

APPLICATION OF ACTIGRAPHY IN FUNCTIONAL MOVEMENT DISORDERS: A REVIEW OF THE LITERATURE

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Introduction

Actigraphy involves the use of a small, wrist-watch sized activity monitor to record and analyse human physical movement over time. Actigraphs were first developed in the 1950s but 'wearable technologies' have rapidly developed over the past decade and are increasingly being utilised for research and clinical applications in organic movement disorders.

However, little is known about the use of actigraphy in functional movement disorders (FMD), syndromes of abnormal involuntary movement where there is incompatibility between the symptoms and any recognised neurological or medical condition (DSM-V). FMD are recognised as prevalent and disabling conditions which can be difficult to diagnose and treat.

This literature review examines the scope and quality of the literature into the use of actigraphy in FMD, considering the use of actigraphy for

- 1) Diagnosis and monitoring of symptoms
- 2) Exploration of underlying pathophysiological mechanisms
- 3) Treatment of FMD.

Methods

A systematic literature search was undertaken in PubMed, Medline, EMBASE and PsychInfo databases, as well as hand-searching citation lists and Google Scholar, using keywords related to actigraphy/wearable technology and FMD.

Given the limited literature base, any study on actigraphy in adult patients diagnosed with FMD was included, covering qualitative or quantitative research and grey literature. Animal studies, other methods of electrophysiological monitoring and outcomes related solely to sleep or activity level were the key exclusion criteria. PRISMA guidelines were adopted.

Results

The literature search identified 385 articles. 13 were considered to be of sufficient relevance and quality for further data extraction and synthesis.

All studies investigated functional tremor, not wider FMD. They were small, observational and heterogeneous in study design, participants, data analysis and outcomes, with no randomised controlled trials conducted. Most compared a small group of patients with functional tremor to unmatched patients with varied organic movement disorders. The power, reliability and validity of the studies were low, with significant bias and confounding identified.

Only three of the studies had a more rigorous study design and these differed in their conclusions. Parees et al (2012) reported patients with functional tremor overestimated tremor duration found on actigraphy by a statistically significant amount compared to those with organic tremor, whereas Kramer et al (2019) concluded there was no significant difference in subjective symptom burden between patients with functional tremor and organic tremor. Of note, Schwingenschuh and colleagues (2011) identified that individual tests such as tremor frequency or amplitude alone were specific but not sensitive enough to reliably monitor functional tremor symptoms, proposing a battery of tests instead.

Quality assessment of included studies (adapted from CASP checklist and STROBE guidelines)

Study	1	2	3	4	5	6	7	8	9	10	TOTAL/10
Kramer et al 2019	Y	Y	N	N	Y	Y	Y	N	Y	Y	7
Parees et al 2012	Y	Y	N	N	Y	?	?	Y	Y	Y	6
Raethjen et al 2004	Y	Y	N	?	Y	Y	Y	?	Y	?	6
Kramer et al 2018	Y	?	N	N	Y	?	Y	Y	Y	Y	6
Dominguez-Vega et al 2018	Y	N	N	N	N	?	?	Y	Y	?	3
Zeuner et al 2003	Y	?	N	N	Y	Y	Y	?	Y	?	5
Cardenas et al 2015	Y	N	?	?	N	?	?	Y	Y	?	3
Saifee et al 2012	Y	Y	N	N	N	?	?	?	N	?	2
Laarhoven 2017	Y	?	N	?	Y	Y	?	Y	Y	?	5
Manzanera et al 2016	Y	Y	?	?	Y	Y	?	Y	Y	N	6
Parees et al 2011	Y	?	?	N	Y	?	?	Y	Y	?	4
Schwingenschuh et al 2011	Y	Y	N	N	Y	Y	Y	Y	Y	?	7
McCauley & Rothwell 2004	Y	Y	N	?	Y	Y	Y	?	Y	N	6

KEY

- 1 Did the study address a clearly focused issue/are the aims clear?
- 2 Were selection criteria clearly described?
- 3 Was bias minimised?
- 4 Have potential confounding factors been identified and addressed?
- 5 Are sources of data/details of measurement available?
- 6 Were the outcomes accurately measured?
- 7 Are the results reliable?
- 8 Do the results fit with other evidence available?
- 9 Was the description of the test/protocol sufficient for it to be replicated?
- 10 Are the results generalisable (external validity)?

Conclusions

This systematic review seeks to evaluate current research on the use of actigraphy in FMD. Due to the low quality and heterogeneity of study designs, it was difficult to draw any firm conclusions. However, available research did provide proof of principle for the use of actigraphy in diagnosing and monitoring symptoms of functional tremor over time, and some attempted to elucidate possible pathophysiological mechanisms. None of the research explored actigraphy in the treatment of FMD.

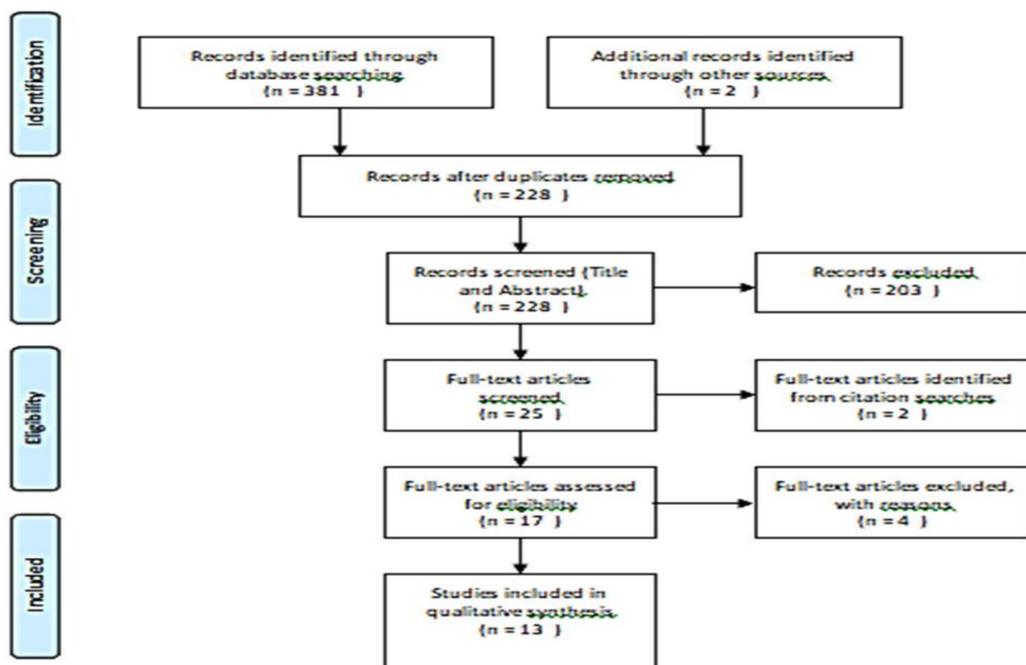
There are a number of limitations to this review. There were a small number of studies identified; there are multiple descriptors for both actigraphy and FMD, and searches were limited to those in the English language within the last 20 years. Consensus on criteria for diagnosis of tremor syndromes using accelerometry is lacking (Bove et al 2018).

Larger, randomised controlled trials are needed to establish reliability and validity of actigraphy in functional tremor and should be expanded to include other forms of FMD and the use of newer wearable technology such as smartphones and fitness trackers. Investigating the treatment of FMD with actigraphy could prove an important and exciting area for research.

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Adapted PRISMA 2009 Flow Diagram



Key References

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