Table 15. Transcranial Direct Current Stimulation (tDCS) for Standing Balance

Author Year Country Research Design Score Total Sample Size	Methods	Outcome
Overground Training in Combination With tDCS		
Klamruen et al. (2024); Thailand RCT PEDro=8 Level 1 N=34	**Population:** 34 participants with SCI and the ability to walk at least 15 m independently (with or without a walking device): • Anodal Group (n=17): Mean (SD) age: 41.88 (13.50) years; 13M, 4F; etiology: Traumatic (n=13) and non-traumatic (n=4); AIS: AIS C (n=7) and AIS D (n=10); level of injury: Tetraplegia (n=8) and paraplegia (n=9); and median (IQR Q1-Q3) time since injury: 17.0 (8.0-22.50) months. • Sham Group (n=17): Mean (SD) age: 48.41 (13.36) years; 12M, 5F; Etiology: Traumatic (n=12) and non-traumatic (n=5); AIS: AIS C (n=5) and AIS D (n=12); Level of injury: Tetraplegia (n=9) and paraplegia (n=8); and Median (IQR Q1-Q3) time since injury: 12.0 (12.0-16.0) months. **Treatment:** Participants were randomly assigned into one of the following two groups: • Anodal Group (n=17): Anodal transcranial direct current stimulation (tDCS)vDCS • was administered over the vertex (lower-limb motor area) at an intensity of 2 mA for 20 min while sitting. • Sham Group (n=17): Participants received the delivered current only for the first 30 seconds before it was automatically terminated, and the electrodes remained on the participant's head for 20 minutes. After tDCS, all participants underwent overground gait training at a moderate intensity (RPE level of 5). The total gait training time was 40 minutes. The	1. No serious AEs of tDCS were observed. The anodal group reported itching (42% of participants) and tingling (44% of participants) sensations only during the stimulation period. The sham group reported itching sensations a moment after starting stimulation, which disappeared after a few (1-2) minutes of stimulation. 2. For TUG, changes over time in the anodal ($p<.001$) and sham ($p=.007$) groups were shown. No between-group differences were found for all time points.

	intervention program was administered for 5 consecutive days. **Outcome Measures:** 10MWT (at self-selected and fast speeds); spatiotemporal gait parameters using the inertial wireless sensor device (the BTS G-WALK) attached to the fifth lumbar spinous process with a belt for assessing cadence, stride length, and stride duration; TUG test, FTSST; and WHOQOL-BREF were assessed at pre-intervention (PRE), immediately post the 5 sessions on the same day (POST), at 1-month follow-up (1M), and at 2-month follow-up (2M).	
Evans et al. (2022); USA RCT PEDro=10 Level 1 N=26	**Population:** 25 participants with chronic motor-incomplete SCI; 18 males and 7 females; mean age 48.6 years; level of injury C4 (n=9), C5 (n=7), C6 (n=2), C7 (n=4), T6 (n=1), and T8 (n=2); AIS C (n=2) and AIS D (n=23); and mean time since injury 85.85 months. **Treatment:** Participants were randomly allocated to one of two groups: • MST+tDCS$_{sham}$ group (n=14). • MST+tDCS group (n=11). Interventions were carried out during 3 consecutive days and consisted of: • Motor Skill Training (MST): Each of the six motor task activities was performed in consecutive order and repeated four times as a circuit. Participants were asked to complete as many repetitions as possible in 60 s with the intent to maintain a moderate exercise intensity (40–60% heart rate reserve). The MST activities were intended to challenge upright standing balance and promote rapid volitional activation and deactivation of lower extremity muscles. • tDCS was delivered via two electrodes for 20 min, which was delivered concurrently with MST. **Outcome Measures:** Overground walking speed (10MWT); spatiotemporal gait characteristics (cadence and stride length), peak trailing limb angle and intralimb coordination (this kinematic data was	1. AEs included cases of mild-to-moderate headache following tDCS and delayed onset muscle soreness following MST. 2. Analyses revealed a significant effect of the MST circuit, with improvements in walking speed, cadence, bilateral stride length, stronger limb trailing limb angle, weaker limb intralimb coordination, BBS, and FES-I observed in both groups. 3. No differences in outcomes were observed between groups.

	obtained during each 10MWT using a 3D inertial measurement unit motion capture system); and balance function (assessed using the BBS and the FES-I). Outcomes were assessed at baseline on Day-1 and 24-h post-intervention on Day-5. To examine within-day (online) and between-day (offline) effects of intervention on outcome measures associated with walking, a subset of selected outcomes was assessed pre- (D2pre, D3pre, D4pre) and post-intervention (D2post, D3post, D4post) on each intervention day.	
BWSTT in Combination with tDCS		
Simis et al. (2021); Brazil RCT PEDro=9 Level 1 N=43	**Population:** 43 participants with incomplete SCI; 33 males and 10 females; median (IQR) age 38 (28-45) years; injury level paraplegic (n=28) and tetraplegic (n=15); AIS C (n=20) and AIS D (n=23); and median (IQR) time since injury 16 (6.5-23.5) months. **Treatment:** Participants were randomly allocated to receive 30 sessions of active (n=21) or sham (n=22) tDCS immediately before RAGT with Lokomat. All participants received 20-min tDCS sessions; 30-min sessions of Lokomat training; and their normal rehabilitation program. • During RAGT sessions, the participant body weight, guidance force and training speed were progressively incremented depending on each participant. • tDCS was performed using a monophasic current device with the anode placed over the primary motor cortex region and the cathode placed over the supraorbital region, contralateral to the anode. **Outcome Measures:** WISCI II; BBS; 10MWT; 6MWT; TUG test; and Lower Extremity Isokinetic Dynamometry were assessed before the beginning of the intervention (baseline), after 15 sessions (intermediate), after 30 sessions (post-treatment) and three months after treatment (follow-up).	1. All the participants tolerated tDCS sessions, without unexpected AEs. One participant did not tolerate Lokomat training due to pain related to the straps of the BWS mechanism and was excluded from the study. 2. Regardless of intervention group, statistical improvement existed between baseline and the other periods as measured by BBS, TUG, 10MWT, and 6MWT. 3. Regarding the improvement in the BBS, 10MWT, 6MWT and TUG, there was no statistical difference between groups for the tested periods.

Raithatha et al. (2016); USA RCT PEDro=9 Level 1 N=15	**Population:** 15 participants with traumatic SCI; 10 males and 5 females; mean (range) age 47.5 (24 – 67) years; level of injury C4 (n=1), C5 (n=1), C5-C6 (n=1), C6 (n=5), C8 (n=1), T2 (n=1), T6 (n=2), T12 (n=1), and L1 (n=2); AIS B (n=1), AIS C (n=11) and AIS D (n=3); and mean (range) time since injury 7.9 (1 – 39) years. **Treatment:** All participants attended to 36 sessions (3/week for 12 weeks) of tDCS immediately before locomotor training with a robot-assisted gait orthosis (LT-RGO). They were randomly allocated into 2 groups: • Active anodal tDCS paired with LT-RGO (active group, n=9). • Sham tDCS paired with LT-RGO (control group, n=6). *tDCS:* Each participant in the active tDCS group received 20 min of tDCS. *LT-RGO:* The Lokomat was used with a novel approach to LT-RGO (with progressively decreased treadmill speed and guidance force in order to minimize momentum and thereby avoid eliciting passive movement). **Outcome Measures:** Muscle strength (assessed by manual muscle testing) of hips (flexion, extension, abduction, adduction, internal and external rotation), knees (flexion, extension), ankles (dorsiflexion, plantarflexion), great toes (flexion, extension), and toes (flexion, extension); 10MWT; 6MWT; TUG; BBS, and SCIM-III were assessed at baseline, post-intervention, and 1-month follow-up timepoints.	1. There were no AEs during the intervention period. 2. Within-group changes from baseline to post-intervention indicated overall improvement on all outcome measures for both groups. Statistically significant improvement was evident on SCIM-III and TUG in the sham tDCS group. 3. Between-groups comparison of changes from baseline to post-intervention revealed that the sham tDCS group improved significantly more than the active tDCS group on TUG.