

FIVE-YEAR CHANGES IN MDS-UPDRS-III AFTER LIGHT TREATMENT (PHOTOBIMODULATION)

Ann Liebert, PhD. Sydney Adventist Hospital; Sydney University, Australia
Geoffrey Herkes, MBBS, PhD, FRACP. Sydney Adventist Hospital, Australia
E-Liisa Laakso, PhD. Mater Research Institute, University of Queensland, Australia

Brian Bicknell, PhD. Sydney University; University of Western Sydney, Australia
Sharon Tilley, B.Ap.Sc (Physiotherapy). Lymphoedema & Laser Therapy, Australia
Hosen Kiat, MBBS, FRACP, FACP, FACC, FCCP, FCSANZ, DDU, DMSc. Macquarie University, Australia

Background

PHOTOBIMODULATION is the use of non-thermal light of particular wavelengths to bring about changes to the metabolism of cells and mitochondria

- Used for over 50 years clinically and in research
- Effective for wound healing, tissue repair, pain management, reducing inflammation and, recently, neurodegenerative disease

PRE-CLINICAL studies of PBM for Parkinson's disease

- In 2010 Sydney University group (Prof John Mitrofanis, Prof Jonathan Stone, Dr Dan Johnstone, colleagues and students) began treating mice with light to precondition against PD¹
- Clinical trials are warranted given the pre-clinical evidence including remote PBM²
- In 2018 we began a proof-of-concept clinical trial of PBM to treat the clinical signs and symptoms of Parkinson's disease using transcranial and abdominal PBM
- Results for the first year of treatment and two and three follow-ups are published^{3,4}

The **NORMAL TRAJECTORY** of Parkinson's disease is a decline in motor signs and non-motor symptoms over time

- MDS-UPDRS-III is estimated to increase between 1.4 and 8.9 points per year⁵
- reduced mobility and balance can lead to increased falls and reduced quality of life

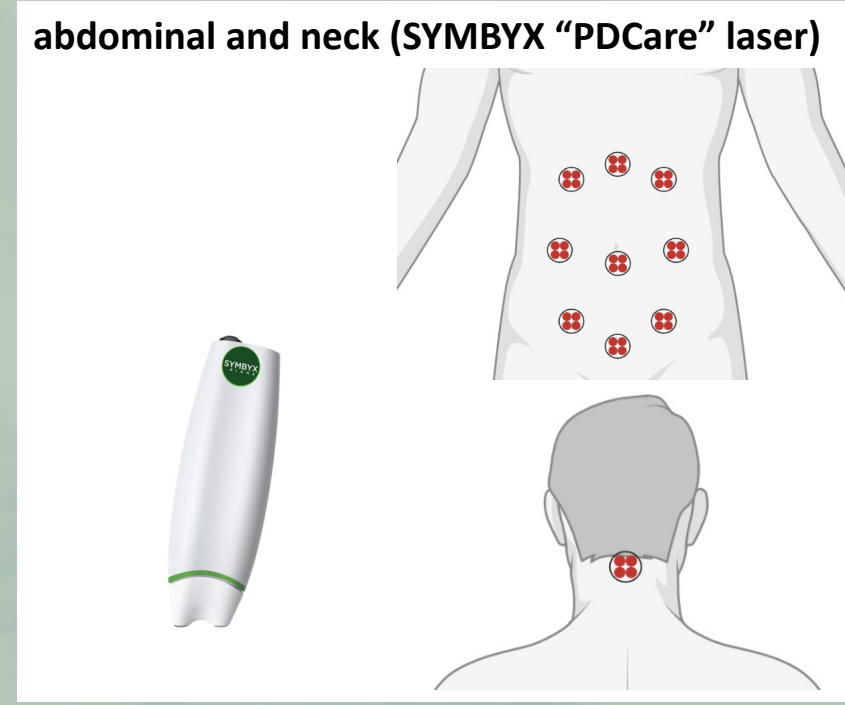
Here we present the results of a five assessment of changes in MDS-UPDRS-III and other symptoms of Parkinson's disease for participants who have continued PBM treatment

Objective

To test the long-term effect of transcranial and abdominal photobiomodulation to treat the clinical motor signs and non-motor symptoms of Parkinson's disease

Methods

- Treatment in-clinic (12 weeks) then at home (5 years)
- Treatment with a low-power laser (904nm; 30mW) over the abdomen and neck with additional transcranial treatment with LED diodes
- 7 participants from the original study have continued the treatment for five years at home
- 8 participants agreed to be re-assessed (7 who continued for 5 years and 1 who discontinued after 1 year).
- MDS-UPDRS-III assessment at baseline and after 5 years
- Additional motor and non-motor assessments at baseline, 1, 2, 3 and 5 years
 - Mobility – Timed up-and-go (TUG) + 10 metre walk test (10MWT)
 - Balance – step test + single leg stance + tandem balance
 - Cognition – Montreal Cognitive Assessment (MoCA)
- Subjective quality of life assessments
 - Sleep quality (PDSS)
 - Quality of life (PDQ39)
- Subjective change in sense of smell



Results

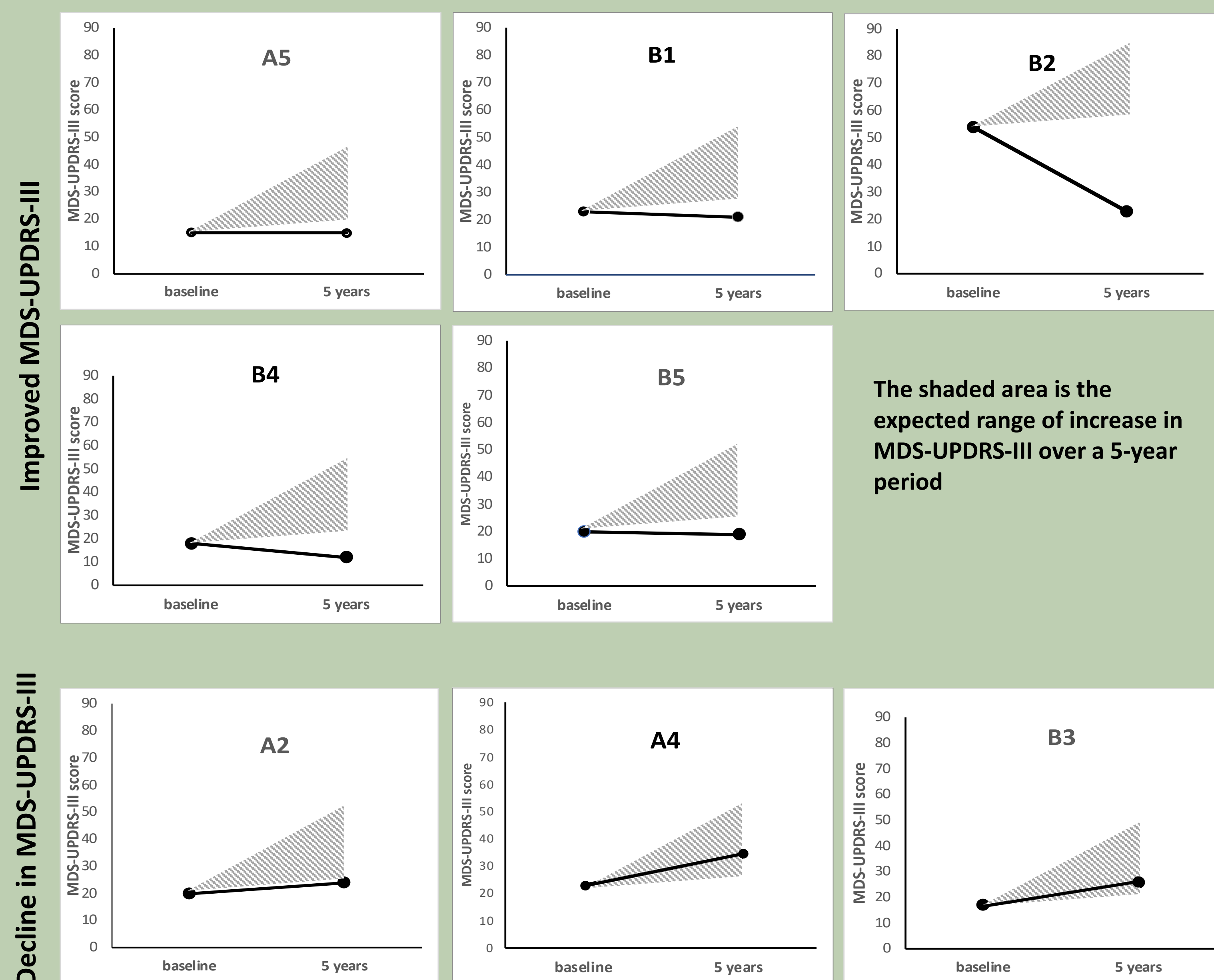
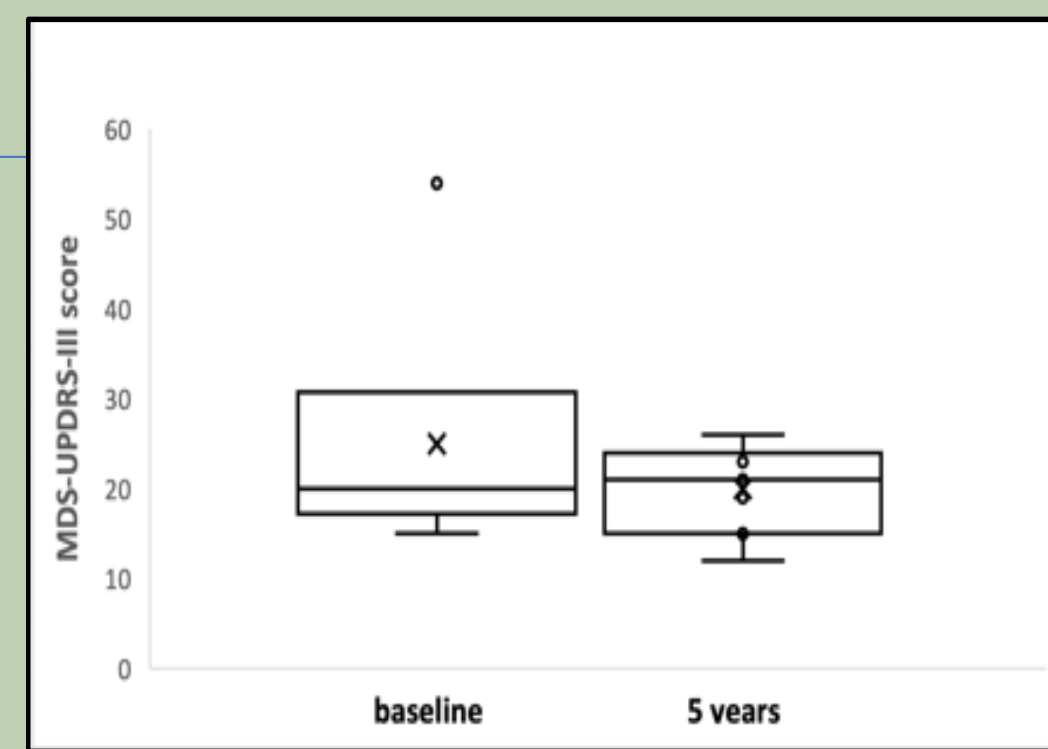
Changes in MDS-UPDRS-III

As a group

- no change in median from baseline (20.0, 22 IQR) to 5 years (20.0, 8.5 IQR)

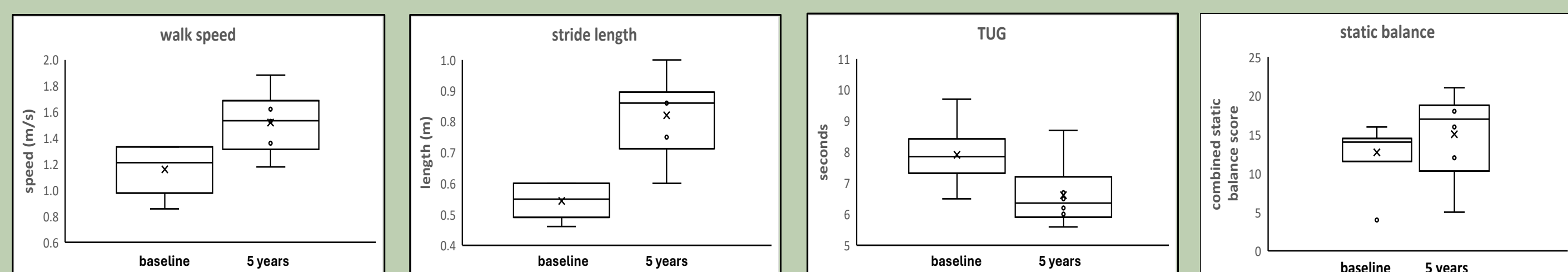
Individually

- 5 of 8 improved or did not decline over 5 years
- Those that declined
 - B3 did not continue PBM treatment after 1 year
 - A4 had a preliminary diagnosis of MSA after year 2
 - A2 had other co-morbidities (rheumatoid arthritis, multiple respiratory infections)



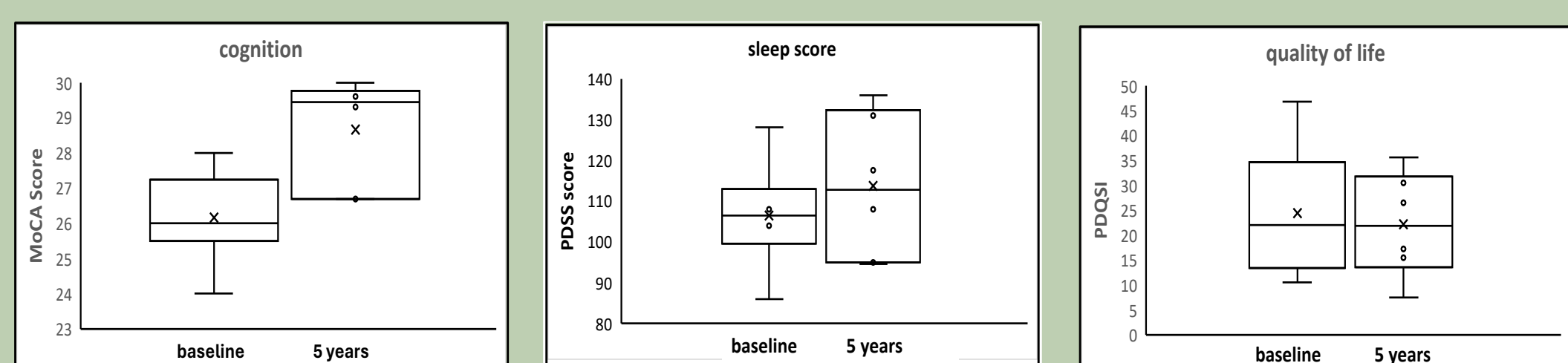
Changes in motor signs

- Improvements in median walk speed, stride length, time to complete timed up-and-go, and balance scores



Changes in non-motor symptoms

- Improvements in median cognition and sleep quality (PDSS) over 5 years
- Slight decline in median quality of life (PDQ39) over 5 years



- 5 of 8 participants reported an improvement in their sense of smell



In 5 years, participant B2 improved her MDS-UPDRS-III (54 to 23), improved her gait and mobility and regained her sense of smell from total anosmia

Conclusions

- 6 of 7 participants who continued PBM treatment did not follow the expected trajectory of MDS-UPDRS-III
- Despite the small numbers, PBM improved motor signs of Parkinson's disease over an extended period
- Improvements in motor signs, including balance, might translate to fewer falls in people with Parkinson's disease, a better quality of life, and might potentially delay symptom progression
- Non-motor symptoms (cognition, sleep quality, quality of life) did not markedly decline and 5 of 8 participants reported either a return or an improvement in their sense of smell
- To our knowledge, no other therapy can achieve these improvements over an extended time
- Continued home PBM treatment might be an effective long-term adjunct therapy for Parkinson's disease symptoms
- Based on these results, a long-term, adequately powered randomized placebo-controlled study is warranted

References

1. Johnstone, D.M.; Moro, C.; Stone, J.; et al. *Frontiers in neuroscience* **2016**, *9*, 500.
2. Salehpour, F., Hamblin, M.R. *Biomolecules* **2020**, *10*, 610 .
3. Liebert, A.; Bicknell, B.; Laakso, E.L.; et al. *BMC Neurology* **2021**, *21*, 256.
4. Liebert, A.; Bicknell, B.; Laakso, E.-L.; et al. *Medical Research Archives* **2023**, *11*.
5. Holden, SK.; Finseth, T.; Sillau, SH; et al. *Movement Disorders Clinical Practice*. **2018**, *5*(1)

We would like to acknowledge **SYMBYX Pty Ltd** for supply of the devices and the research support of the **Olivia Nassaris** of the **Hospital Research Foundation Group**.

