

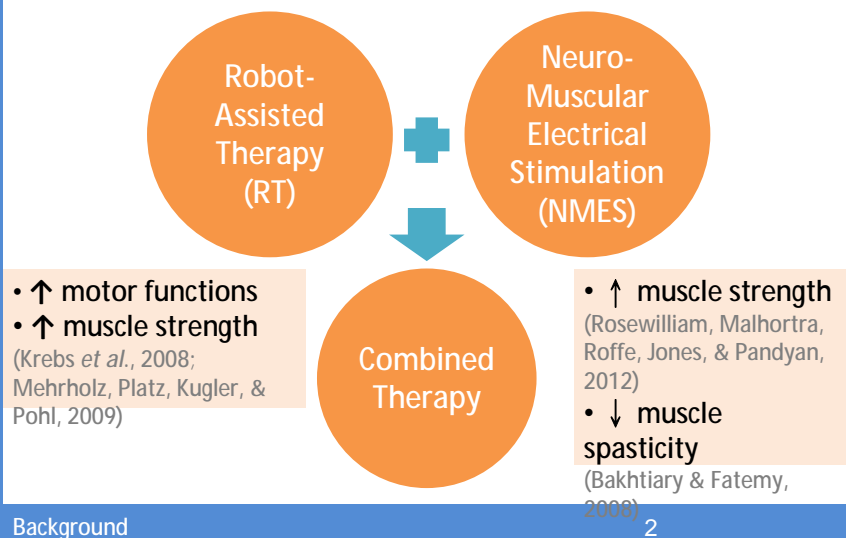
2015 International Occupational Therapy Conference

Combining Robot-Assisted Therapy With Neuro-Muscular Electrical Stimulation on Motor Function in Patients With Stroke

Hsiao-ju Cheng, Yu-fen Huang, Yu-wei Hsieh,
Ching-yi Wu, Keh-chung Lin
School of Occupational Therapy, National Taiwan University
Taipei, Taiwan
Mar. 20, 2015
b97409019@ntu.edu.tw

1

Stroke Rehabilitation



Background

2

Study Purpose and Hypothesis

- Aims: to investigate the differential effects of RT combined with NMES (RT + ES), RT combined with placebo-controlled stimulation (RT + Sham), and control treatment (CT) on motor function in patients with chronic stroke
- Hypotheses: RT + ES or RT + Sham > CT on motor function

Background

3

Study Design and Procedures

- Randomized, placebo-controlled clinical trial
- 3 groups: RT + ES, RT + Sham, and CT
- Outcome measures:
 - Fugl-Meyer Assessment (FMA)
 - Action Research Arm Test (ARAT)
 - Medical Research Council scale (MRC)
 - Modified Ashworth scale (MAS)



Methodology

4

Interventions

20 sessions (90-100 min/d, 5d/wk) lasting for 4 weeks

RT + ES

BMT + NMES

Functional practice

• 60-70 mins

• 30 mins



Bi-Manu-Track

PAS system

(BMT)

Reha-Stim Co.
(Germany)

GD-601

OG GIKEN Co.,
Ltd. (Japan)

RT + Sham

BMT + Placebo-controlled
Stimulation

Functional practice

• 60-70 mins

• 30 mins

CT

Dose-matched occupational
therapy

Functional practice

• 60-70 mins

• 30 mins

Methodology

5

Data Analysis

- Baseline characteristics
 - Categorical variables: chi-squared test
 - Continuous variables: one-way analysis of variance
- Effects of interventions: analysis of covariate (ANCOVA) ($\alpha = .05$)
 - Covariate: baseline score
 - Independent variable: intervention group
 - Dependent variable: posttest score
 - Post hoc pair-wise comparisons: Bonferroni test
- Effect size: partial eta-squared (η^2)
 - Large: $\geq .14$; moderate: $\geq .06$; small: $\geq .01$ (Cohen, 1988)

Methodology

6

Baseline Characteristics

| Characteristics | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | P |
|--|-------------------|--------------------|-------------------|------|
| Sex (male/ female) | 7/3 | 7/2 | 7/3 | .910 |
| Age, mean \pm SD (years) | 59.71 \pm 9.99 | 55.76 \pm 5.85 | 54.39 \pm 13.57 | .507 |
| Months since stroke, mean \pm SD | 26.30 \pm 19.58 | 27.22 \pm 14.27 | 28.10 \pm 19.02 | .975 |
| Side of stroke (left/ right) | 4/6 | 5/4 | 4/6 | .738 |
| Type of stroke (hemorrhage/ ischemic) | 1/9 | 4/5 | 5/5 | .128 |
| Handedness (left/ right) | 0/10 | 0/9 | 0/10 | - |
| FMA-UE, mean \pm SD | 35.90 \pm 8.27 | 31.56 \pm 9.44 | 27.80 \pm 8.66 | .139 |
| MMSE, mean \pm SD | 27.30 \pm 2.16 | 28.11 \pm 1.76 | 27.40 \pm 2.17 | .653 |

Results

7

FMA

| | Pretest, Mean (SD) | | | Adjusted mean (SE) | | | ANCOVA | | |
|----------|----------------------|-----------------------|-----------------|--------------------|------------------------------|------------------------------|--------|-------|----------|
| | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | F | P | η^2 |
| FMA | 35.90 (8.27) | 31.56 (9.44) | 27.80 (8.66) | 36.09 (0.88) | 35.43 (0.89) ^B | 38.72 (0.88) ^A | 3.804 | .036* | .233 |
| proximal | 28.20 (3.82) | 25.33 (6.14) | 22.20 (5.59) | 28.41 (0.74) | 26.71 (0.73) | 29.05 (0.74) | 0.080 | .080 | .183 |
| distal | 7.70 (5.52) | 6.22 (3.56) | 5.60 (3.20) | 8.25 (0.75) | 8.78 (0.78) | 9.04 (0.74) | 0.284 | .755 | .022 |

Results

8

ARAT

| | Pretest, Mean (SD) | | | Adjusted mean (SE) | | | ANCOVA | | |
|-------------|---------------------|--------------------|---------------|--------------------|-----------------------|-----------------|--------|------|----------|
| | Posttest, Mean (SD) | | | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | F | P | η^2 |
| | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | | | | | | |
| ARAT | 23.50 (15.44) | 15.67 (12.80) | 13.10 (13.78) | 24.43 (1.46) | 21.89 (1.49) | 21.27 (1.44) | 1.261 | .301 | .092 |
| | 30.70 (16.07) | 20.00 (15.03) | 16.70 (14.79) | | | | | | |
| grasp | 9.00 (6.34) | 6.11 (5.80) | 4.30 (5.85) | 8.46 (0.69) | 8.46 (0.71) | 8.43 (0.69) | 0.001 | .999 | .000 |
| | 10.80 (5.77) | 8.11 (6.49) | 6.40 (5.62) | | | | | | |
| grip | 5.90 (3.90) | 3.56 (2.60) | 3.20 (3.39) | 5.70 (0.52) | 5.29 (0.52) | 4.65 (0.50) | 1.038 | .369 | .077 |
| | 7.20 (3.49) | 4.67 (3.43) | 3.70 (3.34) | | | | | | |
| pinch | 2.70 (4.57) | 1.56 (4.67) | 1.00 (3.16) | 4.52 (0.83) | 2.32 (0.86) | 2.49 (0.82) | 2.124 | .141 | .145 |
| | 5.50 (6.20) | 2.11 (4.65) | 1.70 (3.95) | | | | | | |
| gross motor | 5.90 (2.38) | 4.44 (1.67) | 4.60 (2.41) | 6.44 (0.41) | 5.58 (0.42) | 5.24 (0.40) | 2.226 | .129 | .151 |
| | 7.20 (1.69) | 5.11 (2.20) | 4.90 (2.69) | | | | | | |

MRC

| | Pretest, Mean (SD) | | | Adjusted mean (SE) | | | ANCOVA | | |
|----------|---------------------|--------------------|--------------|--------------------|-----------------------|----------------|--------|------|----------|
| | Posttest, Mean (SD) | | | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | F | P | η^2 |
| | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | | | | | | |
| MRC | 2.93 (0.90) | 2.71 (0.89) | 2.18 (0.90) | 3.00 (0.14) | 3.04 (0.14) | 3.08 (0.14) | 0.069 | .934 | .005 |
| | 3.27 (0.60) | 3.13 (0.95) | 2.74 (0.93) | | | | | | |
| proximal | 3.70 (0.86) | 3.39 (1.06) | 2.73 (1.07) | 3.76 (0.17) | 3.64 (0.17) | 3.84 (0.17) | 0.349 | .709 | .027 |
| | 4.05 (0.81) | 3.72 (0.91) | 3.48 (0.79) | | | | | | |
| distal | 2.15 (1.14) | 2.03 (0.96) | 1.63 (0.97) | 2.28 (0.23) | 2.44 (0.24) | 2.28 (0.23) | 0.164 | .850 | .013 |
| | 2.48 (1.00) | 2.53 (1.30) | 2.00 (1.19) | | | | | | |

Results

10

MAS

| | Pretest, Mean (SD) | | | Adjusted mean (SE) | | | ANCOVA | | |
|----------------|----------------------------|----------------------------|----------------------------|-----------------------------|-----------------------|-----------------------------|--------|-------|----------|
| | Posttest, Mean (SD) | | | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | F | P | η^2 |
| | RT + ES (n=10) | RT + Sham (n=9) | CT (n=10) | | | | | | |
| MAS | 0.79 (0.26) 0.77 (0.39) | 0.87 (0.37) 1.00 (0.43) | 0.78 (0.55) 0.75 (0.44) | 0.79 (0.08) | 0.95 (0.09) | 0.77 (0.08) | 1.326 | .284 | .096 |
| proximal | 0.90 (0.38) 0.87 (0.50) | 1.07 (0.55) 1.07 (0.58) | 0.89 (0.61) 0.72 (0.50) | 0.91 (0.11) | 0.98 < (0.12) | 0.76 (0.11) | 0.974 | .391 | .072 |
| distal | 0.75 (0.26) 0.64 (0.28) | 0.76 (0.29) 0.90 (0.29) | 0.73 (0.53) 0.80 (0.39) | 0.64 (0.07) | 0.89 (0.07) | 0.81 (0.07) | 3.374 | .050* | .213 |
| wrist flexors | 1.50 (0.63) 1.05 (0.50) | 1.11 (0.74) 1.44 (0.68) | 1.25 (0.92) 1.60 (0.70) | 0.96 (0.17) ^A | 1.53 (0.18) | 1.62 (0.17) ^B | 4.319 | .024* | .257 |
| finger flexors | 1.60 (0.66) 1.45 (0.69) | 1.72 (0.67) 1.94 (0.17) | 1.45 (1.17) 1.60 (0.70) | 1.44 (0.14) | 1.88 (0.14) | 1.66 (0.14) | 2.491 | .103 | .166 |

Summary Table

| RT + ES > RT + Sham or CT | RT + ES & RT + Sham > CT |
|--|---|
| <ul style="list-style-type: none"> •MAS-distal •MAS-wrist flexors | <ul style="list-style-type: none"> •ARAT-grip |
| <ul style="list-style-type: none"> •ARAT •ARAT-pinch •ARAT-gross motor •MAS-finger flexors | |
| CT > RT + ES or RT + Sham | Tantamount effects |
| <ul style="list-style-type: none"> •FMA •MAS-proximal | <ul style="list-style-type: none"> •FMA-proximal •MAS |

