Oculomotor rehabilitation in mild traumatic brain injury: A systematic review & meta-analysis

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Background

Up to 85% of people with a concussion/mild traumatic brain injury (mTBI) experience persistent oculomotor (OM) symptoms

These symptoms may **impede** community reintegration

The efficacy of **OM-based interventions** for adults with concussion/mTBI are currently unknown

Adults may experience **different responses** to rehabilitation. How this applies to OM-based interventions is pertinent to ensure evidence-based care

Sex refers to **biological attributes** of humans; gender refers to **socially constructed** roles, responsibilities, identities and behaviors of men, women, and gender-diverse people

Objectives

This systematic review aimed to:

1. **Synthesize** the evidence on OM-based interventions in adults with concussion/mTBI including timing, frequency and duration
2. **Critically appraise the evidence** on the efficacy of OM-based interventions in adults with concussion/mTBI
3. **Apply a sex and gender** lens to the analyses and conclusions

Methods

Searches: Five databases from inception to March 2023

Key terms: "oculomotor", "rehabilitation", "brain injury"

Quality assessment: Using published guidelines

Meta-analysis: For outcomes reported in two or more studies

Table 1 Study Selection via PICOS framework

Population	Adults recovering from concussion/mTBI
Intervention	Oculomotor-based, non-pharmacological
Comparator	Any comparator, placebo, no treatment
Outcome	Oculomotor metrics, (adverse events- no report)
Study Design	Experimental study

Registration PROSPERO: CRD42022352276

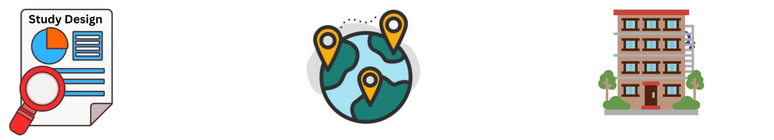
Results

Screened 7,731 citations after duplicates removed

31 studies retrieved for full review

12 studies met PICOS criteria and were analysed

Figure 1 Study characteristics



7 case series
5 crossover

Conducted in USA, Sweden, Denmark

Recruitment: Private & University Clinics

Figure 2 Participant characteristics

N=354 range: 3-218

43% male range: 13-50%

25 years range: 6-56 years

9.2 weeks range:1-56+ weeks

Sex and gender analysis
Zero studies performed sex- or gender-based analysis or discussed limitations/justification of the omission

Figure 3 Intervention Details

Sessions per week: Range: 1 to 3+

Length of session: 40 to 60 minutes

Total number of weeks: 4.5 to 13.6

Figure 4 Certainty of evidence using GRADE: Low

High risk of bias

Imprecision

Indirectness

Inconsistency

Publication bias

Results

Table 2 Meta analysis results*

Outcome	n	SMD	LCI	UCI	SE_{SMD}	I^2
Near Point Convergence (cm)	17	-5.25	-6.71	-3.91	0.71	62.1
Convergence Symptoms (CISS)	17	-4.87	-6.16	-3.59	0.65	0
Peak Fusional Vergence (△)	17	5.5	4.09	6.91	0.72	0
Vergence Facility (cpm)	17	5.5	3.91	6.66	0.10	0
Reading Rate (wpm)	36	1.12	0.62	1.61	0.25	38.87
Vistal Search & Attention Test	19	2.37	1.52	3.23	0.44	87.5

*on outcomes reported on in 2 or more studies

△=prism dioptres; CISS=convergence insufficiency symptoms scale; cm=centimeters; I^2=heterogeneity ; LCI=lower confidence interval; n=number of participants; SE_{smd}=standard error of the SMD; SMD= standard mean deviation; UCI=upper confidence interval; wpm=words per minute

Discussion

1. Results indicate a trend suggesting a benefit of OM-based interventions in reducing OM deficits in adults with mTBI
2. This evidence is of low certainty, attributed to high risk of bias, imprecision, indirectness, and publication bias
3. The influence of sex and gender on response to oculomotor rehabilitation remains a gap that must be explored

Future Directions

A randomized controlled trial is needed to address questions:

1. Is OM-based rehabilitation more effective than usual care?
2. What is the optimal timing, frequency, and duration of OM intervention?
3. Are there sex and gender differences in the acceptability and response to OM-based intervention?

References

Biscardi (2024), Gallaway (2017), Moller (2020), Scheiman (2017), Smaakjaer (2022), Peters (2017), Thiagarajan (2013, 2014a,b,c,d), Thiagarajan (2015), Yadav (2014)

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