**S1 Table. Details of the research included.**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Type** | **Author** | **Year** | **Country** | **Design** | **Subjects** | **Intervention** | **Outcome** | **Results** |
| **Sample** **Size** | **Age** | **Time since stroke** | **Methods** | **minutes per session** | **times** **per** **week** | **duration** | **pre** | **post** | **within group** | **between group** | **Comment** |
| NIBS | Aşkın A et al. | 2017 | Turkey | RCT | IG: 20 CG:20 | IG: 58.80 (12.02) CG: 56.75 (11.46) | IG: 24.35(15.39) months CG: 28.35(15.34) months | IG: LF-rTMS(10 sessions) + CT (20 sessions) CG: CT  | LF-rTMS : 20 CT: n.d. | 5 | 4 | FMAUE BBT | FMAUE IG: 15.0 (0.0-58.0) CG: 15.5 (0.0-58.0)  BBT IG: 0.5 (0.0 - 39.0) CG: 0.0(0.0 - 46.0)  | FMAUE IG: 15.5 (0.0-58.0) CG: 18.5 (1.0-63.0)  BBT IG: 1.0 (0.0-38.0) CG: 1.0 (0.0-78.0) | + | + | FMAUE was significantly increased in both groups. LF-rTMS group was significantly improved FMA-UE score compared to control group. |
| Kuzu Ö et al | 2021 | Turkey | RCT | IG1: 7 IG2: 7 CG: 6 | IG1: 56.3 (11.5) IG2: 61.3 (9.8) CG: 65.0 (4.6) | IG1: 16.4 (2.5) months IG2: 14.5 (1.6) months CG: 14.5 (2) month  | IG1: LF-rTMS + CT IG2: cTBS + CT   CG: sham cTMS + CT | LF-rTMS: 10 sessions cTBS: 10 sessions sham cTBS: 10 sessions CT 30min | n.d. | n.d. | FMAUE | FMAUE IG1: 14.7 (8.2) IG2: 19.4 (14.2) CG: 19.2 (11.1) | FMAUE T1 (immediately effect) IG1: 20.3 (9.1) IG2: 22.7 (14.8) CG: 20.3 (11.1)  T2 (4 week) IG1: 22.4 (10.5) IG2: 23.6 (14.4) CG: 20.3 (11.1) | + | + | Both LF-rTMS and cTBS group were significantly improved compared with sham cTBS group follow up at after intervention and 4 weeks.  |
| Kashoo FZ et al | 2022 | Saudi Arabia | RCT | IG: 32 CG: 32 | IG: 58.7 (5.7) CG: 59.9 (5.6)  | IG: 7.8 (1.3) months CG: 7.4 (1.2) months  | IG: tDCS + MI CG: Sham-tDCS + MI | 30 | 5 | 2 | FMAUE | FMAUE IG: 20.6 (2.6) CG: 20.4 (3.7) ARAT IG: 17.6 (2.6) CG: 17.4 (3.7) | FMAUE IG: 28.3 (6.9) CG: 22.8 (5.0) ARAT IG: 24.5 (6.9) CG: 18.9 (5.1) | + | + | FMAUE and ARAT scores were significantly improved at pre to post in tDCS + motor imagery group.  |
| Koh CL et al | 2017 | Taiwan | RCT | IG: 14 CG: 11 | IG: 55.3 (11.4) CG: 56.9 (13.5)  | IG: 15.8 (8.1) months CG: 13.4 (9.4) months  | IG: tDCS + Exercise CG: Sham-tDCS + Exercise | 30 | 3 | 8 | FMAUE | FMAUE IG: 20.4 (6.2) CG: 27.2 (9.4)  ARAT IG: 2.1 (2.1) CG: 4.7 (9.1) | FMAUE T1 (Immediately) IG: 26.4 (7.7) CG: 28.5 (11.2) T2 (After 3 months) IG: 25.1 (7.9) CG: 26.2 (11.4) T3 (After 6 months)  IG: 24.7 (7.7) CG: 27.4 (11.1)  ARAT T1 (Immediately) IG: 2.6 (2.6) CG: 4.7 (9.7) T2 (After 3 months) IG: 7.1 (5.1) CG: 5.2 (12.5) T3 (After 6 months) IG: 2.8 (2.7) CG: 4.0 (8.4) | - | - | No significant difference in both groups at pre to post. |
| Llorens R et al | 2021 | Spain | RCT | IG: 16 CG: 16 | IG: 57.6 (6.9) CG: 52.3 (10.9)  | IG: 8.7 (2.3) months CG: 9.3 (2.4) months  | IG: tDCS + VR + CT CG: CT | 60 | 5 | 3 | FMAUE WMFT | FMAUE IG: 9.50 (5.11) CG: 9.87 (4.82)  WMFT IG: 110.2 (13.9) CG: 100.3 (16.8) | FMAUE IG: 10.13 (4.60) CG: 14.79 (7.37)  WMFT IG: 103.1 (17.6) CG: 98.8 (18.6) | + | + | FMAUE and WMFT scores were significantly improved at pre to post in tDCS with virtual reality + conventional physical therapy group compared to conventional physical therapy group.  |
| Robotic assist training | Conroy SS et al | 2019 | USA | RCT | IG: 23 CG: 22 | IG: 56.4 (12.7) CG: 55.7 (10.2)  | IG: 39.3 months  CG: 33.5 months | IG: Robot training and physical therapy CG: Robot training only | IG: 45min robot training + 15min Physical Therapy CG; 60 min robot training only | 3 | 12 | FMAUE | FMAUE IG: 20.61 (1.86) CG: 22.47 (2.03)  | FMAUE T1 (12 week) IG: 25.34 (2.73) CG: 25.42 (2.54)  T2 (24 week) IG: 26.82 (2.96) CG: 25.32 (2.76) | + | - | FMAUE was significantly increased in both groups. No significantly difference in between groups.   |
| Page SJ et al | 2012 | USA | RCT | IG: 8 CG: 8 | IG: 59.0 (12.9) CG: 58.5 (9.5)  | IG: 44.7 (38.4) months CG: 106.8 (114.6) months  | IG: RAT CG: TOT | 60 | 3 | 8 | FMAUE | FMAUE IG: 22.88 (5.74) CG: 21.63 (5.71) | FMAUE IG: 22.86 (7.01) CG: 21.0 (7.54) | - | - | No significant difference in both groups at pre to post. |
| Houseman SJ et al | 2009 | USA | RCT | IG: 14 CG: 14 | IG: 54.2 (11.9) CG: 56.4 (12.8)  | IG: 84.5 (96.3) months CG: 112.4 (128.5) months  | IG: RAT CG: CT | 60 | 3 | 8 | FMAUE | FMAUE IG: 21.7 (5.9) CG: 18.1 (5.0) | FMAUE T1 (After 24 sessions) IG: 25.0 (8.3) CG: 20.3 (7.6) T2 (After 6 months) IG: 25.3 (9.8) CG: 19.6 (7.7) | + | - | FMAUE was significantly improved in both groups. No significantly difference in between groups. |
| Volpe BT et al | 2008 | USA | RCT | IG: 11 CG: 10 | IG: 62 (3) CG: 60 (3)  | IG: 35 (7) months CG: 40 (11) months  | IG: RAT CG: CT | 60 | 3 | 6 | FMAUE | FMAUE IG: 12.55 (1.5) CG: 11.60 (1.0)  | FMAUE T1(Discharge) IG: 15.73 (2.0) CG: 15.10 (2.0) T2(After 3 months) IG: 15.82 (2.1) CG: 14.80 (1.6) | + | - | Treatment with robotic training and an intensive movement-based protocol had comparable effects on improving motor outcome, as reflected in nonsignificant treatment interactions |
| Kim JA et al | 2023 | Korea | RCT | IG: 15 CG: 15 | IG: 65.53 (8.43) CG: 64.53 (7.72)  | IG: 214.20 (69.52) days CG: 210.60 (80.78) days  | IG: RAT CG: ROM ex. | IG: 35 CG: 30 | 3-4 | 3 | FMAUE | FMAUE IG: 19.00 (14.00 - 24.00) CG: 23.00 (12.00 - 34.00) | FMAUE IG: 21.00 (15.00 - 27.00) CG: 23.00 (12.00 - 34.00)  | + | - | FMAUE was significantly improved in both groups. No significantly difference in between groups.  |
| Conroy SS et al | 2011 | USA | RCT | IG1: 20 IG2: 21 CG: 21 | IG1: 57 (12) IG2: 60 (13) CG: 56(6.3) | IG1: 3 (2) years IG2: 5 (8) years CG: 4(6) years | IG1: RAT (Planar) IG2: RAT (Planar + Vertical) CG: CT | 60 | 3 | 6 | FMAUE WMFT | FMAUE IG1: 20.3 (14.7) IG2: 16.5 (10.6) CG: 18.2 (12.5) WFMT (Time) IG1: 71.5 (40.2) IG2: 87.1 (35.7) CG: 82.8 (33.3) | FMAUE T1 (After 6 weeks) IG1: 23.24 (15.47) IG2: 18.2 (11.4) CG: 19.39 (13.28) T2 (After 12 weeks) IG1: 23.6 (15.5) IG2: 19.11 (11.41) CG: 20.02 (13.28) WFMT (Time) T1 IG1: 71.5 (40.2) IG2: 87.1 (35.7) CG: 81.09 (35.36) T2 IG1: 66.97 (42.32) IG2: 83.73 (37.86) CG: 80.03 (35.37) | + | - | FMAUE was significantly improved in Planar and Planar with Vertical groups after 6 weeks. No significantly difference in between groups. FMA-UE was significantly improved in all groups after 12 weeks.  The planar group significantly improved their WFMT score compared to the other group after 6 weeks.  |
| BCI | Miao Y et al | 2020 | China | RCT | IG: 8 CG: 8 | IG: 30 - 70 CG: 25 - 72 | IG: 18.3 (10.9) months CG: 11.1(5.0) months | IG: BCI CG: TENS + TOT | BCI: 2 session/1time | 3 | 4 | FMAUE | FMAUE IG: 19.5 (9.9) CG: 20.6 (9.7) | FMAUE IG: 23.0 (11.4) CG: 21.5 (10.0) | + | - | FMAUE was significantly increased in both groups. No significantly difference in between groups.   |
| Biasiucci A et al | 2018 | Switzerland | RCT | IG: 14 CG: 13 | IG: 41 - 76 CG: 36 - 76 | IG: 10- 176 months  CG: 11 - 121 months | IG: BCI + FES CG: Sham-BCI | 60 | 2 | 5 | FMAUE | FMAUE IG: 21.6 (10.8) CG: 19.9 (11.2) | FMAUE IG: 28.5 (10.8) CG: 22.0 (12.2) | + | + | FMAUE was significantly improved in BCI group compared to sham-BCI group.  |
| ES | Gabr U et al | 2005 | USA | RCT | IG: 8 CG: 4 | All: 59.75 | All: 52.75 months | IG: ES CG: CT | 35 | 2 | 8 | FMAUE ARAT | FMAUE IG: 12.0 CG: 15.83 ARAT IG: 1.428 CG: 0 | FMAUE T1 (After 8 weeks) IG: 18.875 CG: 16.83 T2 (After 16 weeks) IG: 11.0 CG: 16.54 ARAT T1 IG: 1.571 CG: 0 T2 IG: 0 CG: 0 |  |  | No statistical analysis. |
| Carda S et al | 2017 | Switzerland | Crossover design | IG: 5 CG: 6 | IG: 45.6 (14.5) CG: 49.8 (13.3)  | IG: 52 (50.5) months  CG: 41.5 (31.7) months  | IG: ES + Exercise CG: CT | 90 | 5 | 2 | FMAUE WMFT | FMAUE IG: 11 (5.4) CG: 13.2 (4.9) WMFT (Time) IG: 99.8 (20.3) CG: 86.2 (31.3) WMFT (FAS) IG: 12.6 (10.8) CG: 14.8 (11.3) | FMAUE IG: 23.2 (10.7) CG: 17.5 (7.5) WMFT (Time) IG: 93.4 (18.5) CG: 87.5 (30) WMFT (FAS) IG: 15.8 (13.5) CG: 14.8 (11.3) | + | + | FMAUE was significantly improved in IG after 2 weeks.  WMFT was not significantly improved in both groups.  |
| Akter R et al | 2023 | Bangladesh | RCT | IG: 12 CG: 13 | IG: 49.15 (12.76) CG: 58.58 (9.42)  | All: over 6 months  | IG: FES + Exercise CG: CT | 60 | 5 | 4 | FMAUE | FMAUE IG: 21.15 (1.07) CG: 21.33 (0.898) | FMAUE IG: 47.38 (0.984) CG: 33.50 (1.209) | + | + | FMAUE was significantly improved in FES group compared to control group after 4 weeks. |
| Minami S et al | 2021 | Japan | Crossover design | IG: 5 CG: 4 | IG: 64.0 (13.4) CG: 61.7 (10.4)  | IG: 8.4 (4.5) years CG: 9.3 (9.2) years | IG: ES + Exercise CG: CT | 60 | 3 | 12 | FMAUE | FMAUE IG: 20.4 (7.6) CG: 28.8 (12.6) | FMAUE IG: 30.0 (11.9) CG: 28.6 (12.3) | + | + | FMAUE was significantly improved at pre to post in IG.  |
| Page SJ et al | 2012 | USA | RCT | IG1: 9 IG2: 8 IG3: 8 CG: 7  | All: 57.6 (10.1) | All: 53.8 (69.4) months | IG1: TOT (30min) +ESN IG2: TOT (60min) + ESN IG3: TOT (120min) + ESN CG: Home exercise program | IG1: 30 IG2: 60 IG3: 120 CG: 30 | 5 | 8 | FMAUE ARAT BBT | FMAUE: IG1: 21.0 (3.3) IG2: 26.6 (10.4) IG3: 27.1 (7.5) CG: 25.6 (9.9)  BBT IG1: 0.7 (1.1) IG2: 5.6 (9.0) IG3: 9.8 (11.7) CG: 7.9 (15.2)  ARAT IG1: 6.4 (4.9) IG2: 11.6 (14.4) IG3: 18.6 (12.3) CG: 10.9 (14.6) | FMAUE IG1: 22.9 (3.4) IG2: 27.9 (9.4) IG3: 31.3 (9.2) CG: 26.9 (12.0)  BBT IG1: 1.6 (2.6) IG2: 4.8 (7.6) IG3: 12.5 (14.2) CG: 7.7 (15.0)  ARAT IG1: 8.3 (6.5) IG2: 13.0 (14.9) IG3: 22.3 (14.1) CG: 12.3 (15.0) | + | - | FMAUE, BBT, and ARAT were significantly improved in 120min RTP + ESN group.  ARAT was significantly improved in 30, 60 min RTP + ESN group. No significantly difference in between groups.  |
| VR | Fischer HC et al | 2007 | USA | RCT | IG1: 5 IG2: 5 CG: 5 | IG1: 32 - 64 IG2: 50 - 88 CG: 42 - 68   | IG1: 1.25 - 9 years IG2: 2 - 12 years CG: 2 - 38 | IG1: VR (Cable orthosis) IG2: VR (Pneumatic orthosis CG: Exercise  | 60 | 3 | 6 | FMAUE WMFT BBT | FMAUE IG1: 28 (17) IG2: 19 (9) CG: 25 (5) WMFT (Time) IG1: 76.4 (37) IG2: 92.0 (36.4) CG: 86.1 (32.2) BBT IG1: 3 (5.3) IG2: 4 (7.1) CG: 0 (0.4) | FMAUE T1 (Post) IG1: 32 (11) IG2: 18 (10) CG: 28 (7) T2 (After one month)  IG1: 29 (15) IG2: 20 (11) CG: 28 (5) WMFT (Time) T1 (Post) IG1: 74.7 (37.5) IG2: 79.1 (34.2) CG: 79.9 (38.8) T2 (After one month) IG1: 75.8 (34.7) IG2: 76.1 (37.2) CG: 73.9 (31.9) BBT T1 (Post) IG1: 5 (7.1) IG2: 3 (6.6) CG: 2 (3.6) T2 (After one month) IG1: 4 (9.4) IG2: 4 (8.3) CG: 3 (1.9) | + | - | FMAUE, WMFT, and BBT were significantly improved in both groups. No significantly difference in between groups. |
| rESWT | Senarath ID et al. | 2023 | Sri Lanka | RCT | IG: 53 CG: 53 | IG: 63.32 (-) CG: 64.42 (-) | n.d. | IG: rESWT + TOT CG: TENS + TOT | 45 | rESWT: 1, task specific training: 3 | 4 | FMAUE ARAT | FMAUE: IG: 20.23(7.77) CG: 17.00(6.98) ARAT: IG: 7.58(5.38) CG: 6.53(5.79) | FMAUE: T1 (immediately effect) IG: 27.75 (8.68) CG: 22.02 (7.40)  T2 (4 week) IG: 41.30 (7.85) CG: 33.04 (7.85) ARAT: T1 IG: 16.34 (7.74) CG: 11.06 (5.65)  T2 IG: 31.21(6.40) CG: 23.68 (2.67) | + | - | Both groups showed improvement in both FMAUE, ARAT, and MAS scores in before and after intervention and after 4 weeks.  The rESWT group improved in all outcomes at T1 and T2 compared to the TENS group. |
| Task oriented training | Waller　SMC | 2014 | USA | RCT | IG: 14 CG: 13 | IG: 56 CG: 57  | IG: 5.3 years CG: 3.1 years  | IG: Bilateral TOT CG Unilateral TOT | 60 | 3 | 6 | FMAUE WFMT BBT  | FMAUE IG: 18.7 (9.1) CG: 23.0 (12.1)  WMFT IG: 89.9 (9.1) CG: 78.2 (24.0) BBT IG: 2.3 (3.3) CG: 3.3 (5.7) | FMAUE T1 (After 12 week) IG: 24.4 (11.5) CG: 26.1 (17.4) T2 (After 18 weeks) IG: 20.5 (12.9) CG: 26.8 (16.7)  WMFT T1 (After 12 week) IG: 76.0 (18.8) CG: 76.2 (30.6) T2 (After 18 weeks) IG: 77.5 CG: 73.3 BBT T1 (After 12 week) IG: 4.1 (6.6) CG: 5.3 (9.5) T2 (After 18 weeks) IG: 2.3 (5.1) CG: 4.8 (8.5) | + | - | FMAUE, WFMT, and BBT were significantly improved after 12 weeks in both groups. WMFT was significantly improved in COMBO group after 12 weeks compared to SAEBO group. WMFT and BBT were significantly improved after 18 weeks in COMBO group compared to SAEBO group. |
| Mirror Therapy | Colomer C et al | 2016 | Spain | RCT | IG: 17 CG: 17 | IG: 53.8 (5.5) CG: 53.3 (10.5)  | IG: 584.2 (478.7) days CG: 520.0 (262.5) days | IG: MT CG: passive ROM ex. | 45 | 3 | 8 | FMAUE WMFT | FMAUE IG: 8.5 (1.2) CG: 9.0 (1.1) WMFT (Time) IG: 1615.2 (67.2) CG: 1492.7 (65.1) WMFT (FAS) IG: 10.9 (1.7) CG: 9.0 (1.1)  | FMAUE IG: 8.6 (1.1) CG: 9.5 (1.1) WMFT (Time) IG: 1539.8 (72.8) CG: 1405.8 (70.8) WMFT (FAS) IG: 10.1 (1.8) CG: 12.6 (1.8) | - | - | WMFT was significantly difference in both groups at pre to post. No significantly difference in between groups.  FMAUE was not significantly difference in both groups at pre to post.  |
| Biofeedback | Cordo P et al | 2013 | Portland | RCT | IG1: 23 IG2: 23 | IG1: 57 (10) IG2: 54 (12)  | IG1: 12.7 (10.8) months IG2: 6.0 (7.4) months  | IG1: Torque Biofeedback IG2: The Electromyographic (EMG) Biofeedback | 30 | 3-4 | 10-12 | FMAUE | FMAUE IG1: 23.1 (8.8) IG2: 19.4 (6.2)  | FMAUE IG1: 27.0 (10.3) IG2: 23.7 (6.2) | + | - | FMAUE was significantly improved in both groups. No significantly difference in between groups.  |
| Other | Zondervan DK et al | 2015 | USA | RCT | IG: 8 CG: 8 | IG: 61 (17) CG: 54 (14)  | IG: 39 (46) months  CG: 19 (9) months | IG: The resonating arm exerciser CG: CT | 180 | 3 | 3 | FMAUE | FMAUE IG: 19 (9) CG: 24 (8) | FMAUE IG: 21.88 (13.68) CG: 25.31 (10.59) | + | - | FMAUE was significantly improved in both groups. MAS was not significantly improved in both groups. |

ARAT: Action Research Arm Test, BBT: Box and Block Test, BCI: Brain-Computer Interface, CG: Control Group, CT: Conventional Therapy, cTBS: Continuous Theta Burst Stimulation, ES: Electrical Stimulation, FES: Functional Electrical Stimulation, FMAUE: Fugl-Meyer Assessment Upper Extremity, IG: Intervention Group, MAS: Motor Assessment Scale, MI: Motor Imagery, MT: Mirror Therapy, n.d.: no date, RAT: Robotic Assisted Therapy, rESWT: radial Extracorporeal Shock Wave Therapy, RCT: Randomized Controlled Trial, ROM: Range of Motion, rTMS: Repetitive Transcranial Magnetic Stimulation, tDCS: Transcranial Direct Current Stimulation, TENS: Transcutaneous Electrical Nerve Stimulation, TOT: Task Oriented Training, VR: Virtual Reality, WMFT: Wolf Motor Function Test