Author Year Country Research Design Score Total Sample Size	Methods	Outcome
Nogueira et al. 2024 Brazil RCT PEDro = 9 Level 1 N = 15	**Population:** 15 participants with chronic and incomplete SCI. • Experimental group: 4M, 3F Mean (SD) age: 38.4 (11.25) years. AIS C (n = 5) and D (n = 2). Mean (SD) time since injury: 6.4 (2.20) years. • Control group: 4M, 3F Mean (SD) age: 33.3 (10.53) years. AIS C (n = 2) and D (n = 6). Mean (SD) time since injury: 6 (4.31) years. **Treatment:** Participants were randomized to the BWSTT/rTMS real (*n* = 7) and BWSTT/rTMS sham groups (*n* = 8). • rTMS protocol: rTMS was applied with participants seated in a comfortable chair, at rest. A rTMS protocol was applied to improve sensorimotor function in incomplete SCI: a total of 1800 pulses (40 pulses, 45 train) delivery at 10 Hz of frequency, through an intensity of 90% resting motor threshold, and intertrain intervals of 28 s. For sham rTMS, participants were exposed to rTMS sounds to mimic the auditory effects of the activity, and the coil, disconnected from the stimulator, was held over Cz for 20 min. • BWSTT protocol: Immediately after the rTMS protocol, participants were forwarded to the BWSTT. The BWSTT was performed on a medical treadmill with a partial body weight-suspension system. The treadmill provided visual feedback on the real-time stride length. Visual feedback was	1. WISCI II: a. When compared to baseline (median (IQR): 9 (7 to 9)), the median values of WISCI II increased significantly after the 6th (median (IQR): 11 (8.5 to 14.5)) and 12th (median (IQR): 13 (10 to 14.5)) sessions and follow-up (median (IQR): 13 (10 to 14.5)) in the BWSTT/rTMS real group (P = 0.001), but not in the BWSTT/rTMS sham group (P = 0.053) (baseline: median (IQR): 12 (8 to 13)); 6th (median (IQR): 12.5 (8 to 14.5)); 12th (median (IQR): 14 (8 to 16.7)); follow up (median (IQR): 14 (8 to 16.7)). The change in median values after the 6th session was significantly higher in the BWSTT/rTMS real group than in the BWSTT/rTMS sham group (P = 0.028). However, there was no significant difference between the real and sham groups after the 12th session and 30-day follow-up. b. 6th session was higher in the BWSTT/rTMS real (n = 7) (median change (IQR): 3 (1.5 to 3.5)) than in the sham group (n = 8) (median change (IQR): 0 (0 to 0.25), but there was no difference between groups after 12th session (BWSTT/rTMS real median change (IQR): 4 (2 to 5);

	provided through a mirror placed in front of the participant during training to maintain step symmetry and control postural compensation. Each BWSTT session consisted of two series of 7.5 min each (until the 6th session) or 10 min (from the 7th to 12th session), with about 3 min breaks between series. In the first training session, a trained therapist selected the appropriate percentage of BWS and velocity, based on individual motor impairment and exercise tolerance. During BWSTT, two therapists provided manual assistance to the lower limbs. Participants were encouraged to target level in the range of 11–13 (moderate intensity) of RPE. **Outcome Measures:** WISCI II was measured at baseline, after the 6th and 12th sessions, and on follow-up (30 days after the end of intervention). LEMS and SCIM-III were measured at baseline, after the 12th session, and at the 30-day follow-up.	BWSSTT/rTMS sham median change (IQR): 0 (0 to 3.25). 2. Compared to baseline, the LEMS increased after 12 sessions in the BWSTT/rTMS real group (P = 0.013), but no significant difference was observed in the sham group (P = 0.200). There was no significant difference between the groups in terms of the median changes at the 12th session and at the 30-day follow-up. 3. The SCIM-III mobility score was increased after 12 sessions in the BWSTT/rTMS real group (P = 0.026), but no significant difference was observed in the sham group (P = 0.444). The change in the median SCIM-III mobility sub-score was significantly higher in the rTMS group than in the sham group at the 30-day follow-up (P = 0.029).
Deng et al. 2024 China RCT PEDro = 7 Level 1 N = 30	**Population:** 30 participants with acute and incomplete SCI. • Sham group (n = 15): 11M, 4F Mean (SD) age: 52.58 (14.02) years. AIS C (n = 10) and AIS D (n = 5) Mean (SD) time since injury: 2.1 (1.1) months. • iTBS group (n = 15): 8M, 7F Mean (SD) age: 47.42 (17.22) years. AIS C (n = 9) and AIS D (n = 6) Mean (SD) time since injury: 1.7 (0.9) months. A total of 10 patients were included who could walk with the aid of a walker, with 5 in the sham group and 5 in the iTBS group. **Treatment:** Patients were randomly assigned to the iTBS group (n = 15) and the sham group (n = 15).	1. Comparison of Maximum Knee Flexor Strength, Knee Extensor Strength, and LEMS Between the Two Groups: On the 21st day of treatment, the maximum knee flexor strength, the maximum knee extensor strength, and LEMS in the iTBS group were higher than that in the sham group (median [IQR], 20 (14-23) vs. 14 (12-17), z = -2.764, P = 0.006), (median [IQR], 59 (24~64) vs. 33(17~37), z = -2.408, P = 0.016), and (median [IQR], 38 (37-47) vs. 25 (18-26), z = -2.391, P = 0.017), respectively. 2. Comparison of SCIM in the Sham Group and the iTBS Group Before and After Treatment: In intragroup comparison, SCIM scores in the sham group and the iTBS

	• The iTBS group received intermittent theta burst stimulation (iTBS) double-target stimulation (the central cerebral sulcus and the nerve root of the spinal cord injury segment – a form of TMS). iTBS parameter selection: intraplexus stimulation frequency 50 Hz, interplexus stimulation frequency 5 Hz, stimulation intensity 80% - 120% rest motor threshold, stimulation time 2 s, intermittent time 8 s, a total of 600 pulses, total time 192 s, 6 days per week, and the treatment cycle is 21 days. The sequence of treatment was central sulci stimulation first and then stimulation at the nerve root of the spinal cord injury segment. • Patients in the sham group received iTBS dual-target sham stimulation therapy (dummy coils rather than treatment coils). After the iTBS (real or sham) intervention, patients received conventional rehabilitation treatment, including trunk control training, sitting training, balance exercise and gait training, proprioceptive neuromuscular facilitation techniques, related physical factor therapy, occupational therapy, lower limb exoskeleton robot training, and other routine rehabilitation training that lasts for more than 3 hours per day, with a treatment cycle of 21 days. **Outcome Measures:** LEMS, SCIM-III, isokinetic muscle strength assessment (knee flexor strength and knee extensor strength in both lower limbs), patient's gait evaluated by the 3D gait analysis evaluation system (if the patient can walk independently or with a walking frame) were measured before treatment, on the third day of treatment and on the 21st day of treatment.	group on the 21st day of treatment were higher than those before treatment (sham group, χ^2 = 29.525, P < 0.001; iTBS group, χ^2 = 25.200, P < 0.001). In the comparison between the 2 groups, after 21 days of treatment, SCIM scores in the iTBS group were significantly higher than those in the sham group (median [IQR]; 68(60~91) vs. 46 (30~75), z = -2.287, P = 0.022). 3. Comparison of Gait Parameters Before and After Treatment Between the Two Groups: a. The results showed that there were no statistically significant differences between the 2 groups in step speed, step frequency, and step length before treatment (P > 0.05), and after treatment, these indexes were increased compared with before, with statistical significance (P < 0.05). After 21 days of treatment, the step frequency and step length in the iTBS group were significantly higher than that in the sham group (69.00 ± 2.91 vs. 53.00 ± 3.39, t = -8.000, P < 0.001) and (40.20 ± 1.92 vs. 32.40 ± 2.41, t = -5.659, P < 0.001), respectively. b. The ground reaction force of the 2 groups were collected and compared using a 3D gait analysis system. The results showed that on the 21st day of treatment, the vertical reaction in the iTBS group was significantly higher than that in the sham group (median [IQR];

		78 (75.5~79) vs. 70(65.5~74), z = -2.522, P = 0.012).
Krogh et al. 2022 Denmark RCT PEDro = 7 Level 1 N = 20	**Population:** 20 participants with motor-incomplete SCI and capable of participating in lower limb RT; 15 males and 4 females; mean age 54.45 years; injury level C2 (n = 2), C4 (n = 4), C5 (n = 4), C8 (n = 1), T3 (n = 1), T9 (n = 1), T10 (n = 1), T11 (n = 1), T12 (n = 1), L1 (n = 1), and L2 (n = 2); AIS A (n = 1), AIS C (n = 5), and AIS D (n = 13); and mean time since injury 89.3 days. **Treatment:** All participants received lower limb RT (twice weekly) and lower limb physical therapy (thrice weekly) for 4 weeks; and were randomly assigned to receive active (REAL group) (n = 11) or sham (SHAM group) (n = 9) rTMS with a double-cone coil over bilateral leg motor cortex, daily (Monday–Friday) immediately before training sessions. • Lower limb resistance sessions lasted 60 min and strength exercises, for each major functioning muscle group, were performed (3 x 10 at moderate to vigorous [50–80% 1RM] loading intensity). • Lower limb physical training included stair climbing and mobility exercises, overground training, BWSTT, FES, and stretching/mobilization. Participants were engaged in additional clinical activities as part of their usual care, such as hydrotherapy, occupational therapy, activities of daily living training, and upper extremity RT classes. **Outcome Measures:** MVC, LEMS, and gait function* (10MWT and 6MWT) were assessed the day before the first rTMS session and the day after the last session; except for LEMS assessment, which was performed at admission and within 1 week of discharge.	1. A seizure during stimulation (n = 1 in REAL group) and mild and transitory headaches following their first treatment session (n = 2 in SHAM group) were reported as AEs. Apart from that, only harmless side effects such as drowsiness, twitching facial muscles, and tingling/poking sensations in the scalp were occasionally reported. 2. Total leg (sum of bilateral MVC in both directions), knee flexor, and knee extensor MVC increased more prominently in REAL compared to SHAM, although no clear main effect for real rTMS was found for any MVC outcome measure ($p > 0.15$). 3. LEMS increased significantly ($p = 0.014$) for REAL but not for SHAM at the time of discharge. 4. Both groups demonstrated significant ($p < 0.02$) improvements in 10MWT at POST, with no difference in progression between groups ($p = 0.16$). 5. Both groups improved in the 6MWT at POST with no clear main effects (treatment: $p < 0.76$, treatment x time: $p < 0.90$, time: $p < 0.76$).

	*Gait function was assessed in a sub-group of ambulators (REAL group, n = 8; SHAM group, n = 8).	
Kumru et al. 2016a Spain RCT PEDro = 7 Level 1 N = 31	**Population:** 31 patients with incomplete motor SCI who were candidates for Lokomat®; 24 males and 7 females; mean age 47.55 years; AIS C (n = 26) and AIS D (n = 5); level of injury cervical or thoracic; and mean time since injury 3 months. **Treatment:** All participants received standard care for SCI rehabilitation (5 h of therapy a day, 5 days per week). Participants also received rTMS applied at rest on their back (for 4 weeks) just before the Lokomat® gait training session; and they were randomly divided into: • Real rTMS (n = 15): 2-s duration bursts of 20 Hz (40 pulses/burst) with intertrain intervals of 28 s, for a total of 1800 pulses over 20 min. • Sham rTMS (n = 16). Lokomat® gait training sessions were 30-45 min of duration, 5 days per week, and for 8 weeks **Outcome Measures:** LEMS, 10MWT (time, step length and cadence), and WISCI II were assessed at baseline, after 4 weeks of training (at the last session of rTMS), and after 8 weeks of training (follow-up 4 weeks after cessation of rTMS).	1. Thirty-four participants were included in this study, but 3 of them didn't continue with the study because of repeated urinary tract infections (n = 1) and severe spasticity (n = 2). 2. All participants tolerated well the study. The participants in real rTMS reported only mild undesired effects (slightly uncomfortable twitching of facial muscles or difficulty to speak because of facial muscle contraction during real rTMS [n = 8], and mild headache 1 h after the first rTMS session [n = 1]). 3. After last session and during follow-up period, the number of the participants who could perform 10MWT was higher for real than for sham rTMS, but it did not reach statistical significance (p = 0.09). 4. The gait velocity, cadence, step length, and WISCI II were similar in real vs. sham rTMS group after last stimulation and during follow-up ($p > 0.05$). 5. The change score in LEMS was significantly higher in real than in sham rTMS after last session (p = 0.001) and during follow-up period (p = 0.02).
Jo & Perez 2020 USA RCT PEDro = 4 Level 2 N = 38	**Population:** 38 participants with chronic SCI; 29 males and 9 females; mean age (± SD) 44.2 (± 14.8) years; injury level C2 (n = 1), C3 (n = 4), C4 (n = 11), C5 (n = 12), C6 (n = 3), T5 (n = 1), T8 (n = 1), T10 (n = 1), L1 (n = 1), L2 (n = 2), and L3 (n = 1); AIS A (n = 12), AIS B (n = 6), AIS C (n = 11), and AIS D (n = 9); and mean time since injury 9.4 years.	1. The time to complete the 10MWT decreased significantly on average by 20% after all protocols. 2. The amplitude of corticospinal responses elicited by TMS and the magnitude of MVCs in

	Treatment: 25 participants were randomly assigned to 10 sessions (completed in 2-3 weeks) of exercise combined with paired corticospinal-motor neuronal stimulation (PCMS) (n = 13) or sham-PCMS (n = 12). In an additional experiment, 13 participants received PCMS without exercise. During PCMS, 180 pairs of stimuli were timed to have corticospinal volleys evoked by TMS over the primary motor cortex arrive at corticospinal-motor neuronal synapses of upper- or lower-limb muscles (depending on the injury level), 1–2 ms before antidromic potentials were elicited in motor neurons by ES of a peripheral nerve. PCMS and sham-PCMS participants exercised for 45 min immediately after both protocols, which involved: • Upper-limb exercises (n = 31). • Lower-limb exercises (involving OWT and BWSTT, and stair climbing) for 2 participants in the PMCS + exercise group; for 2 participants in the sham + exercise group; and for 3 participants in the PCMS group. **Outcome Measures:** • Motor evoked potentials and MVCs were assessed before and after each intervention. • A subset of participants completed functional tasks (PCMS + exercise: n = 6; sham-PCMS + exercise: n = 8; PCMS: n = 8). In the group receiving lower-limb exercises, 10MWT with BWS was assessed before and after the intervention. A subgroup of participants returned for a 6-month follow-up session to examine the same measurements (PCMS + exercise: n = 5, sham-PCMS + exercise: n = 5).	targeted muscles increased on average by 40–50% after PCMS combined or not with exercise but not after sham-PCMS combined with exercise: 3. Motor evoked potentials and MVCs increases were preserved 6 months after the intervention in the group receiving exercise with PCMS but not in the group receiving exercise combined with sham-PCMS: 4. Functional outcomes remained increased for 6 months in the PCMS + exercise participants (by 21.6 ± 9.6%, P < 0.05) compared with baseline whereas the increase present after 10 sessions of sham-PCMS + exercise did not persist 6 months later (0.6 ± 10.5%, P = 0.3).
Naro et al. 2022 Italy Case control	**Population:** • 15 participants with incomplete and thoracic SCI (> 6 months since injury) and with spasticity; 6 males	1. There were no side effects during or after the training. 2. The 10MWT, FIM-L, LEMS, and WISCI II improved in both

Level 3 N = 40	and 9 females; mean (± SD) age 38 (± 9); level of injury T3 (n = 3), T4 (n = 1), T5 (n = 3), T6 (n = 1), T7 (n = 1), T8 (n = 2), and T9 (n = 4); AIS C (n = 6) and AIS D (n = 9); and mean (± SD) time since injury 10 (± 4) months. • 25 matched-SCI persons with spasticity; 11 males and 14 females; mean (± SD) age 44 (± 14); level of injury T3 (n = 4), T4 (n = 2), T5 (n = 3), T6 (n = 6), T7 (n = 2), T8 (n = 4), T9 (n = 2), T10 (n = 2); AIS C (n = 12) and AIS D (n = 13); and mean (± SD) time since injury 12 (± 3) months. **Treatment:** Participants were divided into: • Robot-assisted rehabilitation (RAR) + non-invasive brain stimulation (NIBS) group (n = 15) (RAR + NIBS). • RAR – NIBS group (n = 25): Matched-SCI persons who previously underwent the same amount or RAR without NIBS. Patients were provided with a daily (six sessions weekly) NIBS session followed by a RAR session, for eight consecutive weeks. • NIBS consisted of a rTMS carried out simultaneously with a transvertebral direct current stimulation (tvDCS). • Patients performed a 40-min session per day of RAR with LokomatPro. The amount of BWS was initially set at 70% of the patient's weight, then progressively decreased, and the gait speed was individually adjusted. Patients underwent conventional physical therapy twice a day and five-times a week using the Bobath principles, occupational therapy, and FES. **Outcome Measures:** 6MWT, 10MWT, WISCI II, FIM-L, and LEMS were assessed at baseline (T0), after (T1), and three months after (T2) the training.	groups, but the increase was significant higher following RAR + NIBS than RAR − NIBS ($p = 0.002$, $p = 0.02$, $p = 0.005$, and $p = 0.002$, respectively). 3. The 6MWT test improved in both groups, but without significant differences between groups. 4. There was no significant effect of patients' stratification depending on ASIA on clinical outcome measure changes (all $p > 0.1$). 5. The significant predictors of recovery were the LEMS, age, and time since injury (all $p < 0.0001$).

Benito et al. 2012 Spain RCT PEDro = 8 Level 1 N = 17	**Population**: 17 participants - 13 males and 4 females; incomplete SCI; all AIS D; level of injury: C4 – T12; age range= 18 – 60y. **Treatment**: Patients were randomized to active rTMS or sham stimulation. Three patients from the initial group of 10 randomized to sham stimulation entered the active rTMS group after a 3-week washout period. Therefore, a total of 10 patients completed each study condition. Both groups were homogeneous for age, gender, time since injury, etiology, and ASIA scale. Active rTMS consisted of 15 days of daily sessions of 20 trains of 40 pulses at 20 Hz and an intensity of 90% of resting motor threshold. rTMS was applied with a double cone coil to the leg motor area. **Outcome Measures:** LEMS, Modified Ashworth Scale, WISCI II, 10MWT, Step length and cadence (assessed during 10MWT).	1. There was a significant improvement in LEMS in the active group but not in the sham group. 2. The active group also showed significant improvements in the Modified Ashworth Score, 10MWT, cadence, step length, and these improvements were maintained 2 weeks later. 3. Following sham stimulation, significant improvement was found only for step length.