Dance promotes motor pathway preservation in Parkinson's disease

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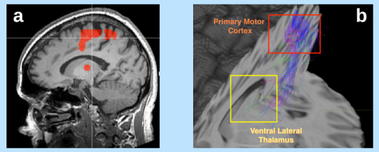
Background

Parkinson's disease (PD) severity often positively correlates with motor decline. Bearss and DeSouza (2021) found that a long-term dance regime could effectively halt PD motor decline, but the exact reason is still unknown. Induced-Rodent studies by Swanson et al. (2023) demonstrated significant VA/VL thalamus to M1 functional connectivity disruption in PD models, which may also applicable to human subjects.

Objective

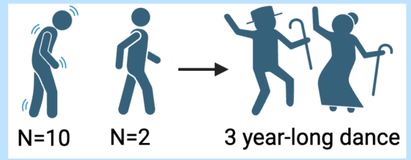
We hope to visualize the FC improvement the dance therapy brought and display the participant's internal capsule structure via structural and functional neuroimaging. We also hope to observe dance prolonging the aging neurodegeneration.



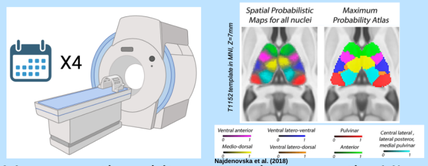
a. This figure depicts VL thamalus and M1, which are the seeds this study will be employing. This figure was made in the joelab by its members.
b. This figure's original DW data was from the Barnett lab. Probabilistic tractography demonstrated the connection within the 3D brain by seeding the M1 and VL thalamus. Tractography was done in MRTrix3, and figures were post-processed in Biorender.

Methods

Participants with PD (n=10) and without PD (n=2) attended a longitudinal dance program.



Their structural and functional imaging were obtained a minimum of 2 of 4 times throughout the program. A total of 28 fMRI was conducted. Probabilistic tractography will compare the mean diffusivity and fractional anisotropy of the corona radiata at different time points within the same subject to reflect dance's neuroprotective effect.

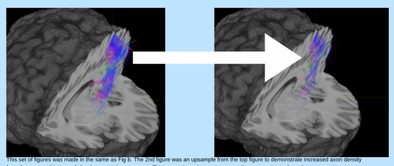


Moreover, the white matter between the V1 and LGN to serve as a intra-subject control pathway, which should not be affected by dance. This control could assist in revealing basal-level neurodegeneration to reflect the benefits dance could brought forth to M1-VA/VL thalamus pathway across 4 months of dancing in 5 subjects with PD.

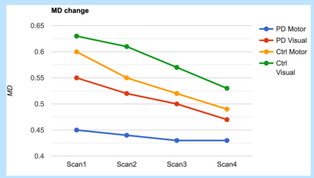
Proposed Results

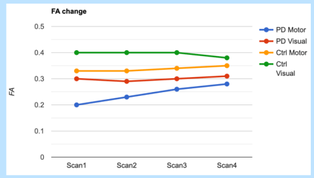
We expect to observe a lower rate of decline in mean diffusivity and an increase in fractional anisotropy in the M1-VL/VA thalamus connection of corona radiata. Higher fractional anisotropy and lower mean diffusivity collectively indicate a healthier aging pattern. As a control pathway, the V1-LGN connection should not display this pattern in PD patients. Subjects without PD should show a similar, but more subtle, white matter improvement in M1-VL/VA thalamus but not V1-LGN.

Process takes longer time with dance



This set of figures was made in the same as Fig b. The 2nd figure was an upsample from the top figure to demonstrate increased axon density from the same subject purely for demonstration purposes. This comparison does not necessarily represent actual results.





NOT ACTUAL RESULTS

Bearss, K. A., & DeSouza, J. F. X. (2021). Parkinson's Disease Motor Symptom Progression Slowed with Multisensory Dance Learning over 3-Years: A Preliminary Longitudinal Investigation. Brain Sciences, 11(7), 895. https://doi.org/10.3390/brainsci11070895
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