Birch et al; (2020)[12] Jost et al, (2022)[17]

still best achieved by patching, dichoptic therapy presents a better and more acceptable alternative because it enables improvement of both visual acuity and SA of patients by encouraging involvement with the treatment of patients.

There are very important practical implications for clinicians in our findings. Since amblyopia remains one of the most common causes of visual impairment in children, it is necessary to find effective ways to treat this condition. It is possible that our method of dichoptic therapy increases the compliance of patients with children which can improve the outcomes for children who do not fully respond to the conventional patch therapy. Nevertheless, this study also has its limitations. The moderate degree of interstudy heterogeneity ($I^2 = 44\%$) in the meta-analysis suggests that there is some variability in treatment effects which might be due to differences in study design, patients and treatment methods. Moreover, an important limitation pertains to the heterogeneity inherent in dichoptic therapy methodologies Table 2. As noted, dichoptic interventions encompass a spectrum of devices and stimuli—including red/green filters, polarized displays, and virtual reality (VR) systems—that differ in their mechanisms of binocular separation and visual stimulation. While pooling these interventions under the umbrella of "dichoptic therapy" aligns with current literature and allows for broader conclusions about its utility compared to patching, we acknowledge this as a limitation. Furthermore, by restricting the review to only English publications, we may have missed out some relevant information regarding the studies involved in our review. Further studies for this topic should be larger, multi-centered and prospective in nature where the long-term effects of dichoptic therapy are tested with the use of technologies such as virtual reality to promote adherence to the treatment which may in turn bear significant positive treatment results for additional communities. Also, the lack of statistical adjustment for compliance rates limits direct efficacy comparisons between dichoptic therapy and patching. Future research should standardize compliance metrics and employ dose-response models to clarify the biological efficacy of each intervention.

Conclusion

This systematic review and meta-analysis offer a detailed comparison of dichoptic therapy and traditional patching for treating pediatric amblyopia. The analysis reveals that while patching shows a slight advantage in improving visual acuity, the difference between the two treatments is not substantial. Dichoptic therapy demonstrates comparable outcomes in many cases, particularly in terms of stereoacuity. One key benefit of dichoptic therapy is higher patient compliance, especially among children, who often struggle with the discomfort and social stigma associated with patching. This makes dichoptic therapy a practical alternative for those who may not tolerate patching well. Adverse events were generally mild in both treatment groups, with skin irritation being more frequent in patients undergoing patching. Future research should focus on the long-term outcomes of dichoptic therapy and its effectiveness across different patient profiles, such as varying ages and severity of amblyopia. Clinicians should consider this when developing individualized treatment plans, particularly for younger patients or those less compliant with patching.

Data Sharing Statement

The datasets utilized and/or analyzed in the current study can be obtained from the corresponding author upon submitting a reasonable request.

Funding

There is no funding to report.

Disclosure

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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