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REVIEW

Efficacy of optometric phototherapy: a systematic review

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Abstract
Purpose: To analyse the scientific evidence about the efficacy of Syntonic phototherapy for producing changes in visual function.
Material and methods: A systematic review was performed to obtain studies on the effects of Syntonic phototherapy on vision. A search in health science databases (Medline, Scopus, Web of Science and PsycINFO) for studies published between 1980 and 2022 was conducted in accordance with the principles of Cochrane approach. The search identified 197 articles. Only clinical studies which used the Syntonic phototherapy as a vision therapy for any visual condition were included. Clinical cases and case series were excluded. Following the inclusion criteria, 8 clinical studies met inclusion, 5 of them being pseudo-experimental studies with an equivalent control group and 3 pre-post pseudo-experimental studies. GRADE tool was used to assess the certainty of the evidence of the studies. The GRADE evidence profile for the studies through the Soft table was made to analyse data.
Results: The studies analysed seven outcomes: visual symptoms, functional visual fields, visual acuity, contrast sensitivity, deviation (phoria/tropia), stereopsis and reading abilities. Finding table about results (Soft Table) showed that for all outcomes reviewed, all studies yielded very low certainty of evidence. Results revealed a lack of scientific evidence of the efficacy of Syntonic optometric phototherapy to produce changes in the visual function.
Conclusion: This systematic review found no consistent evidence for the efficacy of Syntonic phototherapy to cause changes in visual function. There is no scientific evidence to support its clinical use for treating any type of visual anomalies.

Introduction

Light therapy, also known as phototherapy, consists of exposure to light for the treatment of health conditions. It has been used in different health-care fields such as neurosciences,[1] dental therapy,[2] dermatologic conditions,[3] psychological

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disorders as depression,[4] brain injuries[5] and even, not so many years ago, for the treatment of dry age-related macular degeneration (AMD).[6] The type of light applied is usually very varied, ranging from visible, infrared to ultraviolet radiation.[1]

Several studies have shown that phototherapy achieves therapeutic effects changing its intensity and wavelength.[7] Infrared light has also been used in patients who have undergone trauma or developed degenerative diseases.[8,9] The scientific literature has shown that this technique may produce beneficial effects for several conditions such as seasonal affective disorders,[10-13] sleep disorders[14] or psoriasis.[15] Several studies suggest that the application of phototherapy on these alterations improves some of the symptoms suffered by the subjects.[16,17]

Related to vision, phototherapy has been used in amblyopia.[18–20] Evans et al.[19] have shown an improvement of one line of visual acuity in patients between 10 and 57 years old, using an intermittent photopic stimulation. Their results show an improvement for those who present strabismic amblyopia and anisometropic amblyopia. Other authors as Ivandic et al.[20] have used a low frequency laser which irradiates the macula from 1 cm while the subject is in eye adduction position. Their results yield an improvement of three or more lines of visual acuity in 50% of subjects over 12 years old with strabismic and ametropic amblyopia.

Within the field of optometry, Syntonic optometric phototherapy began to be used a few decades ago. According to its followers, this therapy seeks the balance of the visual system associated with a general balance of the organism, through the autonomic nervous system and endocrine system. That is, they seek a balance between the sympathetic and parasympathetic nervous systems.[21] It is a procedure that irradiates light in the retina noninvasively, usually incandescent, using selected filters with different wavelength.[22] However, in the literature there is a controversy related to this procedure. Barret's literature review[23] has shown that this technique has been used as a standalone treatment or as a part of a complete vision therapy program to increase the visual field size and visual memory. However, this literature review[23] has also shown that the author could not find any evidence to support any of these assertions. The same has been reported by Suttle's literature review,[18] which shows the lack of published studies on the effectiveness of this technique in amblyopia therapy. However, other studies such as Ibrahimi et al.[1] have currently reported that the use of this light therapy may produce changes in the metrics of cortical activity in patients with strabismus and amblyopia. Argilés et al.[24] have also reported that the use of Syntonic therapy can modify the functional connectivity of a broad range of visual and non-visual brain regions. Accordingly, even though some clinicians use phototherapy as a visual therapy for several visual conditions, there seems to be a lack of evidence about the efficacy of this technique.

The aim of this study is to analyse the scientific evidence about the efficacy of Syntonic phototherapy for producing changes in visual function.

Material and methods

A systematic review was performed to obtain all the clinical articles on the effects of Syntonic phototherapy on vision. It was conducted in accordance with the principles in the Cochrane Handbook.[25]

Search methods and eligibility criteria

The review was conducted through an exhaustive search in health science databases for studies published between 1980 and 2022. Databases of Medline (via Pubmed), Scopus, Web of Science and PsycINFO were examined. The search strategy applied used free-text terms related to optometric phototherapy. The search equation included Boolean operator, truncated symbols, proximity operators and wildcard characters specific to each database. Table 1 shows the search strategy used for Pubmed and the other databases, it was adapted according to the characteristics of each database.

As recommended in a systematic review, to obtain all the literature about this subject, in addition to the search carried out in these databases, a full search was performed in the journal of the College of Syntonic, as it is not indexed in the databases used. This is a journal in which different authors have published several studies about Syntonic phototherapy. Only articles between 1999 and 2006 were encountered as this journal has not published manuscripts since that date.

Eligible for inclusion were those clinical studies which used the Syntonic phototherapy as a vision therapy for any visual condition, both for the adult or paediatric population. Bibliographic reviews, letters to the editor, editorials or conference proceedings were excluded.

Selection of studies

The search identified 197 articles to be reviewed. Following the inclusion criteria, 182 were excluded for not to being related to Syntonic phototherapy but to light therapy for other conditions, such as eating disorders, systemic or mental diseases. 8 studies were excluded as they were bibliographic, 6 for being bibliographic reviews[18,22,23,26–28] and 2 were editorials.[29,30] Therefore, initially 7 studies[31–37] fulfilled the inclusion criteria, four being pseudo experimental studies with equivalent control groups,[31,32,34,36] two pre-post pseudo experimental studies[35,37] and the other was clinical case series.[33] Reference lists of these seven studies[31-37] were manually searched for further relevant studies, yielding 1 additional study[38] which was a pseudo experimental study with an equivalent control group. The College of Syntonic website showed 4 additional studies,[39–42] three of them were clinical case series[39-41] and one a pre-post pseudo experimental study.[42]

However, since the aim of this systematic review was to analyse the efficacy of this optometric phototherapy, clinical cases and case series should not be used, as they are the types of studies that provide the least level of scientific evidence when it comes to analysing the efficacy of a treatment. Therefore, only randomized clinical trials and/or pseudo-experimental studies should be included, as they are the types of clinical studies that provide the greatest scientific evidence.

Accordingly, following this criterion, the systematic review finally included 8 clinical studies,[31,32,34–38,42] 5 of these being pseudo-experimental studies with an equivalent control group[31,32,34,36,38] and 3 pseudo-experimental studies of pre-post type.[35,37,42]

Table 1 Search strategy used in systematic review on the different used databases.

Database	Search strategy	Strategy elements
Pubmed	#1	"syntonic* NOT ego" [All Fields]
	#2	"visual OR vision" [All Fields]
	#3	#1 AND #2
	#4	"phototherapy" [All Fields]
	#5	#2 AND #4
	#6	#3 OR #5
Web of Science	#1	"visual OR vision"
	#2	"phototherapy"
	#3	#1 NEAR #2
	#4	"syntonic*NOT ego"
	#5	#3 OR #4
	#6	#5 AND #1
PsyqINFO	#1	"syntonic*NOT ego"
	#2	"visual OR vision"
	#3	#1 AND #2
	#4	"phototherapy"
	#5	#2 NEAR #4
	#6	#3 OR #5
Scopus	#1	"visual OR vision"
	#2	"phototherapy"
	#3	#1W/15 #2
	#4	"syntonic*NOT ego"
	#5	#4 AND #1
	#6	#3 OR #5

Two authors independently completed the data extraction so if inconsistences appeared, these were resolved by consensus.

Certainty of evidence

To assess the certainty of the evidence of the 8 clinical articles included, the use of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system is recommended,[43] which allows the quality or certainty of the evidence of the different outcomes of the studies to be obtained. What this tool does for each outcome is the following:

- It is based on an initial certainty of evidence, depending on the methodological study design.
- It takes into account a number of factors, such as the risk of bias in the study, inconsistency of the results, indirect evidence, imprecision of the results, or publication bias. These factors may lower the certainty of the evidence or increase it.
- It rates the overall certainty of evidence for each outcome. The GRADE tool graphically determines the certainty of evidence, showing very low (⊕◯◯◯), low (⊕⊕◯◯), moderate (⊕⊕⊕◯) and high (⊕⊕⊕⊕).

Taking the above into account, GRADE system indicates the degree of confidence that the result reflects the reality.

Risk of bias assessment

Risk of bias was assessed for each study following the Cochrane Handbook for systematic reviews of interventions[25] .The domains analysed were: selection bias (random sequence generation and allocation concealment), performance bias (blinding of participants, detection bias (blinding of outcome assessment, self-reported outcomes and objective measures), attrition bias (incomplete outcome data), reporting bias (selective reporting), and other causes of bias (such as funding sources and conflicts of interest). Each study was then considered to have low, high or unclear risk of bias in each domain. Two review authors independently performed this analysis, resolving and discussing any disagreement.

Results

The methodological characteristics of the 8 studies included[31,32,34—38,42] are shown in Table 2. The table indicates the author, year, characteristics of the sample, dysfunction analysed, study design, type of treatment, results and duration of treatment of each study. As it can be observed, this table shows the information of seven articles. The reason is that there were two studies[34,38] which were published in different journals, with different tittles and years but both shared the same information. They had the same data but with different references.

The GRADE evidence profile for the studies through the Soft table[31,32,34—38,42] was analysed and its results are shown in Table 3. As can be observed, the studies included in the systematic review represent to 433 subjects, where 244 subjects belong to 5 pseudo experimental studies with equivalent control group and 189 subjects are studied in 3 pre-post pseudo experimental studies. Seven outcomes were analysed: visual symptoms, functional visual fields, visual acuity, contrast sensitivity, deviation (phoria/ tropia), stereopsis and reading abilities. For each outcome, the number of studies, the number of subjects in experimental and control groups, commentaries and the certainty of evidence were included in the Table 3. Results of this analysis showed that although there were different results reported by each study, for all outcomes reviewed all studies yielded very low certainty of evidence.

These results may be observed by means Figs. 1 and 2. Fig. 1 represents the risk of bias summary. It contains the findings about each risk of bias item for each included study, assessed using the Cochrane risk of bias tool. Green, red and blue question mark pictures indicate low, high and unclear risk of bias respectively. Fig. 2 shows graphically these risk of bias as percentages across all included studies. Green, red and yellow pictures indicate low, high and unclear risk of bias respectively.

Discussion

The results of this systematic review show a lack of scientific evidence about the efficacy of Syntonic optometric phototherapy to cause changes in the visual function. Accordingly, there is no scientific evidence to support its use in the treatment of visual anomalies.

Table 2 Methodological characteristics of included studies in the systematic review.

Author[Ref] and year	Sample	Dysfunction	Study design	Type of treatment	Results	Duration of treatment
Kaplan, R[31] 1983	24 subjects from different educational and optometric centre Age: 6—16 years old Sex: not defined	Reading problems, binocular deficiencies and writing difficulties	Pseudo experimental study with equivalent control group	Subjects divided in three groups (different basal characteristic between them) Group with treatment: 10 subjects • Syntonic Control group 1: 4 subjects • White light Control group 2: 10 subjects • Only visual therapy	Increase the visual field in treatment group (no p value)	Number of sessions (Syntonic):16 or 18 Time: 20 min
Liberman, J[32]1986	36 subjects from optometry academy Age: 5—29 years old Sex: 20 males, 16 females	Individuals with academic underachievement, primarily in the area of reading	Pseudo experimental study with equivalent control group	Experimental group: 18 subjects • Subjects with reduced visual field and low phoria: green filter • Subjects with reduced visual field with high phoria: yellow-green filter to alleviate the visual fields and red filter to esophorias and indigo to exophorias • Subjects with normal visual field and high phoria: red filter to esophorias and indigo to exophorias Control group: 18 subjects • Do not receive any treatment	Experimental group: visual field is 87 times bigger than control group (EG visual field value: 2.916%, initial diameter size >37°) Control group: the visual field of control group was 85% (initial size of visual field was <36°)	Number of sessions (Syntonic): 20 Time: 20 min
Ingersoll, SJ et al.[34,38] 1999; 2002	Visagraph group: 130 children from developmental academy Average age: 9.95—11.24 years old. Sex: 73 males, 57 females Syntonic group: 98 children from developmental academy Average age: 9.1—10.35 years old. Sex: 61 males, 37 females	Students of Livingston Developmental Academy were referred based on academic and/or behavioural difficulties	Pseudo experimental study with equivalent control group	Visagraph group: measure the reading function with Visagraph (fixations per 100 words, regressions per 100 words, fixations of the duration, reading rate, reading comprehension) • IVL (Integrated Visual Learning, a type of visual therapy for beneficiating learning disabilities): 8 children • Syntonic: 9 children • IVL+ Syntonic: 47 children • Control: 66 children, do not receive any treatment Syntonic group • IVL: 15 children • Syntonic: 15 children • IVL+ Syntonic: 31 children • Control: 37 children, do not receive any treatment	Visagraph group: • Syntonic produced a decrease in some parameters which measured reading function • The combination of IVL+ Syntonic produced more increase in reading function than IVL alone • The control group produced improvements in the major of parameters of reading function • It does not do comparations between groups, there are only gain percentage Syntonic group: • Syntonic and IVL+ Syntonic increase the central visual fields (there are confused results, it is expressed like the total of different measures or this total divided by the number of subjects in	Visagraph group (67 days of treatment): • IVL: 8 sessions • Syntonic: 13 sessions • IVL+Syntonic:12 sessions • Control: without sessions Syntonic group (70 days of treatment approximately): • IVL: 11.8 sessions • Syntonic: 14 sessions • IVL+Syntonic:15.14 sessions • Control: without sessions Time: not defined

Table 2 (*Continued*)

Author[Ref] and year	Sample	Dysfunction	Study design	Type of treatment	Results	Duration of treatment
					each group). IVL only and control do not improve the visual field	
Heinrich, P[42] 2006	7 athletes Age: 23–66 years old Sex: not defined	Not specified	Pre-post pseudo experimental study	Athletes receive 10 sessions of Syntonic with different filters and duration (20 colours per sessions)	Improvement of visual field: • White stimuli: increase in RE of 9.8%, and LE 6.6% • Red stimuli: RE 36.39% and LE 37.6% • Blue stimuli: RE 48.8% and LE 44.4% • Green stimuli: RE 72.8% and LE 63.6%	Number of sessions (Syntonic): 10 Time: between 10 and 30 min
Kondrot, EC[35] 2015	152 subjects from The Healing the Eye Wellness Centre. They are patients who participate in a treatment programme of 3 days (it costs 3000$) Age: 15–95 years old. Sex: 73 males, 79 females	70 atrophic AMD 29 glaucoma, 20 exudative AMD 9 macular hole 3 Stargard disease 6 cataract 4 ischaemia of optic nerve 4 retinitis pigmentosa 3 diabetic retinopathy 3 histoplasmosis wound healing 1 Cone Dystrophy)	Pre-post pseudo experimental study	Participants received 4 therapies in three days • Intravenous vitamins complement • Oxidative therapy (they used ozone, ultraviolet irradiation and intravenous hydrogen peroxide) • Stimulation with electrical microwaves • Syntonic	Improvement of VA (with ETDRS): • ≥2 lines :15% • > 1line: 54% • <1 line:23% • No changes: 8% Improvement in contrast sensitivity (with Lighthouse Letter Contrast Sensitivity Test): • >5 letters: 36% • 1–4 letters: 52% • No changes: 12% Increase of central visual fields: • Marked: 57% • Moderate: 26% • Minimal: 6% • No changes: 11%	Number of sessions (Syntonic): 2 per day (6 total sessions) Time: not defined

Ibrahimi, D et al.[36] 2021	17 subjects from Autonomous University of Querétaro
	• Average age: 18.1 ± 10.5 years old
	• 8 ET (1 with hyperopia)
	• 7 XT (3 with hyperopia)
	• 1 hypertropia
	• 1 anisometropic amblyopia
	• Only 7 of 17 subjects had stereopsis (6 presented fine stereopsis): 128.8 ± 252.1″
	11 Health control subjects (HCs)
	• Average age: 22.3 ± 5.9 years
	• Orthophoria in far
		XT and ET, hyperopia and amblyopia	Pseudo experimental study with equivalent control group	Experimental group: 17 subjects with SA (the protocol was established by the College of Syntonic Optometry)
				• XT and hyperopia: blue filter
				• ET: red filter
				Health control group: 11 subjects
				• Filters was chosen randomized
					Improvement of central visual fields (measured with blue stimuli in LE, for example):
					• SA: 23.75 ± 1.2 to 25.95 ± 0.68 ($p<0.001$)
					• HCs: 24.54 ± 0.6 to 25.14 ± 0.52 (p=0.001)
					• It does not compare between SA and HCs
					Improvement of VA:
					• SA (logMAR):
					  • Far: 0.32 ± 0.37 to 0.16 ± 0.24 (0.48 to 0.69)
					  • Near: 0.24 ± 0.36 to 0.12 ± 0.23 (0.58 to 0.76)
					• HCs: any statistical changes (VA average: 0.0 logMAR)
						Number of sessions (Syntonic): 20 consecutive sessions per day (in all patients)
						Time: 20 min

Table 2 (*Continued*)

Author[Ref] and year	Sample	Dysfunction	Study design	Type of treatment	Results	Duration of treatment
	• Exophoria in near: 12.27± 5.69 • Sex: 15 males, 13 females				Deviation: • SA: all tropias improve. For example, ET in far goes from 29.0 ± 14.84 to 19.13 ± 17.87 • HCs: near phoria increases from 12.27 ± 5.69 to 14.18 ± 6.82 Stereopsis: • SA: improves from 128.8 ± 252.1 to 54.2 ± 73.31 • HCs: it goes from 25.82 ± 12.81 to 25.09 ± 13.99	
Abbas, S[37] 2022	30 patients from Madina Teaching Hospital Faisalabad Age: 8−18 years old Sex: 12 males, 18 females	Anisometropic amblyopia and strabismic amblyopia	Pre-post pseudo experimental study	15 patients with anisometropic amblyopia and 15 patients with strabismic amblyopia received 20 sessions of Syntonic with red filter	Improvement of VA (logMAR) after syntonic therapy in all amblyopes: • Mean difference: 0.22 ± 0.16 (p = 0.00) Improvement of contrast sensitivity (Pelli-Robson chart) after Syntonic therapy in all amblyopes: • Mean difference: −0.20 ± 0.21 (p = 0.00) Improvement of VA (log MAR) after syntonic therapy in anisometropic amblyopia compared to strabismic amblyopia: • Mean difference: 0.309 p = 0.016 Improvement of contrast Sensitivity (Pelli Robson chart) after syntonic therapy in anisometropic amblyopia compared to strabismic amblyopia: • Mean difference: −0.303 p = 0.035	Number of sessions (Syntonic): 20 Time: not specified

IVL, integrated visual learning; RE, right eye; LE, left eye; AMD, age macular degeneration; VA, visual acuity; ETDRS, early treatment diabetic retinopathy study; ET, esotropia; XT, exotropia; HCs, health controls; SA, strabismus and amblyopia; logMAR, logarithm of the minimum angle of resolution.

Table 3 Summary of finding table including GRADE assessment for the certainty of the evidence (soft table), for Syntonic phototherapy to produce changes in visual function.

Outcome	No. studies	Experimental group	Control group	Relative effect (95% CI)	Anticipated absolute effects (95% CI)		Certainty of the evidence	Comment
					Risk with any treatment	Risk with Syntonic		
Visual symptoms	4 Pseudo-experimental control group Kaplan 1983[31] Liberman 1986[32] Ingersoll et al. 2002[34]/1999[38] Ibrahimi et al. 2021[36]	91 (10 + 18 + 46 + 17)	70 (4 + 18 + 37 + 11)	Not estimable	No study of this comparison reported this outcome		Very Low [a,b,c,d,] ⊕○○○	Not defined
	3 Pseudo-experimental of pre-post study Heinrich 2006[42] Kondrot 2015[35] Abbas 2022[37]	189 (7+152+30)	0	Not estimable	No study of this comparison reported this outcome		Very Low [a,b,c,d,] ⊕○○○	Not defined
Central Visual Field	4 Pseudo-experimental control group Kaplan 1983[31] Liberman 1986[32] Ingersoll et al. 2002[34]/1999[38] Ibrahimi et al. 2021[36]	91 (10+18+46+17)	70 (4+18+37+11)	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,b,c,d,] ⊕○○○	Syntonic improve the visual fields but not compared to placebo effect
	2 Pseudo-experimental of pre-post study Heinrich 2006[42] Kondrot 2015[35]	159 (7+152)	0	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,b,c,d,] ⊕○○○	Syntonic improve the visual fields but not compared to placebo effect
Visual Acuity	1 Pseudo-experimental control group Ibrahimi et al. 2021[36]	17	11	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,b,c,d] ⊕○○○	Syntonic improve the VA in strabismus and amblyopia but not compared to placebo effect
	1 Pseudo-experimental of pre-post study Kondrot 2015[35] Abbas 2022[37]	182 (152+30)	0	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,c,d] ⊕○○○	Syntonic improve the VA but not compared to placebo effect
Contrast Sensitivity	1 Pseudo-experimental of pre-post study Kondrot 2015[35] Abbas 2022[37]	182 (152+30)	0	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,b,c,d] ⊕○○○	Syntonic improves sensitivity of contrast but not compared to placebo effect
Deviation (tropia/phoria)	1 Pseudo-experimental control group Ibrahimi et al. 2021[36]	17	11	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,b,c,d] ⊕○○○	Syntonic reduces deviation in strabismus and increases phoria in control group
Stereopsis	1 Pseudo-experimental control group Ibrahimi 2021[36]	17	11	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,b,c,d] ⊕○○○	Syntonic increases stereopsis in strabismus and amblyopia, and reduces in control group
Reading abilities/skills	1 Pseudo-experimental control group Ingersoll et al. 2002[34]/1999[38]	56	66	Not estimable	Data not pooled due to high heterogeneity in interventions, comparisons, participants, settings and outcomes		Very Low [a,b,c,d] ⊕○○○	Syntonic decreases the reading abilities

[a] Unclear risk of selection bias, absence of bias randomized, absence of placebo effect control. Downgraded two levels for very serious limitations.
[b] Absence of confidence interval values (95% CI). Downgraded two levels for very serious imprecision.
[c] There is not comparations with other treatments. Downgraded one level for serious indirectness.
[d] Published in no indexed journals or limited circulation. Downgraded two levels for very serious risk of bias of publication.

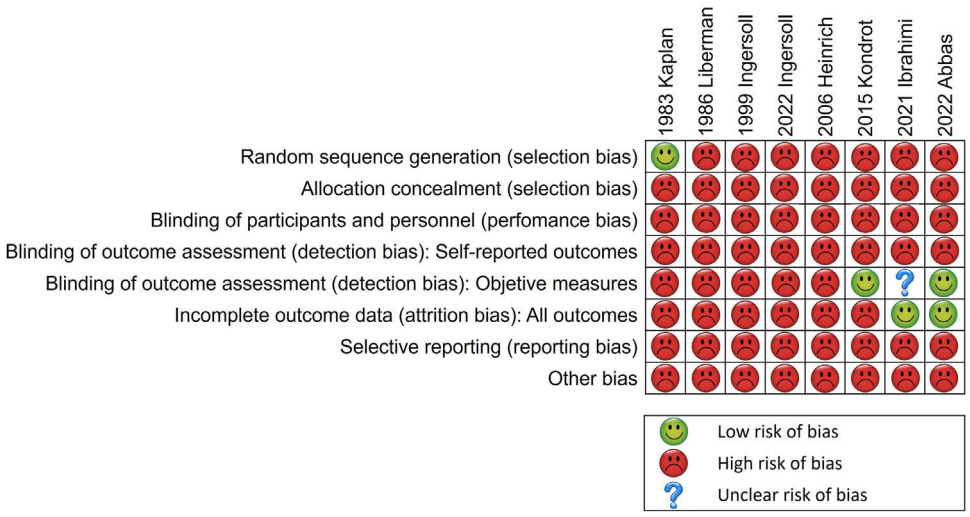

Fig. 1 Risk of bias summary. Findings about each risk of bias item for each included study, assessed using the Cochrane risk of bias tool. Green, red and blue question mark pictures indicate low, high and unclear risk of bias respectively.

The overall analysis of the studies included shows a lack of adequate methodology in clinical studies to provide good certainty evidence. Thus, according to the sample, there is no clinical trial which had analysed Syntonic therapy. Hence, there is no randomized sample and all patients studied are related to selected samples. This reduces the certainty of the evidence found in the systematic review as in no case the results of the treatment may be contrasted with a placebo control. Similarly, regarding the protocol for using the Syntonic technique, the studies also provide different methods. According to the application time, several authors[31-33,36,40,41] use the technique during 20 min, other authors[42] describe a variable duration and others do not describe the time of application.[34,35,37,39] The same happens for the number of sessions needed. Several authors describe between 16 and 18 sessions,[31] others 12 sessions,[40] 20 sessions,[32,37] 25 sessions,[39] 10 sessions,[42] 6 sessions,[35] and other authors do not describe the number of sessions used.[33,34,41]

Furthermore, following the principles of Syntonic therapy[21] different colour filters are used to improve certain visual dysfunctions, although without any scientific criteria. However, in most of the studies of this review, the different spectral and illuminance characteristics of the syntonic system are not specified. Only the studies of Ibrahimi et al.[36] and Abbas et al.[37] specify that they use a bulb that delivers 1.4 lx when unfiltered and only the Kaplan[31] study shows the spectral distribution of filters. On the other hand, only 4 studies[31,36,37,42] specify the selected filters used. Thus, one study uses the red and blue filters,[31] other study only uses the red one,[37] another study[36] specify that they use 13 different colour filters and the other study[42] uses 20 different filters. In addition to all these observations, it has been shown that filters have different transmission spectra when they are used with different lamps in the devices.[44] All these aspects further limit the certainty of evidence of the Syntonic phototherapy.

The review also revealed different results reported by each study, according to the changes observed in the different visual outcomes analysed when the Syntonic therapy was used.

According to the visual field, of the 8 pseudo experimental studies of the review, 7 of them[31,32,34–36,38,42] analysed this outcome and showed an improvement of visual field size. In some studies,[36] this parameter even increased in the control group and in the case of Liberman[32] it decreased in the

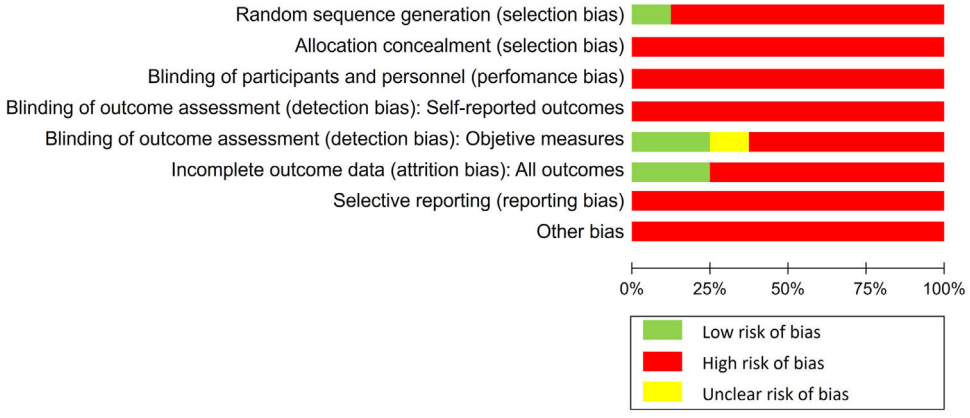

Fig. 2 Risk of bias graph. Findings about each risk of bias item presented as percentages for included studies. Green, red and yellow pictures indicate low, high and unclear risk of bias respectively.

controls. However, the vast majority of them have serious methodological errors that make the certainty of the evidence they provide for this outcome very low. For example, Heinrich[42] only examined seven patients. Kaplan[31] presents different baseline characteristics between the groups being compared in his study, that is, the experimental group presented writing difficulties, a control group binocular dysfunctions and the second control group presented inefficient reading. Ingersoll et al.[34,38] have a different number of subjects between groups. Ibrahimi et al.[36] used different coloured filters for the control subjects for their study, so the efficacy of each cannot be evaluated separately. Kondrot[35] presented confusion biases in his study, since in addition to the Syntonic he applied 3 other therapies. Even the subjects included had 11 different baseline conditions. Furthermore, another factor that decreases the certainty of the evidence of these 7 articles[31,32,34—36,38,42] is that they present very heterogeneous populations, which means that there is indirect evidence (children with low academic performance,[32,34,38] children with academic difficulties,[31] athletes,[42] people with eye diseases[35] and patients with strabismus and amblyopia).[36]

The studies that investigated effects of Syntonic phototherapy on visual acuity (VA) were three pseudo experimental studies.[35—37] In the study by Ibrahimi et al.[36] VA increased both in subjects with strabismus and in subjects with amblyopia (it did not change in controls). However, it is not analysed whether there were differences between the treatment group and the control group. In addition, for the control group, different types of coloured filters were applied, making it difficult to compare them with the treatment. For all this, the certainty of the evidence is very low. On the other hand, Kondrot[35] refers to improvement in VA (VA lines). However, 3 therapies are applied (intravenous vitamins, oxidative therapy and stimulation by electrical currents) plus Syntonic, with which there is a confusion bias and the effect of only the Syntonic cannot be known. In this study, another outcome is also analysed, contrast sensitivity, in which an increase was produced. Lastly, in the study of Abbas et al.[37] an improvement was found in VA (they did not specify how many log MAR VA lines improved), both in subjects with anisometropic amblyopia and in subjects with strabismic amblyopia. In addition, they report that subjects with anisometropic amblyopia improved more than those with strabismic amblyopia. However, there is no control group, nor has a placebo effect been controlled. In addition, it is a study with a very small sample. Therefore, the results obtained cannot be generalized to a population, since a larger and more significant sample would be required.

The studies that investigated effects of Syntonic phototherapy on contrast sensitivity were two pseudo experimental studies.[35,37] Despite the fact that Kondrot[35] refers to increases in this parameter, it cannot be confirmed that these changes are due to the application of Syntonic, since 3 different therapies were used at the same time. On the other hand, Abbas et al.[37] refer to increases but does not offer numerical values to be able to quantify how many lines of contrast sensitivity the subjects improved by.

In relation to deviations (tropias/phorias), Ibrahimi et al.[36] found that the deviation in strabismus is reduced, although by a very small value and it does not disappear. However, curiously, this parameter increases in the control group. Again, the certainty of the evidence is very low due to the methodological errors that it presents, since in the control group the subjects present phoric values, which could be classified with subjects that present dysfunctions. Therefore, the value of the phorias not only does not decrease but increases.

After applying Syntonic phototherapy, with respect to stereopsis, Ibrahimi et al.[36] reported an increase in the treatment group and a decrease in the control group. The certainty of the evidence is very low because the control group does not apply the same filter to all subjects. In addition, when it says that the value of stereopsis increases, it can be seen that the values of the subjects are already within normality, so there is a diagnostic problem, since it is not logical that patients who have tropias present stereopsis.

In relation to visual symptoms, it is noteworthy that any of the eight studies[31,32,34—38,42] have reported data about this outcome. However, in all studies the authors usually refer to symptoms and anybody use a symptoms questionnaire to know about them.

Lastly, regarding reading abilities, in the study by Ingersoll et al.[34,38] they found that Syntonic diminished reading abilities. However, the certainty of the evidence is again very low. In this case, due to the great difference between groups that the study presents, since the experimental group has 9 subjects and the control 66 subjects.

The results of this systematic review are difficult to compare with other reviews, as, to our knowledge, this is the first systematic review on reports of the efficacy of this method. Other reviews have been published but they are bibliographic reviews without a systematic search of the literature.[22,26-28] The Barret bibliographic review,[23] although without a systematic search in the study, shows similar results to this systematic review, concluding that there is no scientific evidence to confirm that Syntonic phototherapy applied as visual therapy improves any aspect of visual function.

Conclusions

In conclusion, in this systematic review we found no consistent evidence for the efficacy of Syntonic phototherapy to cause changes in visual function. Accordingly, there is no scientific evidence to support its clinical use for treating any type of visual anomalies. This suggests that optometrists should not recommend its use in the clinical practice as it has been proved that this technique do not offer any improvement in visual function. Future studies in the field of light therapy should therefore clearly report visual outcomes based on studies adequately designed for the purpose. This is necessary not only for professionals as they will be able to provide a validated treatment, but also for patients, as they will benefit from receiving a treatment option based on scientific evidence.

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Conflicts of interest

The authors have no conflicts of interests.

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