

# Wearable sensor (Parkinson's Kinetigraph™) and dopamine transporter imaging as potential biosignature for constipation in Parkinson's disease

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## Objective

To assess whether wearable sensor data, generated by the Parkinson's Kinetigraph™ (PKG), or dopamine transporter scan could be used as a potential biosignature for constipation in Parkinson's disease (PD).

## Background

- Currently there are no specific biomarkers for constipation, a major non-motor symptom (NMS) of PD<sup>1</sup>.
- Wearable sensors have proven value in monitoring the motor state of PD patients, and efforts are being made to identify non-motor targets for remote monitoring<sup>2</sup>.
- The PKG system comprises a wrist-worn watch-like device with a triaxial accelerometer which provides scores, among others, for bradykinesia (BKS) and dyskinesia (DKS).

## Methods

- A cross-sectional analysis of 107 participants enrolled in the global Non-motor Longitudinal International Study (NILS; UKCRN No: 10084, database held at King's College Hospital (London UK)) who also underwent a six day PKG recording at home.
- 47 patients also underwent a dopamine transporter scan (DaT scan).
- Constipation scores on question 21 of the validated Non-Motor Symptom Scale (NMSS) were used to stratify participants based on constipation severity: mild 0-3 points (n=70), moderate 4-7 points (n=22), and severe 8-12 points (n=15).
- The primary outcome was the difference in PKG bradykinesia and dyskinesia scores between groups.
- Secondary outcomes included differences in non-motor and motor scores, and DaT scan results. Statistical analysis was performed using ANOVA testing with correction for multiple testing.

## Results

Primary and secondary outcomes are provided in the table.

- PKG bradykinesia (BK) scores significantly correlated with constipation severity (Spearman's  $r=0.219$ ;  $p=0.022$ ) and were significantly higher in those with severe constipation compared to mild constipation ( $p=0.008$ ).
- Scales for Outcomes in Parkinson's disease (SCOPA-M) disability scores were higher in the former group ( $p<0.001$ ).
- DAT scan putamen and caudate binding ratios did not correlate with constipation severity ( $p>0.35$ ).
- Total NMSS scores were 36% higher in participants with severe constipation ( $77.7\pm 35.6$ ) compared to those with mild constipation ( $49.4\pm 35.6$ ) ( $p=0.006$ ).

Constipation	Mild (NMS21: 0-3) (n=70)	Moderate (NMS21: 4-7) (n=22)	Severe (NMS21: 8-12) (n=15)	p
Age	61.5 ± 9.1	67.3 ± 14.4	66.5 ± 10.5	0.041*
Disease duration	7.2 ± 5.3	11.3 ± 16.4	12.0 ± 13.8	0.09*
LEDD (mg)	951.6 ± 772.1	144.5 ± 995.2	808.7 ± 720.9	0.027*
BKS (PKG)	25.4 ± 8.4	28.8 ± 7.5	32.4 ± 9.4	0.008*
DKS (PKG)	6.9 ± 14.8	3.5 ± 8.5	1.9 ± 3.8	0.28*
SCOPA-A	10.2 ± 6.1	14.3 ± 6.6	12.5 ± 5.1	0.021#
SCOPA-B	6.0 ± 3.6	10 ± 4.7	8.5 ± 4.5	<0.001#
SCOPA-C	3.7 ± 2.7	4.7 ± 2.6	3.7 ± 3.4	0.32#
NMSS total	49.4 ± 35.6	69.5 ± 38.4	77.7 ± 35.6	0.006†
NMSQ	9.7 ± 5.0	11.3 ± 4.0	12.3 ± 4.4	0.26†
MMSE	28.3 ± 4.0	28.0 ± 2.8	27.3 ± 2.7	0.62†
HADS	13.6 ± 7.0	16.1 ± 8.1	12.1 ± 7.1	0.22†
PDSS	101.3 ± 24.9	87.8 ± 27.8	99.5 ± 24.8	0.10†
PDQ-8	9.6 ± 5.9	12.8 ± 7.0	12.9 ± 5.6	0.035†
Epworth	9.0 ± 5.2	10.5 ± 6.3	7.5 ± 4.3	0.25†
DAT scan	(n=33)	(n=6)	(n=7)	
DAT Striatum *	1.06 ± 0.36	0.98 ± 0.31	1.01 ± 0.39	0.84
DAT Putamen *	0.80 ± 0.32	0.71 ± 0.19	0.71 ± 0.28	0.70
DAT Caudate *	1.32 ± 0.42	1.24 ± 0.44	1.31 ± 0.47	0.92

\* Most affected side; † level of significance  $p=0.05/5=0.01$ ; #  $p=0.05/3=0.17$ ; ‡  $p=0.05/7=0.007$



## References

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## Conclusions

Wearable sensor bradykinesia scores appear to be a marker for constipation and this association seems to be independent of central dopaminergic neurotransmission as indicated by the absent correlation with DaTscan.

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