Dance improves affective state in individuals with Parkinson's Disease

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INTRODUCTION

Parkinson's Disease (PD) is a neurodegenerative disease marked by the death of dopaminergic neurons in the substantia nigra pars compacta. It is characterized by both motor and non-motor symptoms (NMS).

Retrieved from Miller and O'Callaghan (2015) doi:10.1016/j.metabol.2014.10.030

Retrieved from Bearss and DeSouza (2021) doi:10.3390/brainsci11070895

y=18.96+0.0001
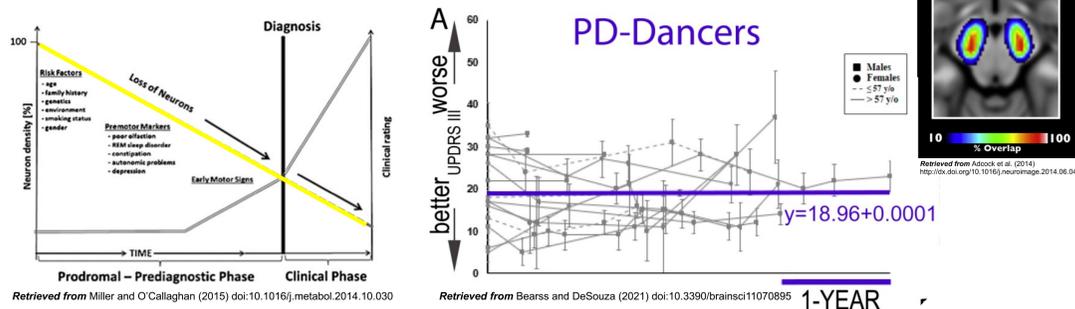
Depression and **anxiety** are common mental illnesses. Depression is considered both a premotor marker and NMS of PD[1]. Depressive symptoms are apparent in 35%[2] and anxiety disorders are apparent in 31% of individuals with PD[3].
Previous research by Bearss and DeSouza (2021) used the UPDRS-III to demonstrate slowing of the progression of both motor and NMS in PD, but without distinguishing between the two[4]. No research has focused on both **depression** and **anxiety**, in people with PD after **dance** classes.

Current Aims:
1. Support **dance** as a form of neurorehabilitation to improve **depression** and **anxiety** symptoms
2. Observe changes in **BOLD signals** in fMRI data associated with **dance** classes

Photo Credit : National Ballet School

METHODS

Group (N=55) PANAS-X	Individual Data Points	Mean Age (SD)	Age range	Group (N=10) fMRI
PD (n=37)	PD ($n_{session}$ = 94)	70.34 (8.12)*	52 – 87*	PD (n=10)
HC (n=18)	HC ($n_{session}$ = 43)	65.62 (10.85)*	22 – 80*	-

*13 ages not reported

Participants: completed 1.25-hour long **Dance for PD®** classes from 2013 – 2019.

Measures: affective data was collected from 2014 – 2019 pre and post dance class, and functional data was collected from 2013 – 2014. Statistical analysis was conducted using R Studio Version 2023.06.1+524, Brain Voyager 22.0 and MATLAB.

PANAS-X

PANAS-X other affective states were sorted into **generalized anxiety disorder (GAD-related)** symptoms and **major depressive disorder (MDD-related)** symptoms, based on DSM-IV diagnostic criteria.

Tables 1 and 2 retrieved from: Watson, D., & Clark, L. A. (1994) https://doi.org/10.1077/48vii-m442

fMRI collection

Participants were scanned over an 8-month period of dance classes, with a minimum of 1-4 imaging sessions in September, December, January and April.

Procedures: Participants visualized learned dance in scanner; 30 s *OFF* and 60 s *ON*

Retrieved from: https://mri.info.yorku.ca/equipment/3t-prisma/

RESULTS

F = 19.442
p = 1.921e-11
df = 3
η^2 = 0.18; "very small"

Tukey multiple comparisons of means
HCpre-HCpost p<0.05 = 0.0004564
PDpre-HCpost p<0.05 = 0.0000000
PDpre-PDpost p<0.05 = 0.0000004

HC = healthy controls
PD = people with Parkinson's
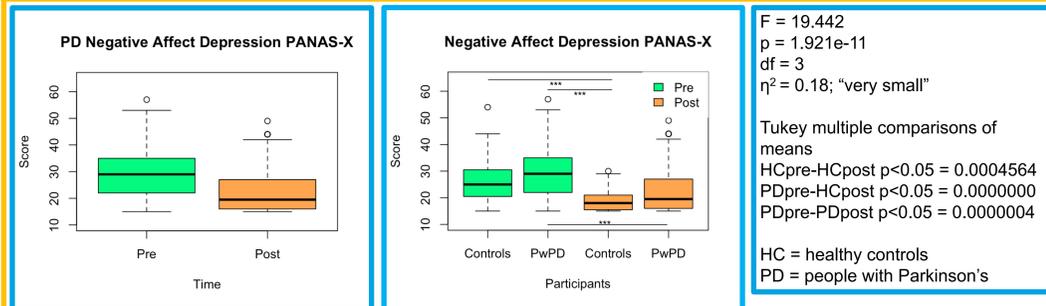
Significant **improvements** *(p<0.05)* in PANAS-X **depression** scores were found when conducting an ANOVA using four groups; **HCpre, PDpre, HCpost, PDpost**. With a post-hoc Tukey test, **significant differences** were also found between **HCpre and HCpost; PDpre and HCpost; PDpre and PDpost**.

F = 7.3005
p = 0.0001005
df = 3
η^2 = 0.08; "very small"

Tukey multiple comparisons of means
PDpost-HCpost p<0.05 = 0.0042968
PDpre-HCpost p<0.05 = 0.0001040
PDpre-HCpre p<0.05 = 0.0439249
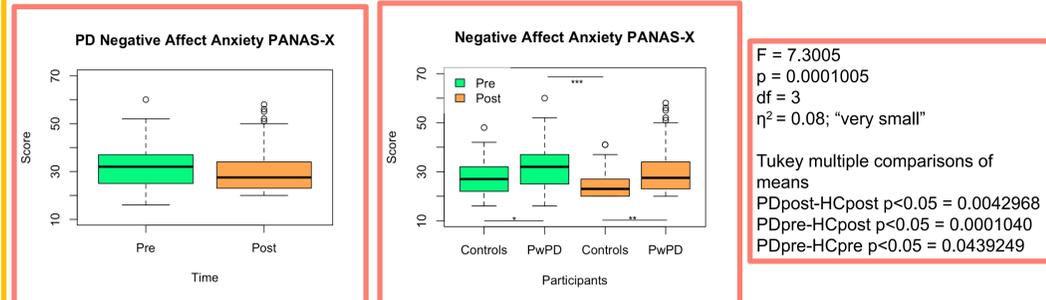
Significant **improvements** *(p<0.05)* in PANAS-X **anxiety** scores were found when conducting an ANOVA using four groups; **HCpre, PDpre, HCpost, PDpost**. With a post-hoc Tukey test, **significant differences** were also found between **PDpost & HCpost; PDpre & HCpost; PDpre & HCpre**.
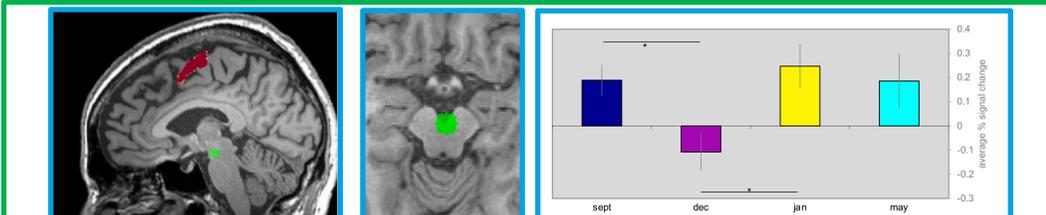
Significant changes *(p<0.05)* in BOLD signal were found in the **ventral tegmental area (VTA)** in between the **Sept** & **Dec** recordings *(p=0.023067)* and **Dec** & **Jan** *(p=0.02434)* recordings.
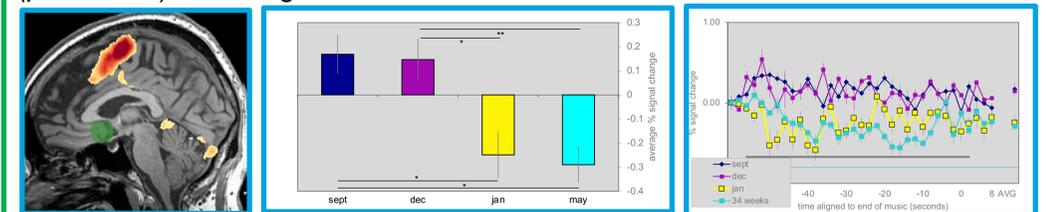
Significant changes *(p<0.05)* in BOLD signal were found in the **subcallosal cingulate gyrus (SCG)** in between **Dec** & **Jan** *(p=0.029667)*, **Sept** & **Jan** *(p=0.030261)*, **Dec** & **May** *(p=0.007934)* and **Sept** & **May** *(p=0.020389)*.
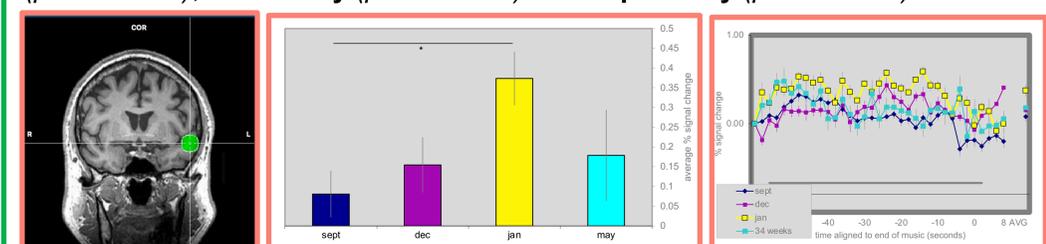
Significant changes *(p<0.05)* in BOLD signal were found in the **superior temporal gyrus (STG)** in between the **Sept** & **Jan** recordings *(p=0.015397)* and a change in between Jan & May *(p=0.082193)*.

DISCUSSION

This study provides insights into the **affective** benefits of attending **dance** classes for individuals with PD. The significant change in **PANAS-X** and **BOLD signal** is likely due to the integration of physical, cognitive, emotional and sensory processes that occur while dancing. It is important to note that the PANAS-X and fMRI collection do not overlap in time and cannot be correlated together. The significant changes found at these two time points allows for further investigations to collect the PANAS-X and conduct neuroimaging at the same time.

REFERENCES

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[3]Broen MP, Narayen NE, Kuijf ML, Dissanayaka NN, Leentjens AF. Prevalence of anxiety in parkinson's disease: A systematic review and meta-analysis. *Movement Disorders*. 2016;31(8):1125-1133. doi:10.1002/mds.26643
[4]Bearss KA, DeSouza JF. Parkinson's disease motor symptom progression slowed with multisensory dance learning over 3-years: A preliminary longitudinal investigation. *Brain Sciences*. 2021;11(7):895. doi:10.3390/brainsci11070895