Study Number	Study Name	Year	Country	Study type (double blind)	Sample size with control/sham	Population age ranges	Gender distribution	Inclusion criteria (stroke type, area, time since stroke)	Exclusion Criteria (previous conditions, baseline assessm	Type of intervention with details (tcds, brain area, hyperbaric, frequenc	Intervention length and schedule	Observation times	Measurement method (Tests, MRI, FMA)	Results for tests baseline and studied	Additional notes (Things study says about itself, limitations, next steps, etc)
1	Constraint Induced Movement Therapy Increases Functionality and Quality of Life after Stroke	2021	Brazil	Double blind	n=70 tested for eligibility n=30 included in study n=15 in control group n=15 in constraint induced movement therapy group	45-80	N/A	Age group 45 to 80 years old Both sexes Clinical diagnosis of stroke Time of injury above six months	Score above 24 points in the Mini State Exam Mental	Therapy was constraint induced physiotherapy, with the healthy portion of the limb secured to force the use of the damaged portion over a series of household tasks, 5 minutes each for 60 minutes	24 sessions over 8 weeks, thrice a week	After the 12th and 24th session (1 month and 2 months)	FMA SSQOL FRT (functional reach test) Modified Ashworth	Reduction in muscle tone (resistance) in muscles relative to baseline FMA scores increased, indicating its effects on cortical reorganization	Suggest a combination of more functional activities in future research Also warns of risks of greater injury if treatments are too intense
2	Effect of Cerebellar Stimulation on Gait and Balance Recovery in Patients With Hemiparetic Stroke: A Randomized Clinical Trial	2018	Italy	Double blind	n=52 tested for eligibility n=36 included in study n=18 allocated to iTBS n=18 allocated to sham n=2 lost to follow-up	60- 70	Male:Female=21:13	First ever chronic ischemic stroke Hemiparesis due to left or right subcortical or cortical lesion in the territory of the middle cerebral artery Residual gait and balance impairment	History of seizures Severe general impairment or concomitant diseases Patients older than 80 years Treatment with benzodiazepines, baclofen, and antidepressants	Patients were randomly assigned to treatment with CRB-iTBS or sham iTBS applied over the cerebellar hemisphere ipsilateral to the affected body side immediately before physiotherapy	Daily during 3 weeks	March 2013- June 2017	BBS FMA BI Gait Analysis	Patients treated with CRB-iTBS but not with sham iTBS showed an improvement of gait and balance functions	Treatment of tendency to fall considered highly valuable, as it typically declines into a long term disability in stroke patients No neurological changes noticed in areas in unaffected hemispheres, allowing the treatment to specifically target areas Small sample size
4	Evidence of neuroplasticity with robotic hand exoskeleton for post-stroke rehabilitation: a randomized controlled trial	2021	India	Double blind	n > 300 tested for eligibility n = 27 clinical assessment n = 13 in Robotic-therapy Group (n = 3 dropouts) n = 14 in in Control-Group (n = 1 dropout) n = 12 in Robotic therapy Group n = 13 in in Control-Group	30.8-53.0	Male:Female = 19:4	Ischemic / Hemorrhagic stroke Single lesioned Cortical / Subcortical Stroke Stroke onset = 3-24 months Age = 18-70 MMSE Score = 24-30	Incompatible with TMS Physical, social and economic constraints Having Craniotomy, Aphasia or cognitive issue Age > 70 No spasticity at 3 months	Evaluate the effects of a novel exoskeleton based therapy on the functional rehabilitation outcomes of upper-limb and cortical-excitability in patients with stroke as compared to the conventional-rehabilitation	20 sessions of 45 min each 5 days a week	4 weeks	MRI MAS FMA BI BS Range of motion	Robotic-exoskeleton training showed improvement in motor outcomes and cortical-excitability in patients with stroke. Neurophysiological changes in RG could most likely be a consequence of plastic reorganization and use-dependent plasticity.	Limitations: -Small sample size -Lack of an activity level measurement like Wolf Motor Function test and Action Research Arm Test -No midterm clinical assessment -No long term follow-up of patients
5	Brain-actuated functional electrical stimulation elicits lasting arm motor recovery after stroke	2018	Switzerland	Double blind	n = 27	36-76	Male: 16 Female: 11	Age > 18 Minimum 10 months from stroke Moderate-to-severe disability Severe hand paralysis with a FMA-UE score ≤ 40 points Good or corrected eyesight	Factors hindering EEG acquisition (e.g., skin infection) Heavy medication affecting the central nervous system Concomitant serious illness (e.g., fever) Unilateral spatial neglect Neurological disorders (e.g., Parkinson's disease) Severe or recent heart disease	Motor areas in the affected hemisphere	Clinical evaluations were performed immediately before and after the intervention, as well as 6–12 months after the end of the intervention (average 36 weeks)	Groups received therapy two times per week for a period of 5 weeks each session lasting 60 min	MRI Mixed-design ANOVA statistical tests MRS MRC Electroencephalography analysis	Results illustrate how a BCI–FES therapy can drive significant functional recovery and purposeful plasticity thanks to contingent activation of body natural efferent and afferent pathways.	Limitations: - Did not check for any placebo effect that could have influenced patients - The limited accuracy and repeatability of hand movements generated by FES
6	Shaping neuroplasticity by using powered exoskeletons in patients with stroke: a randomized clinical trial	2018	Italy	Double blind	n = 58 Assessed for eligibility n = 18 Excluded n = 40 Were analysed	57-76	M: 23 F: 17	Age >= 55 Suffering from a first, single ischemic supra-tentorial stroke Muscle Research Council score of ≤3 Mini-Mental State Examination of > 24 Functional Ambulatory Categories of ≤ 4 MAS of ≤2	Had to meet the inclusion/exclusion criteria of the manufacturer's recommendations	Forty patients in a prospective, pre-post, randomized clinical study were tested. Twenty patients underwent Ekso™ gait training (EGT) (45-min/session, five times/week), in addition to overground gait therapy, whilst 20 patients practiced an OGT of the same duration. All individuals were evaluated about gait performance (10 m walking test), gait cycle, muscle activation pattern (by recording surface electromyography from lower limb muscles), frontoparietal effective connectivity (FPEC) [using EEG–cortico-spinal excitability (CSE), and corneau motor	Conventional physiotherapy training: Five sessions per week for eight consecutive weeks, 60 min for each session. In addition to conventional physiotherapy training, EGT patients practiced 45-min session of Ekso training, while OGT patients underwent 45	8 Weeks	MCID TMS SMI CSE	Ekso™ could be useful to promote mobility in persons with stroke owing to mechanisms of brain plasticity and connectivity re-modulation that are specifically entrained by the robotic device, as compared to conventional OGT.	Limitations: -Lack of long-term follow-up evaluation
15	Effect and Safety of Transcutaneous Auricular Vagus Nerve Stimulation on Recovery of Upper Limb Motor Function in Subacute Ischemic Stroke Patients: A Randomized Pilot Study	2020	China	Single blind	n=23 tested for eligibility n=2 declined to participate n=10 in taVNS group n=11 in sham taVNS group	51-75	Male:Female = 13:8	First time ischemia stroke Between 0.5 and 3 months post onset Single upper limb motor function impairment No obvious cognitive impairment	Hemorragic stroke, leading to lesion etiology heterogeneity Advanced cardiac, pulmonary, liver, or blood disease Malignant tumors Infectious disease Unrelated neurological or musculoskeletal disease Heart rate under 60bpm Previous surgery on the vagus nerve Botox injections on upper extremeties	taVNS Left auricular branch vagus nerve stimulated by the modified dot-like electrodes that were fitted to the cymba conchae 600 pulses at 20Hz every 5 minutes Intensity subject to tolerance Performed 30 minutes a day for 15 consecutive days Also performed physical rehabilitation for 30 mins after each taVNS session	Daily taVNS and physical training sessions for 15 days Physical training included postural control, proprioception exercises, neuromuscular facilitation, and gait training	15 days, 4 weeks and 12 weeks	FMA-U WMFT FIM Brunnstrom	All measures increased after the 15 days, typically with twice as great an increase as in the sham group Brunnstrom test was similar between the two groups after 15 days FMA-U increase remained about double versus sham group at 4 weeks and 12 weeks, though did decrease slightly at 12 weeeks.	Limitations -Lack off measurement of other scores at later observation periods Study believes the effect of taVNS may decrease over time, with FMA scoures at 12 weeks slightly lower than those at 8 weeks Sham group did not receive electric stimulation, meaning participants were not blinded
22	Pharyngeal Electrical Stimulation in Dysphagia Poststroke: A Prospective, Randomized Single-Blinded Interventional Study	2016	UK	Single blind	n=516 assessed n = 38 baseline evaluated n = 36 randomised n = 36 assessed at 2 weeks n = 35 assessed at 3 months	56-79	Male:female=22:14	Newly onset Dysphagia(swallowing difficulties) Within 6 months of hemorragic or ischemic stroke Failed VFS or FEES	Advanced dementia Other neurological conditions which could influence dysphagia Previous history of dysphagia Patients had been intubated/tracheotomized Pacemaker or internal defribulator Tumors Severe cardiac or respiratory conditions Structural anomalies in mouth or throat Required continuous oxygen supply	Pharyngeal electrical stimulation Intraluminal pharyngeal stimulation catheter Inserted orally or nasally 0.2ms pulses at 280V, 5Hz frequency with patient determined intensity thresholds Standard swallowing treatments as determined by patient hospitals 10 minutes a day for 3 days	Pharyngeal electrical stimulation 10 minutes a day for 3 days	Baseline swallowing test 2 week DSR/VFS/FEES test 3 month DSR/VFS/FEES test	Toronto bedside Swallowing Screening Test (TOR-BSST) Dysphagia Severity rating (DSR) Fiberoptic endoscopic examination (FEES) of swallowing) Video fluroscopic swallowing test (VFS)	11% more patients had no/mild dysphagia after 2 weeks (61% to 50%) 1 patient in sham had worse dysphagia, none in treated 78% had no/mild in treated at 3 months, 76% in control 39 to 52 days in hospital discharge times for treated and control	Limitations/notes Low time spent on treatment makes its effectiveness inconclusive Authors do suggest data suggests an effect, but does not prove one Suggests that treatment is most effective early on, as swallowing seems to be regained eventually naturally
24	Hyperbaric oxygen induces late neuroplasticity in post stroke patients--randomized, prospective trial	2013	Israel	Single blind	n=62 initially evaluated n=29 evaluated after sham treatment n = 30 evaluated after treatment	49-73	Male:female = 39:20	Isechemic or Hemorrhagic Stroke 6-36 months prior to inclusion At least one motor dysfunction 18 years or older	Heart/lung conditions incompatible with hyperbaric oxygen therapy Inner ear disease Claustrophobia Inability to sign consent Non smoker	Hyperbaric oxygen therapy 40 sessions scheduled 5x a week 90 minutes each 100% oxygen at 2 atmospheres	Sessions for 90 minutes 5x a week	Initial neurological evalutation and secondary assessment after 2 months Tertiary assessment at 4 months for cross group	Neurological evaluation according to NIHSS (National institute of health stroke scale) rCBF-SPECT brain scan Activities of daily living independence assessment (Questionaire) EQ-5D Quality of life assessment (Questionaire)	All measures improved over the period compared to the control in the treated group, with both improving relative to their respective baselines. The controlled group had the best scores after their treatment, likely due to the increased time elapsed since the stroke. 90% of treated group had mild to significant improvement. Cross group had 36% with mild improvement and 6.2% with significant. After HBOT, cross ad 43% and 29% Lesions began to disappear	Notes: Study used a cross evaluation, where after an inital 2 months of control, control group had two months of actual treatment This was due to sham trials requiring added pressure without hyperbaric oxygen conditions, which would result in possibly dangerous atmospheric chamber conditions
25	Hebbian -Type Primary Motor Cortex Stimulation: A Potential Treatment of Impaired Hand Function in Chronic Stroke Patients	2020	USA	Double blind	n = 48 Assessed for eligibility n = 26 Excluded in screening n=22 Tested n=2 Excluded in analysis n = 20 Analysed	50.6-72.6	M:10 F:10	Single ischemic infarction affecting M1 and/or corticospinal tract (CST) >6 months after enrollment Motor deficit in the hand contralateral to the infarct and ability to perform the training task No other neurological disorder affecting ability to consent or understand instructions No contradiction to TMS or MRI No intake of medication that could affect results motor evoked potential (MEP) >50 µV Absence of dementia: > 70 score on RBANS Has ability to give informed consent	N/A	Standard Motor Training for both sham and rTMS groups: 360 auditory-cued ballistic wrist extension movements w/ affected hand Move a cursor from its home position to a target located along the same vertical axis by extending the wrist as quickly as possible rTMS group: rTMS delivered to optimal spot for contralateral ECU muscle (supports training movement), which was determined before test Minimum stimulus intensity to evoke MEP (motor evoked potential) of >50 µV for at least 5/10 trial = about 1% of maximum stimulator output (MSO)		2-4 days before intervention (baseline) 2-4 days after intervention (posttest) 4 weeks after intervention (follow-up)	blood oxygen level dependent (BOLD) response Jebsen Taylor Test (JTT) Secondary Test: "How Well" subtest of MAL (motor activity log) for 30 daily living activities fMRI	JTT score improved over time MAL score improved over time rTMS increased from posttest to follow-up while sham decreased between the 2 periods Negative correlation between hand function & contralesional M1 functional activity at baseline Follow-up showed relation b/w hand function & m1 activity reversed relative to baseline; Significant correlation b/w degree of improvement in hand function & change in M1 activity (b/w baseline & follow-up) for both hemispheres of brain (increase in hand function -> greater increase in task-related M1 activity)	Limitations: -Small sample size Differences in performance, attention, and strategy potentially led to confounding factors in task-related fMRI
28	Robotic Assistance for Training Finger Movement Using a Hebbian Model: A Randomized Controlled Trial	2017	USA	Double blind	n = 48 Assessed for eligibility n = 18 Excluded in screening n = 30 Analysed	44-70	M:20 F:10	>6 month history of unilateral stroke 18- 50 years old Minimum score of 3 blocks on the Box and Blocks Test (BBT)	N/A	FINGER robootic exoskeleton used Low vs. High Robotic Assistance applied to finger Training to play game similar to Guitar Hero Dynamically adjusted robotic assistance to aim towards 85% (for high) and 50% (for low) success rates on the game Robot only provided assistive force on movements initiated by patient w/ minimum threshold of 6-N 1 song/week played without robot assistance to measure ability to move fingers without aid	3 1-hour training sessions per week for 3 weeks 5 songs played, twice each (1065 possible movements/session)	2 Baseline tests (before intervention; 1 week apart from each other 2 Post-intervention tests: 1 at end of therapy (EOT), 1 follow-up after 1 month	Box and Block Test (BBT) Fugl-Meyer (FMA) ARAT Nine-Hole Peg Lateral Pinch Strength 3 Jaw Pinch Strength Motor Activity Log (How Much) Motor Activity Log (How Well) NIH Stroke Scale Beck Hopelessness Scale Geriatric Depression Scale	Motivation significantly higher for high-assistance group than low Motivation increased over time for both groups Baseline FMA scores acted as predictor; lower baseline -> benefit more from training) Baseline finger proprioceptive ability acted as predictor: better proipoceptive ability -> larger increase in BBT score at follow-up Both groups generally improved for clinical & robotic measured of movement + psychological assessments High-assistance training more effective at reducing upper extremity impairment on F-M	Limitations: - Large proportion of hemorrhagic stroke victims represented in sample - Baseline tests only 1 week apart Protocol not designed to maximize transference of benefits of high assistance to FMA and LPG scores -Attention and motivation are factors different to separate from each other

31	Neuroplastic effects of end-effector robotic gait training for hemiparetic stroke: a randomised controlled trial Neuroplastic effects of end-effects	2020	Korea	Double blind	n = 75 Assessed for eligibility n = 45 Excluded in screening n=30 Tested n=2 Withdrew n = 28 Analysed	42.0-64.4	M: 23 F: 5	Suffers from hemiplegia due to a first-ever stroke Time after stroke onset: 3–12 months Functional ambulation category level = 3 Korean Mini-Mental State Examination score > 24	Has orthopaedic problems or muscle diseases impairing mobility High risk of spontaneous fracture Suffers from other neurological diseases	end-effector robot-assisted gait training (E-RAGT) bodyweight-supported treadmill training (BWST) E-RAGT began w/ 30% bodyweight support @ 0.8km.h & was adjusted based on individual participant gradually reduced to 0% BW & increased to 2.0 km/h BWST began w/ same parameters as E-RAGT (30% BW, 0.8km/h) & same reduction/increase later Real-time visual feedback from pressure plates to view weight distribution and auditory cues to remain centres and maintain symmetrical movements	30 min/day, 5 times/week, 4 weeks (20 sessions total) week 1: passive mode training week 2 onwards: active mode passive = track predefine trajectories + recover movement ability active = encourage triggering robotic assistance by active effort	cortical activity-related changes were assessed at baseline (pre-test) and after 4 weeks of the intervention (post-test) FMA, TUG, and 10MWT were assessed at baseline (pre-test), after 2 weeks of the intervention (mid-test), and after 4 weeks of the intervention (post-test)	fNIRS optical imaging system to record cortical activity-related changes in oxyHb Secondary: Lower-extremity subscale of FMA, the timed up and go test (TUG), and 10-m walk test (10MWT)	No significant Grp x Time interaction in cortical activity noted in any region Cortical activity in SMC, SMA, PMC of affected hemisphere showed no significant Group x Time interaction For E-RAGT, significant differences between pretest & posttest for activity of SMC, SMA, PMC at affected hemisphere For BWST, no significant differences at any region between pre- and posttest Fugel-Meyer (FMA) showed significant GroupsTime interaction No sig effect of Group x Time in TUG or 10MWT results For E-RAGT, sigificant within group differences between pre- and posttest for FMA, TUG, 10MWT For BWST, FMA & 10MWT significantly improved after intervention	Limitiations: -small sample size -fNIRS only able to measure cortical activity but not subcortical -Procedure potentially lacked intensity and length to evoke noticeable neuroplastic change
33	High-frequency versus theta burst transcranial magnetic stimulation for the treatment of poststroke cognitive impairment in humans	2020	Taiwan	Double blind	n = 65 Assessed for eligibility n = 20 Excluded in screening n=1 Withdrew before test n=3 n=44 Tested Withdrew before analysis n = 41 Analysed	Range for whole sample unavailable iTBS: 46.03-74.23 5 Hz rTMS: 45.15-69.75!! Sham: 44.23-68.23	M:33 F:8	left hemispheric ischemic/hemorrhagic stroke >3 months previously with cognitive impairment RBANS score below 85 no seizure history no intracranial occupying lesion no concurrent use of antidepressants or neurostimulators	unstable cardiac dysrhythmia, fever, infection, hyperglycemia, epilepsy or previous administration of tranquilizers, neurostimulators or other medication that significantly affected the cortical motor threshold metallic intracranial devices, pacemakers or other electronic devices in patient's body	Left dlPFC (F3 point) stimulated with international 10/20 electroencephalography (EEG) recording system 5 Hz rTMS and iTBS groups: 80% intensity of the resting motor threshold iTBS: 3 pulses of 50 Hz bursts repeated at 5 Hz (2-s on and 8-s off) 190 seconds (600 pulses) total 5 Hz rTMS protocol at intensity of 80% of the resting motor threshold, with 2 s trains (10 pulses) at an intertrain interval of 8 seconds, repeated every 10 seconds total of 10 minutes (600 pulses) Sham (placebo Magstim) coil was used instead for sham group <5% of the magnetic output with an audible click on discharge	10 days of rTMS treatment, each morning from Monday to Friday for 2 consecutive weeks (10 sessions total)	Cognitive and depression status asessed before beginning of intervention and 1 day after end of intervention	Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Beck Depression Inventory (BDI)	The 5 Hz group had a significantly higher disease duration at baseline No significant differences between the 3 groups in BDI scores, nor before aand after treatment RBANS scores for 5Hz rTMS and iTBS groups poststimulation significantly increased compared to sham 5 Hz group demonstrated increased attention & delayed memory compared to sham	Limitations : -heterogeneity associated with cortical and subcortical implications -RBANS unable to assess other cognitive domains such as executive function -mechanism for rTMS is still mostly unknown
35	Comparison of Neuroplastic Responses to Cathodal Transcranial Direct Current Stimulation and Continuous Theta Burst Stimulation in Subacute Stroke	2018	Switzerland	Double blind	n = 184 tested for eligibility n = 41 included in study	28-85	Male:Female = 18:9	Ischemic or Hemorrhagic stroke ≤10 weeks after stroke Unilateral lesion in the territory of the middle cerebral artery First-ever appearance of upper extremity motor impairment based on the Fugl-Meyer upper extremity scale	epileptic seizures presence of metallic objects in the brain skull breach after craniectomy presence of implants or neural stimulators pregnancy, sleep deprivation, recent traumatic brain injury, delirium or disturbed vigilance, inability to participate in 1-hour treatment sessions severe language comprehension deficits new stroke lesions during rehabilitation medical complications	neuronavigated cTBS - One application consisted of a continuous train of 267 bursts, each composed of 3 pulses applied at 30Hz, repeated at interburst intervals of 167 milliseconds. The train lasted approximately 30 seconds and consisted of 600 stimuli. cathodal tDCS - 25 minutes at an intensity of 1mA sham transcranial magnetic stimulation/sham tDCS - current was ramped up for 30 seconds and then slowly tapered down to zero	Each subject completed 9 stimulation sessions over 3 weeks, combined with physical therapy	Brain function was assessed with directed and nondirected functional connectivity based on high-density electroencephalography before and after stimulation sessions	Fugl-Meyer Assessment score, Box and Block test score, 9-Hole Peg Test score, and Jamar dynamometer	Only cTBS was able to reduce transcallosal influences from the contralesional to the ipsilesional M1 during rest tDCS enhanced perilesional beta-band oscillation coherence compared with cTBS and sham groups enhancement of perilesional beta-band connectivity through tDCS might have more robust clinical gains if started within the first 4 weeks after stroke.	absence of significant clinical differences between the 3 groups of subjects involved in study could be caused by the small sample size. cannot extrapolate the results presented here to protocols applied to the affected hemisphere. cTBS and tDCS may show comparable effects in this case. Moreover, excitatory protocols applied to the affected hemisphere may be less time sensitive.
43	Low-Frequency Repetitive Transcranial Magnetic Stimulation Over Contralesional Motor Cortex for Motor Recovery in Subacute Ischemic Stroke: A Randomized Sham-Controlled Trial	2020	South Korea	Double blind	n=79 provided consent during screening n =2 declined to participate n = 4 withdrew consent n = 73 analyzed	Real rTMS (n = 36) 61.2 ± 11.2 Sham rTMS (n = 37) 62.9 ± 13.1	Real rTMS (n = 36) M:F = 21:15 Sham rTMS (n = 37) M:F = 24:13	displayed unilateral upper limb hemiparesis in Brunnstrom hand stage rating of 3 to 5 within 90 days after first-ever ischemic stroke onset confirmed by magnetic resonance imaging (MRI). They were aged between 20 and 80 years	hemorrhagic or recurrent stroke previous history of traumatic brain injury seizure or cerebrovascular surgery need for intensive care due to severe complications of stroke metallic materials in the body, (eg, pacemakers, cochlear implants, aneurysm clips) pregnant or lactating women likely to become pregnant but did not agree to appropriate contraception during the trial skin lesions around the contralesional M1 which interfered with rTMS, or those who could not regularly receive occupational or physical therapy.	1 Hz rTMS over the contralesional M1 sham rTMS	applied for 30 minutes per day over 10 days	assessed at baseline (T0), immediately after the end of treatment (EOT, T1), and 1 month after EOT (T2)	change in the Box and Block Test (BBT) results between baseline and immediately after EOT upper extremity FMA score; Finger Tapping Test (FTT); hand grip, pinch grip, lateral prehension, and three jaw chuck strength; Brunnstrom hand and arm stage ratings; modified Ashworth Scale (MAS) in the elbow, wrist, and finger flexors; Korean version of Modified Barthel Index (K-MBI)	no significant differences in changes in any outcomes between real and sham rTMS BBT from baseline to 1 month after EOT in PP set revealed a trend for greater improvement for real rTMS than for sham rTMS (16.9 ± 9.7 real vs 11.9 ± 9.7 sham; P = .038) but this pattern did not remain statistically significant following Bonferroni correction	orticospinal tract integrity was not objectively measured using single-pulse TMS or brain imaging. The degree of corticospinal tract integrity is a strong predictor of motor recovery did not measure the changes in cortical activation pattern or neurophysiological parameters using functional neuroimaging or paired-pulse TMS in all patients the possible differences in rTMS effect on motor recovery according to hemispheric dominance was not considered most of the outcomes in this study were focused on assessing the hand function. Therefore, it is possible that the effects of rTMS on proximal arm recovery were not captured well medications which can promote motor recovery after stroke were not limited during this study various rehabilitation modalities could not be exactly counterbalanced between the groups from EOT to 1-month follow-up
49	Transcranial electrostimulation with special waveforms enhances upper-limb motor function in patients with chronic stroke: a pilot randomized controlled trial	2021	Taiwan	Single blind	n = 36 Assessed for eligibility n = 12 excluded n = 24 analysed	Real NIBS (N = 12) 62.08 ± 15.58 Sham NIBS (N = 12) 65.92 ± 13.98	Real NIBS (N = 12) M:F = 9:3 Sham NIBS (N = 12)!! M:F = 7:5	patients with ischemic or hemorrhagic chronic stroke (within 6 months to 5 years after onset); aged ≥ 20 years; unilateral cerebral stroke with hemiplegia and Brunnstrom stage IV or V; adequate understanding of verbal/written information and physically able to complete the motor learning of functional tasks with the affected hand;	lower motor neuron impairment; unstable autonomic nervous system; extremely sensitive to electrical stimulation and could not tolerate it; contractures in the upper extremity or limitations of joint motion; severe spasticity; myositis ossificans; a history of arrhythmia; a medical electronic device implant, such as a pacemaker; decubitus or scalp wounds; metal head or neck implants; severe cognitive dysfunction or active psychiatric diseases, such as schizophrenia or dissociative identity disorder; history of seizures or organic brain disease; severe traumatic brain injury; drug or alcohol abuse; a malignant tumor or an autoimmune rheumatic disease, such as systemic lupus erythematosus, rheumatoid arthritis, or ankylosing spondylitis;	real NIBS which included conventional rehabilitation (CR) combined with real-tDCS + iTBS output; 1.5-mA intensity was superposed on continuous 1-mA DC sham NIBS with sham-tDCS + iTBS output (the sham NIBS group) stimulation intensity current was ramped up to 1 mA and then the current was ramped down to 0 mA	18 sessions of a 1-h CR program (i.e., 3 days a week for 6 weeks), where a 20-min NIBS current was simultaneously applied at the beginning of the 1 h of CR in all sessions	week before treatment initiation (baseline); functional outcomes were measured at the baseline, immediately after, and 6 weeks after 18 therapeutic sessions (post-treatment)	FMA-UE was performed (score ranges 0 ~ 66) to assess upper-limb motor recovery; Jebsen-taylor hand function test (JTT) Finger-to-nose test (FNT)	FMA-UE - significant time effect with an increase in mean FMA-UE scores in both the sham NIBS group (from 45.17 ± 17.18 at the baseline to 52.17 ± 15.03 post-stimulation; p < 0.001) and the real NIBS group (from 37.50 ± 20.54 at the baseline to 48.33 ± 16.55 post-stimulation; p < 0.001); JTT and FNT Times increased in Real NIBS group	did not include conventional tDCS or iTBS stimulation as a comparison group in study; study was single-blinded due to characteristics of the tDCS device. This could potentially have caused bias when conducting the sessions; sample size was small, so applications in large population are required in the future study tested electrostimulation only on chronic stroke patients with upper-limb impairment (Brunnstrom stage IV or V) other neurological conditions, like Alzheimer's and Parkinson's disease, will be tested in the future for the effect of electrostimulation on the brain for improvements in cognition, memory, and functional activity status to develop smart electrostimulation devices for use in clinical rehabilitation
52	Transcranial Direct Current Stimulation Enhances Motor Skill Learning but Not Generalization in Chronic Stroke	2018	USA & Germany	double-blinded	n =272 Assessed n =56 proceeded n =6 withdrew n =50 Analyzed	SHAM tDCS(N=18) 61.6±3 Real tDCS (N=18) 61.9±3 NO TRAINING/ NO tDCS (N = 14) 64.7±2!!	SHAM tDCS(N=18) M/F = 67/33% Real tDCS (N=18) M/F = 83/17% NO TRAINING/ NO tDCS (N = 14) M/F = 57/43%	age 18–80 years; unilateral, first ever ischemic stroke more than 3 months before study enrollment; mild to moderate hemiparesis with residual hand function sufficient for task performance; clear hand preference as assessed by the Edinburgh Handedness Inventory; sufficient cognitive function to comply with study requirements;	N/A	(40μA/cm2) real or shame tCDS for 20 minutes per day with the anode targeting the primary motor cortex (M1) of the affected hemisphere	five consecutive days and were then subjected to 5 follow-up visits	Every day for 10 days starting from first day of tCDS	practiced a modified version of the sequential visual isometric pinch force task (SVIPT) for approximately 45 min per day	Both training groups show increased accuracy, effect was catalyzed by tDCS (a reduction in no. of errors is indicated by positive values), on all days, while the no-training/no-tDCS group shows less accuracy Total learning was significantly enhanced by tDCS Compared to sham tDCS, patients showed more online learning and less offline learning when stimulated with real tDCS	unable to infer which stimulated cortical areas may contribute most to learning required that patients have sufficient hand function to execute the SVIPT, it is unclear how results would translate to more severely affected patients long-lasting generalization to untrained upper extremity function due to training, but no additional benefit provided by tDCS. could include a more impaired patient cohort and more multifaceted generalization measures to comprehensively gauge stimulation effects in the clinical context