

Clinic-based videotaped assessment of turning strategies used by patients with Parkinson's Disease

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Introduction

- One of the most serious consequences of Parkinson's disease (PD) is that of gait instability and falls.
- Turning is associated with an increased fall risk in people with PD.
- Previous studies have divided turning strategy into step and spin turns and have suggested that a preference for less stable spin turns may contribute to a higher risk of falling in healthy elderly subjects (1,2).
- A previous study examining in-place 180 degree turns has also shown that people with PD and healthy unimpaired people both show a slight preference for spin turns and suggested that this preference may simply be an effect of aging (3).
- Previous tasks have not closely resembled real-life situations where people are frequently required to turn suddenly to avoid an obstacle or are required to turn while concentrating on another thought or task.
- Most studies utilize sophisticated instrumentation that is unavailable and time consuming in clinical practice.

Objectives

To assess turning strategies in subjects with Parkinson's disease using a simple clinic-based videotaped method and to determine if a preference for spin turns exists that may explain a higher rate of falls in this population.

To determine if turning strategy correlates with disease severity, an individual's balance confidence or fear of falling, or cognitive impairment.

To determine if turning strategy changes as task complexity increases.

To assess the practicality of using such a simple measure to judge and potentially advise patients in regards to their risk of falls due to usage of potentially unstable turning strategy.

Method

Participants

- Nine patients (7 male, 2 female) aged 50-76 years ($M = 63$, $SD = 9$) with PD from the movement disorder clinic at London Health Sciences Centre, London, Ontario Canada were recruited to participate in this study

Inclusion criteria:

- Consenting patients over age 18 years
- Diagnosis of idiopathic PD (UK Brain Bank Criteria)
- Hoehn & Yahr Stage 1-3

Exclusion criteria:

- Other significant neurological disease
- Other illness or injury that may impair motor function or that necessitated a walking aid

Procedure

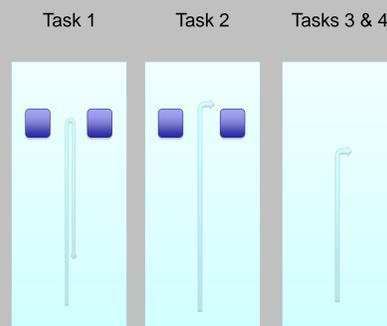
- Participants completed a series of assessment tools including:

Unified Parkinson's Disease Rating Scale (UPDRS, motor component)	<ul style="list-style-type: none"> used to grade severity of physical symptoms in Parkinson's disease administered by study physician
Activities-specific Balance Confidence (ABC) Scale	<ul style="list-style-type: none"> respondents are asked to rate their confidence that they will avoid a fall in the course of daily activities in validation studies, lower average scores correlated with the respondent having had a fall in the past year
Montreal Cognitive Assessment (MoCA)	<ul style="list-style-type: none"> used to assess cognitive function administered by study physician

- Participants performed 6 trials each of 4 walking and turning tasks.
- Tasks were videotaped and videos were segmented to facilitate the analysis of turn strategy for each trial.

- Turning task 1:** participants were instructed to walk forward, turn 180 degrees between two pillars and return to their starting position.
- Turning task 2:** participants were instructed to walk forward, turn 90 degrees right or left (standardized) after a pillar and continue walking forward (planned turn).
- Turning task 3:** participants were instructed to walk forward; while walking they were instructed to turn 90 degrees right or left (standardized) and continue walking forward (surprise turn).
- Turning task 4:** identical to task three except serial subtractions were performed aloud while walking (surprise turn with cognitive load).

Method



- Six patients completed the tasks in "on" state and 3 in "off" state relative to PD medications.

Statistical Analysis

- Variables entered into statistical calculation included UPDRS score, ABC score, MoCA score, on/off state status, and percentage of turns by turn type for task.
- Data met assumptions for parametric testing
- The effect of turn type for 180 degree turns (Task 1) was calculated using a t-test statistic for dependent measures.
- The effect of increasing task demand was determined using a mixed ANOVA for repeated measures (within-between subjects) using data from tasks 2-4.
- The relationship between measures of motor skills, balance confidence, and cognition with percentage of turns used in each task was determined using bivariate correlation tests (Pearson's)
- SPSS statistics package V. 17 was used for all analyses
- Alpha was set at 005 for all testing

Results

Table 1. UPDRS, ABC, MoCA scores

	UPDRS (on)	UPDRS (off)	ABC	MoCA
M(SD)	19.08 (7.41)	33.16 (3.75)	72.53 (21.07)	25.33 (2.83)

Variability of turns used by individual participants across tasks (Figures 1-4)

Figure 1

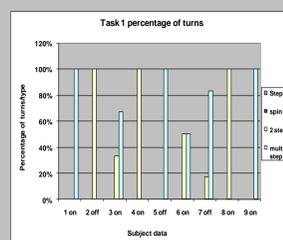


Figure 2

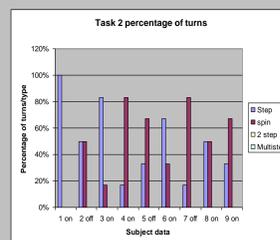


Figure 3

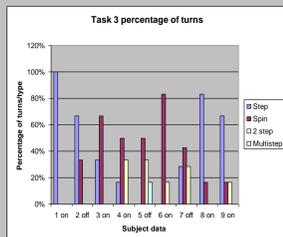


Figure 4

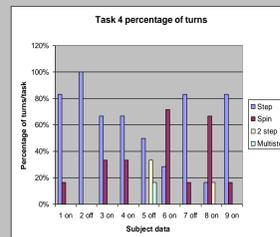
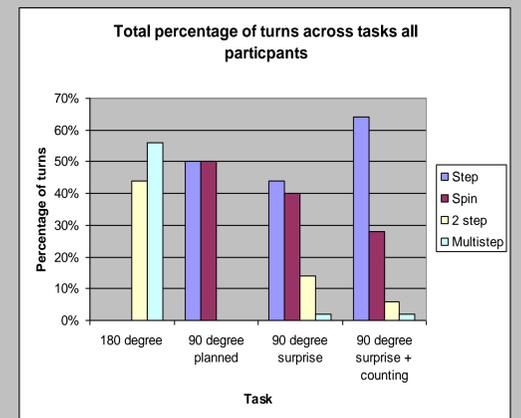


Table 2. Correlation of turn type by task with UPDRS, ABC, and MoCA

Turn	Task	UPDRS	ABC	MoCA
Step	2	$r = .067$ $p = .864$	$r = -.148$ $p = .704$	$r = .057$ $p = .885$
	3	$r = -.067$ $p = .864$	$r = -.148$ $p = .704$	$r = -.057$ $p = .885$
	4	$r = .249$ $p = .519$	$r = -.275$ $p = .474$	$r = .122$ $p = .754$
Spin	2	$r = -.067$ $p = .864$	$r = -.148$ $p = .704$	$r = -.057$ $p = .885$
	3	$r = -.219$ $p = .571$	$r = -.092$ $p = .813$	$r = -.165$ $p = .671$
	4	$r = -.612$ $p = .080$	$r = .616$ $p = .077$	$r = .277$ $p = .471$
2 Step	2	n/a	n/a	n/a
	3	$r = -.055$ $p = .888$	$r = -.329$ $p = .388$	$r = .039$ $p = .921$
	4	$r = .501$ $p = .169$	$r = -.416$ $p = .265$	$r = -.624$ $p = .072$
Multi Step	2	n/a	n/a	n/a
	3	$r = .550$ $p = .125$	$r = -.601$ $p = .087$	$r = -.575$ $p = .106$
	4	$r = .550$ $p = .125$	$r = -.601$ $p = .087$	$r = -.575$ $p = .106$

Results

Figure 5



- With $\alpha = 0.05$ there was a significant effect of task on turn type for 2-step turn [$F(1,7) = 21.85$; $p = .002$].
- Spin turn [$F(2,6) = 4.144$; $p = .074$] and step turn [$F(2,6) = 4.448$; $p = .065$] only approached significance.
- There was no effect of task on turn type for multi step turn [$F(1,7) = 2.333$; $p = .170$].
- There was no interaction of drug and task on turn type for 2-step turn [$F(1,7) = 1.625$; $p = .243$], step turn [$F(2,6) = .646$; $p = .557$], or multi step turn [$F(1,7) = 2.333$; $p = .170$].
- The interaction of task and drug on turn type for spin turn approached significance [$F(2,6) = 3.890$; $p = .083$].
- There was no significant difference between the percentage of step turns and multistep turns used during the 180 degree turn task [$t(8) = .22$; $p = .832$].

Conclusions

- Participants did not show an increased preference for spin turns over step turns during any of the turning tasks as previously shown in other studies. This may be due to our small sample size or differences in tasks, age, cognition or motor function between studies.
- In addition to step and spin turns, participants used 2-step and multistep turns as task demands increased. We did not anticipate this variability in turn type.
- Even with our relatively small sample sizes, there was a main effect of task suggesting that step, spin and 2-step turns vary in use depending on task but that multistep turns seem less affected; as task complexity increased, step turn and 2-step turn use increased while spin turn use decreased.
- Our conclusions regarding the interaction of drug and task on turn type are guarded secondary to our small sample size. However our results indicate that the primary effect on choice of turn type is dependent on task and not on the patient's "on"/"off" state.
- In the cognitively-loaded task (Task 4), the use of spin turns decreased in participants with greater motor symptoms (higher UPDRS scores) and reduced balance confidence.
- An increased use of 2-step turns and multistep turns was observed as UPDRS scores increased and balance confidence and cognition decreased in both the surprise turn task (Task 3) and the cognitively-loaded task (Task 4).
- The above correlations may occur because participants employ more cautious strategies as turning becomes more demanding in order to compensate for motor and cognitive deficits.
- Simply observing turn type in clinic could help identify patients at higher risk of falls, irrespective of their medication status.
- Such observations in clinic could then be useful in providing immediate feedback to patients in terms of safer strategies in day-to-day activities which often involve using "cognitively loaded" turns.
- Larger sample sizes are required to determine if turn type variability can explain the greater number of falls that occur in this population.

References

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