

Sleep Assessment in Parkinson's disease – the use of Parkinson's KinetiGraph

Lisa Klingelhofer^{1,2}, Malcolm Horne^{3,4}, Alexandra Rizos², Anna Sauerbier², Sarah McGregor³, Dhaval Trivedi², Lauren Perkins², K Ray Chaudhuri^{2,5}

¹Department of Neurology, Technical University Dresden, Fetscherstraße 74, Dresden, Germany ²National Parkinson Foundation International Centre of Excellence, Department of Neurology, King's College Hospital, Denmark Hill, London, UK ³Centre for Clinical Neurosciences and Neurological Research, St Vincent's Hospital Melbourne, Fitzroy, Victoria, Australia ⁴Florey Institute for Neuroscience and Mental Health, University of Melbourne, Parkville, Victoria, Australia ⁵Institute of Psychiatry, Psychology and Neuroscience, King's College London, Denmark Hill, London, UK

BACKGROUND and OBJECTIVE

Sleep disturbances are important non-motor symptoms (NMS) in patients with Parkinson's disease (PD) and a key determinant of health related quality of life (HRQoL). A consequence of disturbed nighttime sleep can be excessive daytime sleepiness (EDS). The Parkinson's KinetiGraph (PKG), a system consisting of algorithms operating on wrist worn accelerometry, can be used as an objective measure of different motor states. Furthermore, periods of immobility during daytime are thought to reflect short episodes of sleep.

We aim to evaluate whether the PKG can be used as an objective marker of disturbed nighttime sleep in PD.

METHODS

- prospective study in PD patients
- data from 24-hour PKG recordings over six consecutive days are compared with Hauser diaries and scales focusing on motor state, sleep and HRQoL.

Correlation coefficient as r_s values	Sleep onset and maintenance insomnia		Nocturnal restlessness		Nocturnal psychosis		Nocturnal motor symptoms	
	NMS Quest 23	PDSS	NMS Quest 26	PDSS	NMS Quest 14	PDSS	NMS Quest 25	PDSS
Nighttime sleep quantity								
PKG: Duration of Sleep	-0.36*	3: 0.42*	-0.44*	4: 0.49** 5: 0.41*	-0.36*	6: 0.43*	-0.36*	10: 0.38* 11: 0.45**
PKG: Duration of Wakefulness	0.56***		0.41*	4: -0.49** 5: -0.39*	0.56***	6: -0.50** 7: (-0.39*)	0.45**	10: (-0.36*) 11: -0.42*
Diary: Duration of Sleep	-0.38*	2: (0.57***)				6: (0.37*)		12: (0.36*)
Diary: Duration of Wakefulness		2: (-0.48**)	0.39*					
Nighttime sleep quality								
PKG: % sleep of duration of rest	-0.57***		-0.49**	4: 0.46** 5: 0.46**	-0.49**	6: 0.52** 7: (0.38*)		10: 0.38* 11: 0.45** 12: 0.41*
PKG: % awake >20min of duration of rest	0.54**		0.46**	4: -0.47** 5: -0.46**	0.50**	6: -0.54** 7: (-0.41*)		10: -0.38* 11: -0.45** 12: -0.40*
PKG: % asleep >20min of duration of rest	-0.37*	3: 0.43*	-0.40*	5: 0.37*	-0.36*	6: 0.52**		10: 0.41* 12: 0.43*

Total scores	NMS Quest	PDSS	PDQ 8
Nighttime sleep quantity			
PKG: Duration of Sleep	-0.55**	0.53**	-0.57***
PKG: Duration of Wakefulness	0.55**	-0.59***	0.54**
Nighttime sleep quality			
PKG: % sleep of duration of rest	-0.66***	0.68***	-0.59***
PKG: % awake >20min of duration of rest	0.65***	-0.68***	0.60***
PKG: % asleep >20min of duration of rest	-0.57***	0.57***	-0.46**

RESULTS

- 63 PD patients (43 male) in total
- Based on an Epworth Sleepiness Scale (ESS) cut off score of less than 10 points: 33 PD patients as "non sleepy" controls (PD-C, ESS < 10) and 30 PD had EDS (PD-EDS, ESS ≥ 12).
- The groups are matched for age, gender and Hoehn and Yahr state.
- Both groups showed similar motor disability, scales for depression, levodopa equivalent dose per day.
- We found significant correlations of objective parameters for nighttime sleep quantity and quality of the PKG with subjective sleep perception as measured by the NMSQuest and PDSS only in the PD-EDS group.
- There were no significant correlations of nighttime sleep quantity parameters of the Hauser diary with subjective sleep perception, nor any correlations in the PD-C group.

Tables: Correlations between PKG measures, Hauser diary and questionnaires of nighttime sleep. Correlation coefficient as r_s values, significance levels p values as *p < 0.05; **p < 0.01; ***p < 0.001, values of PD-C group in brackets.

CONCLUSIONS

This first PKG based study of nighttime sleep in PD suggest that the PKG, in addition to being a marker of the motor state, could be utilised to evaluate aspects of nighttime sleep. The PKG can not discriminate between sleepy and non-sleepy PD patients but in sleepy PD patients quantity and quality PKG parameters correlate with different aspects of sleep like insomnia, parasomnia, RLS and RBD. The use of the PKG in PD patients recognised to suffer from daytime sleepiness can help to detect disturbed nighttime sleep, to decide for which patients further investigations are needed and to tailor specific treatment.