Impact of Cognitive Impairment on Mini-BESTest and EMG Activity During Balance for Patients with Parkinson's Disease (PD)

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Aim Statement

Compare cognitive measure (MoCA) score with balance outcome measures (Mini-BESTest and EMG activity) in patients with Parkinsonism.

Background

Parkinson's Disease (PD) causes profound balance problems and falls, resulting in significant morbidity, mortality, healthcare expense, and reduced quality of life.[1] Currently, there is a gap in knowledge as to how cognitive impairments influence balance reactions in patients with PD. The MoCA is a brief screening instrument designed to assess various cognitive domains while the Mini-BESTest is a clinical measure designed to challenge distinct balance domains. The measures used in this study were chosen based on reliability and frequency of use among health professionals. We hypothesized that participants with MoCA scores below 26/30 would perform worse on subdomains of the Mini-BESTest involving a cognitive component.

Study Design

Prospective cross-sectional study embedded within an longitudinal study of fall risk in Parkinson's patients.

Study Variables:
- Montreal Cognitive Assessment (MoCA)
- Mini Balance Evaluation Systems Test (Mini-BESTest)
- Lower leg EMG recordings during balance testing (McKay et al., in review)
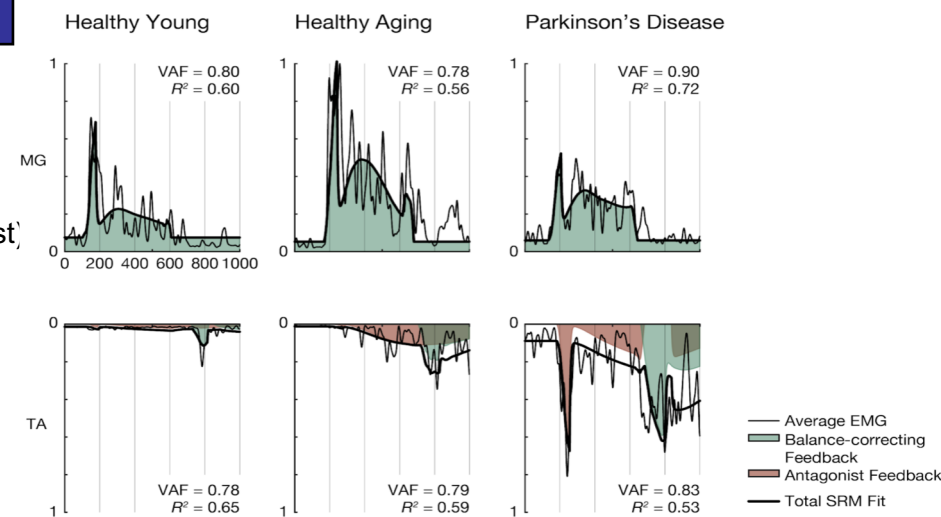
Methods

Data Collection:
1. Informed consent and study enrollment
2. Collection of demographic information
3. Cognitive assessments: MoCA
4. Functional assessments: Mini-BEST
5. Movement Disorders Society Unified Parkinson's Disease Rating Scale (MDS-UPDRS-III) Rated by SA Factor, DO
6. Preparation and collection of EMG data
7. Monthly fall report collection for 12 months
8. Data analysis performed by G. Dolce

Data Analysis

Demographic information

	Overall (N=65)		Overall (N=65)
Age		**MDS-UPDRS-III (Motor)**	
Mean (SD)	67.2 (7.5)	Mean (SD)	34.3 (14.0)
Range	47.0-82.0	Range	4.0-73.0
Sex		**PD Duration**	
Female	24 (36.9%)	Mean (SD)	7.8 (5.3)
Male	41 (63.1%)	Range	0.7-22.0
MoCA		**Destabilizing Feedback**	
Mean (SD)	26.3 (2.7)	Mean (SD)	2.8 (1.4)
Range	19.0-30.0	Range	9.0-28.0
		MiniBESTest Total	
		Mean (SD)	21.6 (4.3)
		Range	9.0-28.0

Examples of Destabilizing Feedback EMG

Healthy Young / Healthy Aging / Parkinson's Disease

- Average EMG
- Balance-correcting Feedback
- Antagonist Feedback
- Total SRM Fit
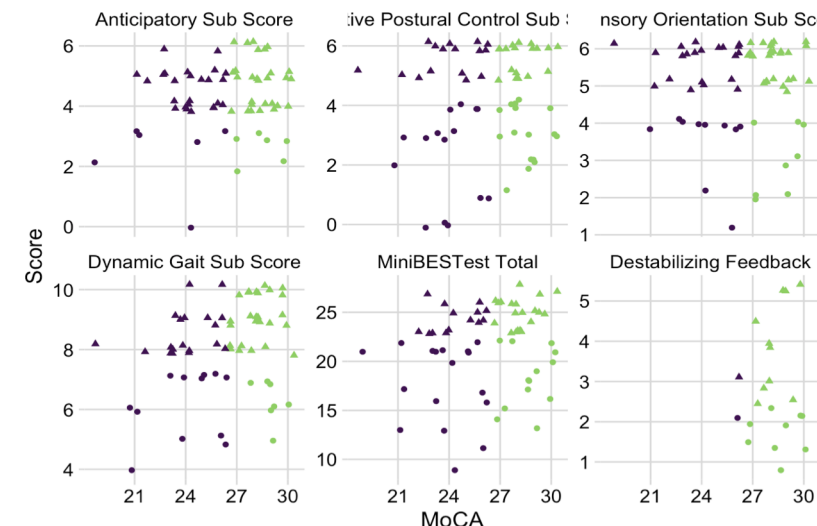
Data Analysis

1. Study variables were dichotomized about median values
2. Unadjusted univariate associations between study variables and MoCA score (<26) were expressed as Odds Ratios (OR) in a logistic regression framework
3. Unadjusted Odds Ratios were compared with Odds Ratios adjusted for Age, Sex, and PD duration.

Results

Individuals with lower MoCA scores tend to score worse on all subdomains of the Mini-BESTest. The most significant values were found in the dynamic gait and sensory orientation subscores.
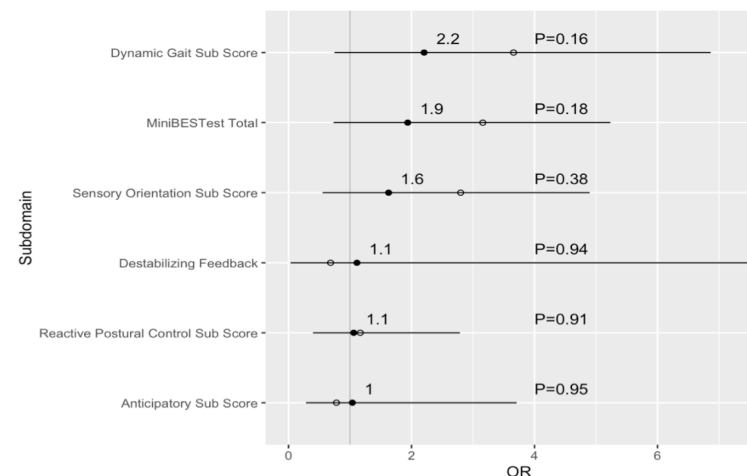

The first point represents the unadjusted odds ratio. The second point represents the odds ratio adjusted for age, sex, and years with PD. OR=1 Exposure does not affect odds of outcome

Conclusions

There is likely an association between low MoCA scores and low subdomain scores of the Mini-BESTest. There is a stronger association in the dynamic gait subscore compared to the other subdomains. We hypothesize that MCI causes a decreased MoCA and impacts the cognitive component of the Mini-BESTest. Overall, a strong association was found and supports the hypothesis that PD patients with MCI will score lower on Mini-BESTest Dynamic Gait and Sensory Orientation subdomains than PD patients.

Recruitment for Substudy
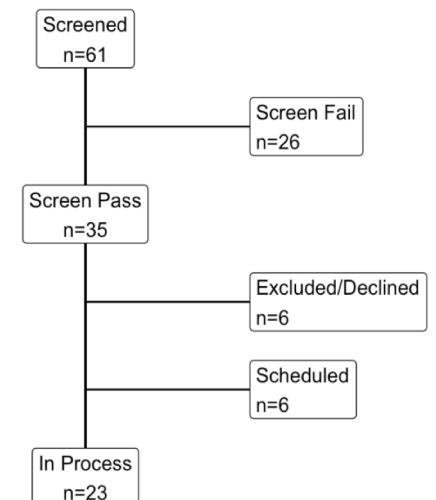
Screen Fail Reason	N	%
No documented cognitive problem	13	50
Wheelchair bound / other gait problem	6	23
Other diagnosis	4	15
Patient reported cognitive problem not regarded as clinically significant	2	8
Inability to contact (e.g., moved out of state)	1	4

Exclude/Decline Reason	N	%
Inability to contact	4	67
Too far to travel	2	33

Limitations: Sample size limits statistical power to control for multiple covariates, difficulty recruiting patients.

References

1. Bong, S. M., McKay, J. L., Factor, S. A., & Ting, L. H. (2019). Perception of whole-body motion during balance perturbations is impaired in Parkinson's disease and is associated with balance impairment. bioRxiv, 666636. doi:10.1101/666636
2. Bansal, S., et al. (2016). "Identifying Fallers among Home Care Clients with Dementia and Parkinson's Disease." Canadian Journal on Aging. La Revue Canadienne Du Vieillissement 35(3): 319-331.
3. Gujord Tangen G, Engedal K, Bergland A, Moger TA, Mengshoel AM. Relationships Between Balance and Cognition in Patients With Subjective Cognitive Impairment, Mild Cognitive Impairment, and Alzheimer Disease. Physical Therapy. 2014;94(8):1123-1134. doi:10.2522/ptj.20130298.