

Transcranial Photobiomodulation in Dementia with Lewy Bodies: A Proof-of-Concept Sham-Controlled Trial

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Methodology for a randomized proof of concept study on the effect of transcranial PBM on clinical symptoms, quality of life, and brain connectivity in DLB.

Introduction

Dementia with Lewy Bodies (DLB) is the second most common progressive neurocognitive disorder after Alzheimer's disease¹

Photobiomodulation (PBM) involves applying red to infrared light ($\lambda=600-1000\text{nm}$) to body tissues

- ➔ Light absorption by photoreceptors located in the mitochondria $\uparrow$ energy production (ATP)
- ➔ Can penetrate up to 30-50mm in some brain regions²
- ➔ **Positive results were seen in Alzheimer's and Parkinson's disease**^{3,4}

Early-stage DLB: cortically located pathology and characterized by synaptic dysfunction rather than cell death⁵, therefore PBM has a **high potential for clinical and symptomatic effects**

Objectives: To explore the effect of PBM on clinical symptoms, quality of life, and brain connectivity in patients with DLB after 3 and 6 months of twice daily PBM sessions, as well as one month post intervention for any remanent effect.

Methods

Randomized, double-blind, sham-controlled, proof-of-concept trial.

Study setting: CM2R, Strasbourg University Hospital Center (Strasbourg, France)

Participants : N=30

Active group (n=15)

Control group (n=15)

- ➔ > 50 years old, probable or prodromal DLB
- ➔ Presence of a daily caregiver
- ➔ MMSE score $\geq 18/30$
- ➔ Head circumference 54-62cm

Study procedure: (see figure 1)

- ➔ 2x daily at-home PBM or sham sessions, 32 minutes each, for 6 months
- ➔ In person home visits every two weeks
- ➔ Phone calls every other week to monitor participants' well-being, assess for potential adverse events, assess device functionality, and monitor adherence to the study protocol.

Material:

- ➔ **LUCIOLE Cap**, a non-invasive LED device delivers transcranial PBM ($\lambda=810\text{nm}$)
- ➔ Total illumination power of up to 8W (approximately $40\text{mW}/\text{cm}^2$)
- ➔ The sham caps are visually identical to the active PBM caps, but do not deliver PBM

Evaluations & Analysis:

- ➔ Comprehensive neuropsychological assessments (e.g. RBANS, MoCA), clinical and neurological examinations (e.g. Time up and go, physical exam), symptom questionnaires
- ➔ Multimodal MRI (VBM, functional connectivity)
- ➔ Group comparison: transversal and longitudinal comparisons
- ➔ Correlation analyses between MRI measures and clinical variables

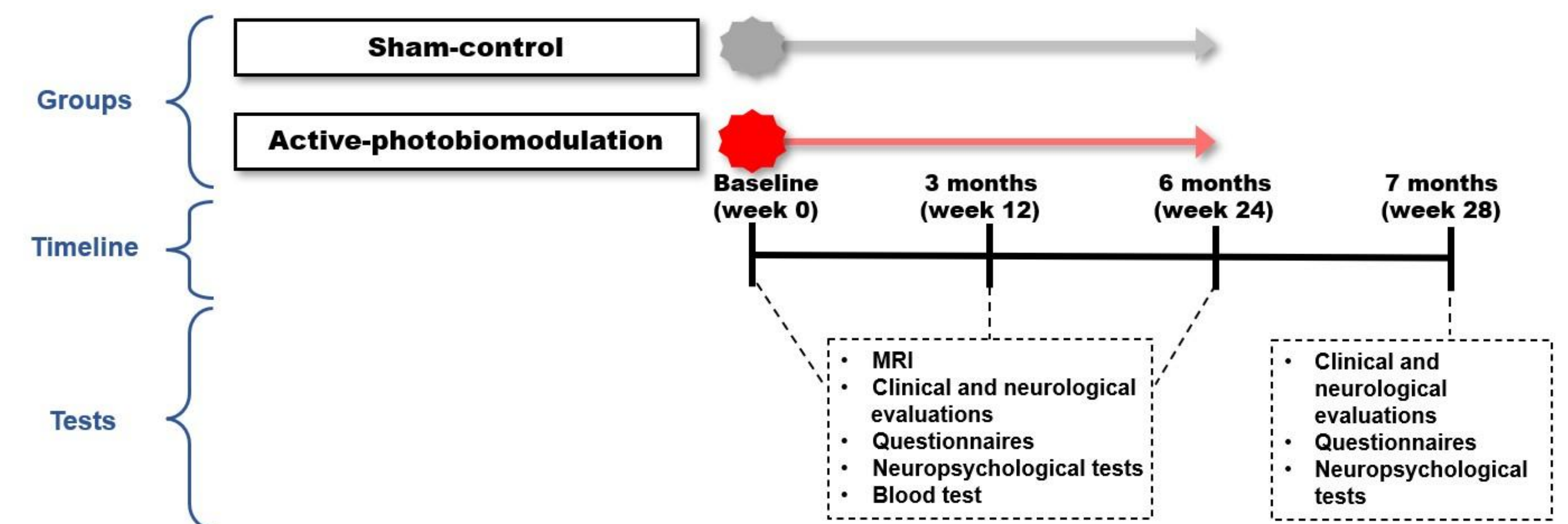


Figure 1. Methodology of LewyLIGHT study



Expected Results

Hypotheses:

- ➔ PBM will improve DLB patients' **cognitive performances, core symptoms, and enhance the well-being** of both patients and their caregivers
- ➔ PBM will improve **functional connectivity patterns** in key brain networks affected in DLB and modulate blood biomarkers

Inclusions: starting summer 2026 at the University Hospitals of Strasbourg, in France

Conclusion

In summary, this proof-of-concept study is led by a specialized multidisciplinary healthcare team in France, in partnership with the **CLINATEC endowment fund** that specializes in PBM including researchers, engineers, doctors and more.

This study is the **first study** evaluating the effects of PBM in early stages of DLB and could be an important step towards a **non-invasive therapeutic solution** to improve the quality of life for DLB patients and their caregivers.

References 1. Erkinen et al. (2017). Clinical Neurology and Epidemiology of the Major Neurodegenerative Diseases. Cold Spring Harbor Perspectives in Biology. 10. a033118. 10.1101/cshperspect.a033118.; 2. Tedford et al., (2015), Quantitative analysis of transcranial and intraparenchymal light penetration in human cadaver brain tissue. Lasers Surg. Med., 47: 312-322. <https://doi.org/10.1002/lsm.22343> 3. Berman et al. (2017). Photobiomodulation with Near Infrared Light Helmet in a Pilot, Placebo Controlled Clinical Trial in Dementia Patients Testing Memory and Cognition. Journal of Neurology and Neuroscience. 08. 10.21767/2171-6625.1000176. 4. Liebert et al. (2021). Improvements in clinical signs of Parkinson's disease using photobiomodulation: a prospective proof-of-concept study. BMC Neurology. 21. 10.1186/s12883-021-02248-y. 5. Mastenbroek, S. E., Vogel, J. W., Collij, L. E., Serrano, G. E., Tremblay, C., Young, A. L., Arce, R. A., Shill, H. A., Driver-Dunckley, E. D., Mehta, S. H., Belden, C. M., Atri, A., Choudhury, P., Barkhof, F., Adler, C. H., Ossenkoppele, R., Beach, T. G., & Hansson, O. (2023). Disease progression modelling reveals heterogeneity in trajectories of Lewy-type α -synuclein pathology. bioRxiv : the preprint server for biology, 2023.12.05.569878. <https://doi.org/10.1101/2023.12.05.569878>

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