

The presence of dyskinesia is associate with worse gait and balance in Parkinson's Disease

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BACKGROUND

Levodopa-induced dyskinesia (LID) affects about 40% of Parkinson's disease (PD) patients after 4–6 years of levodopa treatment, interfering with balance, functional mobility, and increasing fall risk [1,2,3]. While LID's impact on postural sway is well-documented, its effect on gait is less understood [2].

MATERIALS AND METHODS

Cohort: PD patients from a cohort of candidates for device-aided therapies were divided into dyskinetic and non-dyskinetic groups based on anamnestic report and clinical evaluation in the "supra-ON" state, obtained administering 1.5x morning levodopa dose. 74 patients (77%) with LID and 22 (23%) without LID were enrolled.

Tools: using wearable motion sensors (APDM Mobility Lab), we assessed gait in OFF and ON state during a two-minute walk test and Root mean square (RMS) for static balance with a 30-seconds sway test.

Statistic: propensity score matching (PSM) was used to create two groups matched for age, gender, disease duration, disease severity (MDS-UPDRS III in OFF) and the postural instability gait disorder (PIGD) score. Gait and balance parameters were compared using Mann-Whitney test, and using Wilcoxon test for in-group differences from OFF to ON phase.

AIM OF THE STUDY

To assess the impact of LID on postural and gait parameters in the 'OFF' and 'ON' therapeutic condition using wearable motion sensors

	Dysk	Dysk (after PSM)	No-Dysk	P value (Dysk vs No-Dysk)	P value (matched Dysk vs No-Dysk)
N of patients (M/F)	74 (50/24)	22 (20/2)	22 (20/2)	/	/
Age (y)	60.5 ± 8.4	60.7 ± 7.7	60.8 ± 9.1	0.814	0.778
Disease duration (y)	12.7 ± 5.6	10.5 ± 3.6	10.2 ± 3.0	0.032	0.850
LEDD (mg)	1188 ± 408	1275 ± 457	1387 ± 485	0.358	0.398
MOCA (raw score)	24.1 ± 3.1	24.2 ± 3.2	24.5 ± 3.2	0.646	0.941
MDS-UPDRS I	13.1 ± 5.7	13.8 ± 5.7	13.3 ± 6.2	0.923	0.742
MDS-UPDRS II	16.0 ± 6.9	14.8 ± 7.6	13.0 ± 6.3	0.039	0.176
MDS-UPDRS III_OFF	47.6 ± 14.1	40.1 ± 10	41.9 ± 13	0.176	0.605
MDS-UPDRS III_ON	17.9 ± 9.8	14.3 ± 7.5	16.3 ± 9.3	0.364	0.698
Hoehn & Yahr stage - OFF	2.6 ± 0.7	1.9 ± 0.2	1.8 ± 0.6	0.146	0.697
Hoehn & Yahr stage - ON	2.1 ± 0.5	1.9 ± 0.6	1.8 ± 0.6	0.047	0.620
MDS-UPDRS IV	11.1 ± 2.6	11.5 ± 2.9	8.1 ± 2.7	< 0.001	< 0.001
PIGD score (OFF)	5.5 ± 2.9	5.1 ± 3.3	4.3 ± 2.5	0.072	0.568
PIGD score (ON)	2.7 ± 0.5	2.9 ± 2.4	2.1 ± 1.6	0.363	0.325
UDysRS I	13.1 ± 5.6	13.3 ± 6.3	/	/	/
UDysRS III+IV (ON)	9.2 ± 5.7	10.6 ± 7.0	/	/	/
N of fallers in the previous month (%)	24 (32.4)	7 (31.8)	2 (9.1)		

Table 1. Demographic and clinical characteristics of analyzed cohort. PIGD score was calculated as sum of MDS-UPDRS 3.9, 3.10, 3.12, 3.13.

RESULTS

After PSM with 22 matched pairs, the dyskinetic patients showed worse gait performance the 'OFF' condition, especially for stride length (p=0.006) and gait speed (p=0.007), while they presented only higher gait variability in the 'ON' condition. RMS sway increased from the OFF to the ON phase only in dyskinetic patients (p=0.030).

	Dysk	Dysk (after PSM)	No-Dysk	p value (Dysk vs No-Dysk)	p value (matched Dysk vs No-Dysk)
OFF - RMS Sway (m/s ²)	0.98 ± 0.56	1.03 ± 0.46	0.82 ± 0.37	0.288	0.159
OFF - Gait speed (m/s)	0.64 ± 0.26	0.61 ± 0.28	0.84 ± 0.19	0.001	0.007
OFF - Speed asymmetry (m/s)	0.02 ± 0.01	0.01 ± 0.01	0.02 ± 0.01	0.021	0.030
OFF - Stride length (m)	0.72 ± 0.28	0.70 ± 0.29	0.95 ± 0.21	< 0.001	0.006
OFF - Stride variability (m)	0.08 ± 0.05	0.07 ± 0.04	0.06 ± 0.04	0.021	0.265
OFF - Stride asymmetry (m)	0.19 ± 0.19	0.15 ± 0.11	0.27 ± 0.18	0.053	0.025
OFF - Step time (s)	0.59 ± 0.11	0.59 ± 0.11	0.57 ± 0.68	0.944	0.953
OFF - Step time variability (s)	0.05 ± 0.04	0.05 ± 0.04	0.03 ± 0.01	0.018	0.149
OFF - Step time asymmetry (s)	0.37 ± 0.05	0.34 ± 0.45	0.21 ± 0.19	0.236	0.690
OFF - Double support (%gct)	28.1 ± 7.5	29.5 ± 9.4	25.0 ± 4.5	0.045	0.047
ON - RMS Sway (m/s ²)	1.43 ± 1.09	1.63 ± 1.25	0.83 ± 0.21	0.003	0.009
ON - Gait speed (m/s)	0.90 ± 0.21	0.91 ± 0.28	1.02 ± 0.12	0.005	0.193
ON - Speed asymmetry (m/s)	0.18 ± 0.14	0.22 ± 0.19	0.17 ± 0.14	0.882	0.525
ON - Stride length (m)	1.03 ± 0.19	1.04 ± 0.24	1.18 ± 0.14	0.001	0.053
ON - Stride variability (m)	0.59 ± 0.31	0.59 ± 0.28	0.47 ± 0.13	0.044	0.189
ON - Stride asymmetry (m)	0.23 ± 0.23	0.26 ± 0.20	0.22 ± 0.17	0.951	0.492
ON - Step time (s)	0.59 ± 0.07	0.60 ± 0.09	0.59 ± 0.04	0.906	0.869
ON - Step time variability (s)	0.03 ± 0.02	0.03 ± 0.02	0.02 ± 0.08	< 0.001	0.021
ON - Step time asymmetry (s)	0.29 ± 0.32	0.27 ± 0.17	0.19 ± 0.15	0.191	0.076
ON - Double support (% gct)	22.9 ± 4.96	25.5 ± 7.22	22.8 ± 3.60	0.800	0.511

Table 2. Gait features of the two groups after matching for PSM.

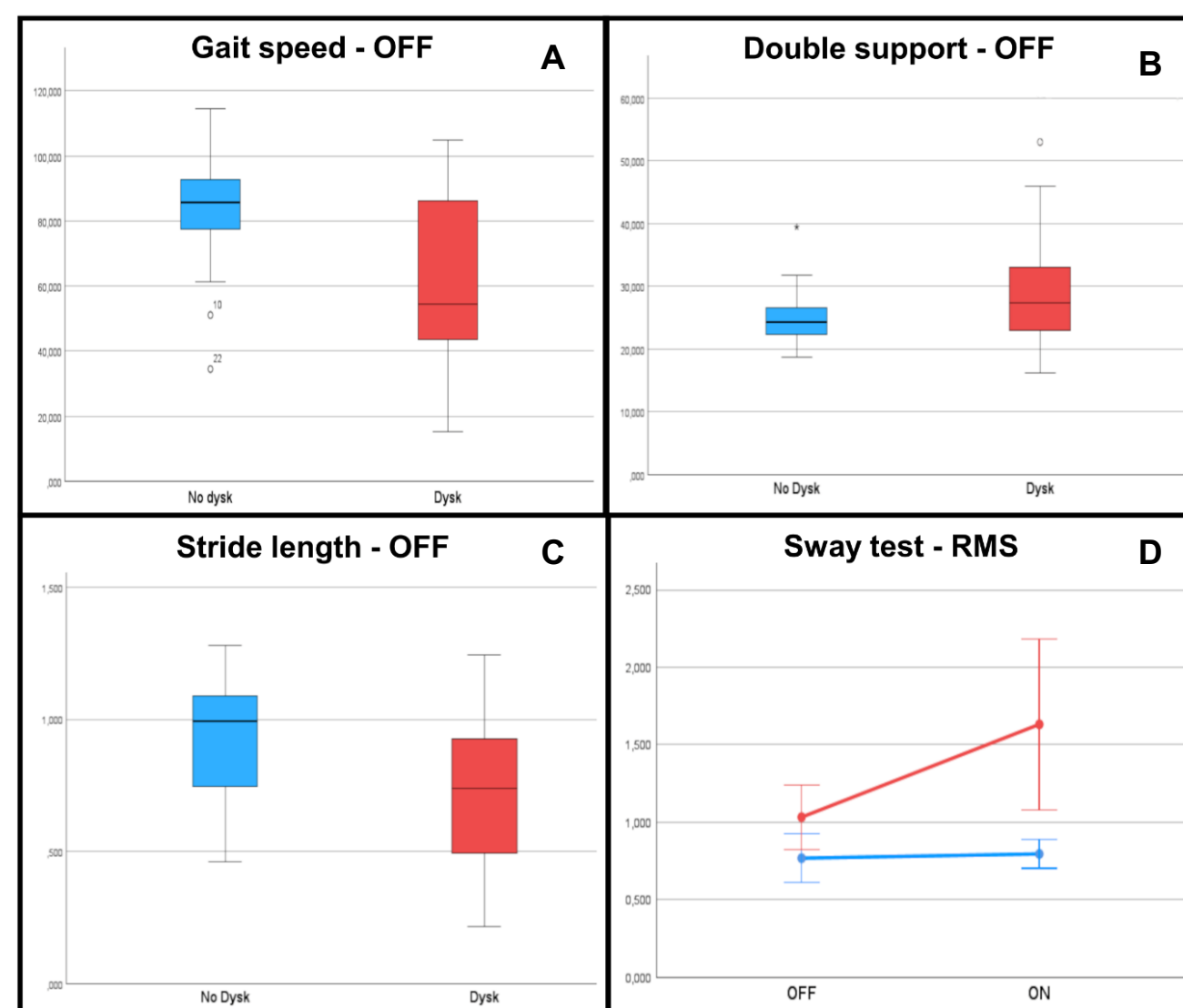


Figure 1:
A. Gait speed of matched groups.
B. Double support (OFF) of matched group
C. Stride length (OFF) of matched groups.
D. RMS sway from OFF to ON phase of matched groups.

CONCLUSIONS

While confirming greater postural sway in the ON phase, our findings show that dyskinetic patients exhibit worse gait performance in the OFF state compared to matched non-dyskinetic patients. These results suggest intrinsic motor phenotype differences, beyond the direct impact of dyskinesias. Further studies are needed to explore shared mechanisms linking dyskinesia and gait dysfunction in advanced PD.

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