

## Can transcranial photobiomodulation improve cognitive function in TBI patients?: A systematic review

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### ADMINISTRATIVE INFORMATION

**Support -** No.

**Review Stage at time of this submission -** Data extraction.

**Conflicts of interest -** None declared.

**INPLASY registration number:** INPLASY202390005

**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 03 September 2023 and was last updated on 03 September 2023.

## INTRODUCTION

**Review question / Objective** To systematically review the effect of transcranial photobiomodulation on the intervention of cognitive function in TBI patients.

**Condition being studied** Traumatic brain injury (TBI) profoundly impairs a patient's cognitive function, dramatically affecting their occupational and personal lives. With the advancement of scientific technology, an increasing array of clinical studies are now utilizing transcranial Photobiomodulation (tPBM) as a treatment modality for TBI. As tPBM is a novel treatment, it is necessary for us to conduct a systematic review of the effects of tPBM intervention on cognitive function in TBI patients.

## METHODS

**Search strategy** We searched Web of Science, Cochrane, Scopus, EMBASE, PubMed and PsycInfo, using the following keywords: ("photobiomodulation" OR "low-level light therapy" OR "low-level laser therapy" OR "infrared light therapy" OR "infrared laser therapy" OR "transcranial laser" OR "transcranial light-emitting diode") AND ("Traumatic brain injury" OR "Brain injury" OR "Head injury" OR "concussion") AND ("cognition" OR "cognitive functioning").

**Participant or population** In this study, we selected the TBI patients with cognitive impairment.

**Intervention** The intervention measures were transcranial photobiomodulation.

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**Comparator** other therapies, blank controls or no control groups.

**Study designs to be included** RCT, case reports and short case series.

**Eligibility criteria** The inclusion criteria were: 1) evaluation of tPBM intervention; 2) traumatic brain injury population; 3) employed neuropsychological test or experimental paradigm in measuring participants' cognitive functions. Exclusion criteria were: 1) reviews, conference articles, meeting abstracts; 2) guideline article, study protocol, expert opinions, editorials or commentaries; 3) animal studies; 4) lack of full text; and 5) lack of cognitive outcome measures.

**Information sources** Various databases were searched including Web of Science, Cochrane, Scopus, EMBASE, PubMed and PsycInfo.

**Main outcome(s)** Various scales and tests used to assess cognitive function including California Verbal Learning Test II (CVLT-II), Wechsler Adult Intelligence Scale, Controlled Oral Word Association Test (COWAT)/FAS Test, D-KEFS Color Word Interference test, the Wechsler Memory Scale, verbal and category fluency, the digit vigilance test (DVT), The symbol digit test, The Rey auditory verbal learning test (RAVLT), The complex Rey figure, etc.

**Quality assessment / Risk of bias analysis** Each included article was assessed for quality using tools developed by the Johanna Briggs Institute (JBI). The quality of each study is the percentage of the number of "yes" (low risk of bias) obtained over the total number of items in the corresponding checklist. A study was categorized as high quality, moderate quality, and low quality if the score is above 70 %, between 50 % and 69 %, and below 49 %, respectively.

**Strategy of data synthesis** None.

**Subgroup analysis** Specific domains cognitive such as executive function and memory.

**Sensitivity analysis** None.

**Language restriction** No language restrictions.

**Country(ies) involved** China.

**Keywords** tPBM; TBI; Cognitive Function; Systemic Review.

### Contributions of each author

Author 1 - Jia Zeng drafted the manuscript.

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Author 2 - Chen Wang contributed to the development of the selection criteria, and the risk of bias assessment strategy. Investigation data curation, and formal analysis.

Author 3 - Danyun Lei contributed to the development of the selection criteria, and the risk of bias assessment strategy. Investigation data curation, and formal analysis.