



The effectiveness of transcranial direct current stimulation on ambulation in persons with Parkinson's Disease: A Systematic Review

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Overview



- Background
 - Parkinson's Disease
 - Effect of Parkinson's on Gait
 - Transcranial Direct Current Stimulation
- Purpose
- Methods
- Search Terms
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Background



- Parkinson's Disease
- Effect of Parkinson's on Gait
 - Temporal-Distance Gait Parameters
- Transcranial Direct Stimulation



Parkinson's Disease

- Clinical features of PD¹
 - Resting tremor
 - Rigidity
 - Bradykinesia
 - Postural instability
- Typical gait deviations¹
 - Freezing of gait (FOG)
 - Festination



Effect of Parkinson's on Gait

Temporal-Distance Parameters of Gait¹:

- 1. Cadence:** number of steps per minute
 - Fluctuates, increased or decreased cadence
 - Mild/Initial PD: slightly reduced
 - Advanced PD: increased with small, rapid steps and decreased stride length (festination)



Effect of Parkinson's on Gait

2. **Stride length:** distance covered in 2 steps (consecutive heel strike on same leg)
 - Consistently decreased
 - Leads to postural instability→ increases fall risk

3. **Velocity:** average horizontal speed over one or more strides
 - Consistently decreased
 - Freezing of gait



Transcranial Direct Current Stimulation

Transcranial direct current stimulation (tDCS)²:

- **Non-invasive, painless** brain stimulation treatment that uses direct electrical currents to stimulate specific parts of the brain
- A constant, **low intensity current** is passed through two electrodes placed over the head which modulates neuronal activity
- Two types of stimulation with tDCS: anodal and cathodal stimulation
 - Anodal stimulation → excites neuronal activity
 - Cathodal stimulation → inhibits or reduces neuronal activity

Purpose



The purpose of this study was to determine the effectiveness of transcranial direct current stimulation (tDCS) on ambulation for persons with Parkinson's Disease

Methods



- **Databases:**
 - Proquest Central, MEDLINE/PubMed, CINAHL, Cochrane Library
- **Search Limits:**
 - English, human subjects, Peer reviewed, RCTs
- **Selection Criteria:**
 - Adults 18 y/o + with PD, intervention included tDCS and an outcome measure of temporal distance and/or functional gait



Search Terms

(Parkinson* OR PD) AND (Transcranial direct current stimulation OR tDCS OR tDC) AND (Gait OR mobility OR ambulation OR gait velocity) NOT (transcranial magnetic stimulation OR TMS)



Inclusion and Exclusion Criteria

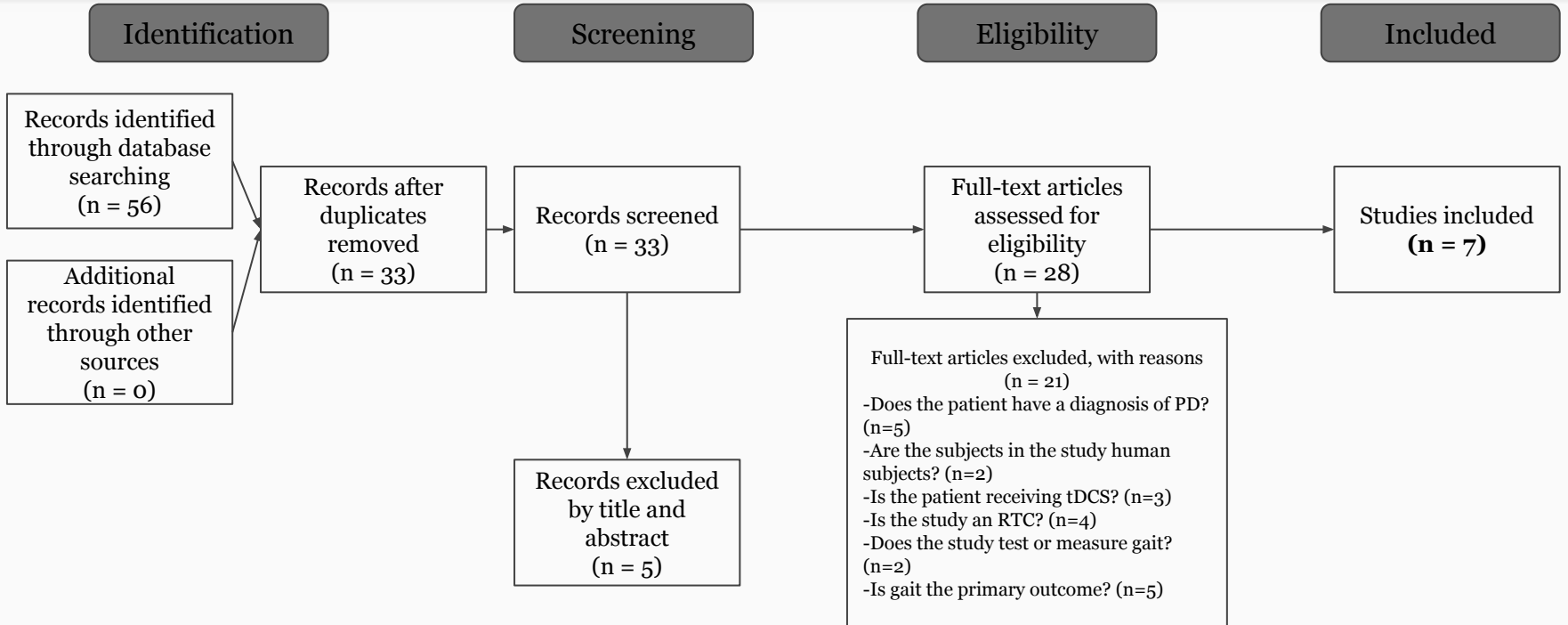
- Inclusion Criteria:

- Temporal-distance gait
- Ambulation ability

- Exclusion Criteria:

- Not a randomized control trial
- Did not measure gait

PRISMA



PEDro Scores



Study	1	2	3	4	5	6	7	8	9	10	Total Score
1. Schabrun et al	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10/10
2. Benninger et al	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10/10
3. Kaski et al	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9/10
4. Costa-Ribeiro et al	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10/10
5. Lattari et al	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10/10
6. Swank et al	Y	N	Y	Y	N	N	Y	Y	Y	Y	7/10
7. Costa-Ribeiro et al (2)	Y	Y	Y	Y	N	N	Y	Y	Y	Y	8/10
Average Score: 9.14/10											
Strong level of Evidence											

Results



- Samples ranged from 10-25 subjects with mild to moderate PD
- Treatment Parameters
 - 2mA of tDCS applied anterior to central zone or left dorsolateral prefrontal cortex of brain
 - 13 to 20 min duration, 3x per week for 2.5-4 weeks
 - Applied during on phase of medication



Results continued

- Primary outcomes
 - 10 m Walk Test, 6 min Walk Test, Timed Up and Go (TUG), TUGcog, Dynamic Gait Index (DGI)
- Statistically significant improvements found in:
 - Gait speed (+0.19 m/s): tDCS with gait training or dual task conditions
 - TUG scores (-1.24 s): tDCS combined with gait training
 - TUG and DGI scores when evaluating gait immediately post-tDCS
- No adverse events requiring drop-outs



Conclusions

- There is strong evidence to support the effectiveness of tDCS on improving gait in patients with PD
- tDCS and gait training combined showed both accelerated and prolonged effects of treatment compared to gait training alone



Clinical Relevance

- PD is a common neurological condition that PTs can encounter in various settings
- tDCS is a safe and therapeutic method to improve gait in patients with PD
- Alternative treatment option for patients who are unresponsive to traditional interventions



Limitations

- Small sample sizes
- Lack of follow up on long-term effects
- Treatment occurred during “on” phase of medication only



Future Research

- Placement of electrodes
- Duration of treatment
- Parameters for tDCS
- Long-term effects
- Focus on quality of gait



Take Home Message

- PD primarily affects an individual's ambulation ability, leading to increased disability
- tDCS proves to be a safe, therapeutic option to improve gait in those with PD
- Explore potential with current patient population
- Consider as an option upon FDA approval



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Thank you



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Questions?



tDCS Availability

