

# Gait and Balance Impairments in Idiopathic Rapid Eye Movement Sleep Behavior Disorder

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ProtoKinetics' [Zeno Walkway pressure mat](#) and [PKMAS software package](#) were recently used in a gait study which looked at using gait analysis procedures to highlight subtle gait abnormalities within a select population – in this case, patients with idiopathic rapid eye movement sleep behavior disorder (iRBD). A simple self-selected walking task did not show differences between the experimental and control groups. But when the walking task was made more difficult by adding dual-tasking like counting backward from 100 by 1's, or asking the subjects to walk at higher speeds, gait abnormalities surfaced in the experimental group.

While this study is interesting from the lens of motor impairments for patients with iRBD, the overarching theme has an even broader appeal. Increasing task difficulty through cognitive load or increased physical requirements can reveal gait and balance abnormalities that otherwise would not be visible. This could be key for identifying early signs of disease or impairment.

This is the first study to conduct quantitative analyses examining all 5 independent domains of gait across increasingly complex dual tasks in polysomnography-confirmed iRBD patients.

## Can early indicators of Parkinson's Disease be discovered by analyzing gait in iRBD patients?

Idiopathic rapid eye movement sleep behavior disorder (iRBD) is characterized by overt movements or vocalizations during sleep that are reported as dream enactment. Most people with iRBD will develop a [synucleinopathy](#), neurodegenerative diseases characterized by the abnormal accumulation of aggregates of alpha-synuclein protein in neurons, nerve fibers or glial cells. Most people with iRBD develop Parkinson's disease (PD) or Dementia with Lewy bodies (DLB).

iRBD has become one of the most important clinical phenotypes for predicting future neurodegeneration because of synucleinopathy. Although studies have been conducted into characterizing the key prognostic features of PD within this clinical population, more work is required to be able to accurately predict and treat conditions such as PD and DLB at the earliest possible stages when potentially disease-modifying therapies might prove most effective.

The primary aim of this study was to quantitatively determine any gait and balance impairments in a polysomnography-confirmed cohort of iRBD patients by examining the differences between iRBD patients and healthy age-matched controls across different walking and static balance conditions.

The participants completed 5 different walking trials across a Zeno pressure sensor walkway. The participants were instructed to walk in the following 5 different conditions:

1. at a normal pace
2. at their fastest pace
3. at a normal pace while counting backward from 100 by 1s
4. at a normal pace while naming as many animals as possible
5. at a normal pace while subtracting 7s from 100.

Following this, the participants were instructed to stand on the Zeno pressure carpet at a comfortable stance and perform 2 quiet stance trials of 30 seconds, first with their eyes open and followed by eyes closed. The participants subsequently completed 2 single-leg stance trials on their left and right legs.

The gait and balance analyses were performed using the PKMAS software package. Primary gait outcome measures were selected to summarize the following 5 independent domains of gait:

1. pace, velocity (cm/s) and [step length](#) (cm);
2. rhythm, step time (seconds);
3. variability, coefficient of variation (%) of step length;
4. [asymmetry](#), step time asymmetry (seconds; ie, the difference in step time between the left and right steps) and step length asymmetry (ie, the left-right step length);
5. postural control, step width and step width coefficient of variation (%).

To capture a summary of the participants' balance impairments, the following outcome measures were calculated during the eyes-open and eyes-closed trials:

1. x and y range (cm),
2. anterior-posterior and mediolateral root mean square of the center of pressure (COP) displacement (cm),
3. mean COP length (cm),
4. COP velocity (cm/s),
5. and max COP velocity (cm/s).

Only the total duration (seconds) was quantified for the single-leg stance trials.

## iRBD patients showed subtle gait impairments under cognitive load

Although no gait differences were found between the groups during normal walking, there were significant differences under the fast-paced and dual-task gait conditions. In response to the dual-tasking, healthy controls widened their step width without changing step width variability, whereas iRBD patients did not widen their step width but instead significantly increased their step width variability.

Similarly, during fast-paced walking, the iRBD patients demonstrated greater step length asymmetry.

This study demonstrates that iRBD patients have subtle gait impairments, which likely reflect early progressive degeneration in brainstem regions that regulate both REM sleep and gait coordination.

[Read more on this iRBD study.](#)