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# Synergic Effects of Robot-Assisted Gait Training with Inhibitory rTMS in Chronic Stroke Patients

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## Objective

**The purpose of this study is to identify the synergistic effect of inhibitory rTMS on PMC and body-weight-supported robot-assisted gait training on functional recovery in patients with chronic stroke patients.**

## Subjects and Method

### Subjects

**18 chronic stroke patients with**

**(1) Patients diagnosed more than 2 years**

**(2) No other brain-related disease (Parkinson's disease, multiple sclerosis, etc) that can cause gait disturbances.**

**(3) K-MMSE more than 15 score.**

### Methods

**Retrospective medical chart review of 18 patients with chronic stroke who were hospitalized from 2021 year to 2025 year in our hospital. Gait training and inhibitory rTMS was conducted 5 times a week.**

**1. Control group (Group I, n=13)**

**- conducted 20 sessions of body-weight-supported robot-assisted gait training (WALKBOT®G for RAGT manufactured by P&S Mechanics Co., Ltd., Seoul, Korea) for one month**

**2. Intervention group (Group II, n=5)**

**- conducted 20 sessions of inhibitory rTMS on PMC (Magpro R30 for rTMS manufactured by MagVenture Inc. USA) and body-weight-supported robot-assisted gait training (WALKBOT®G) for one month**

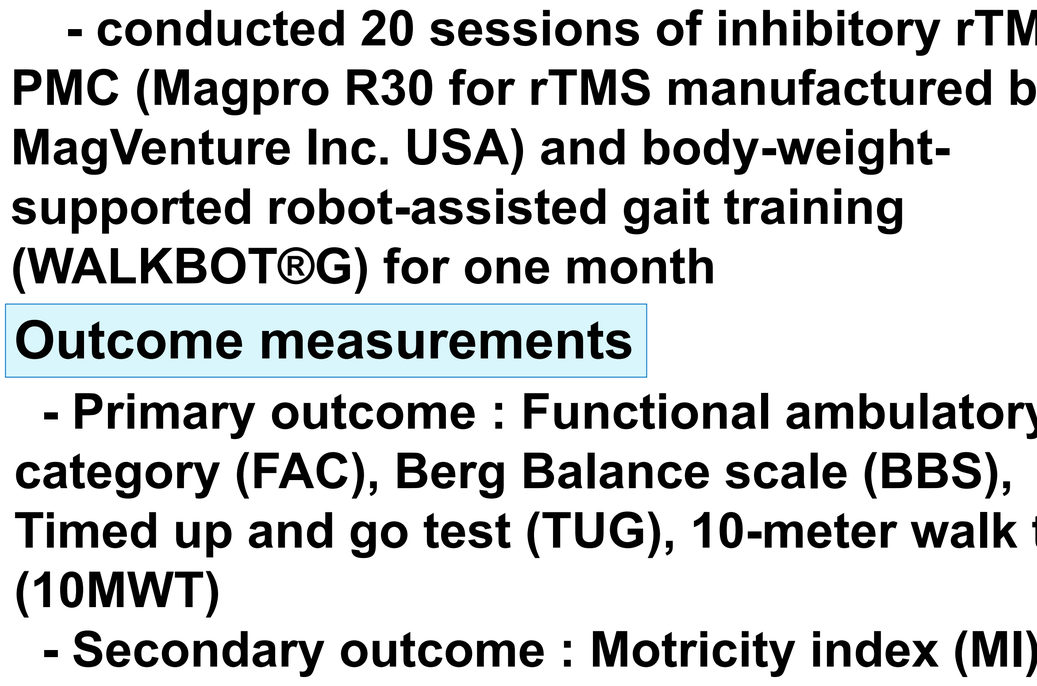
### Outcome measurements

**- Primary outcome : Functional ambulatory category (FAC), Berg Balance scale (BBS), Timed up and go test (TUG), 10-meter walk test (10MWT)**

**- Secondary outcome : Motricity index (MI), Modified Barthel index (MBI), Functional independence measure (FIM), Spasticity**

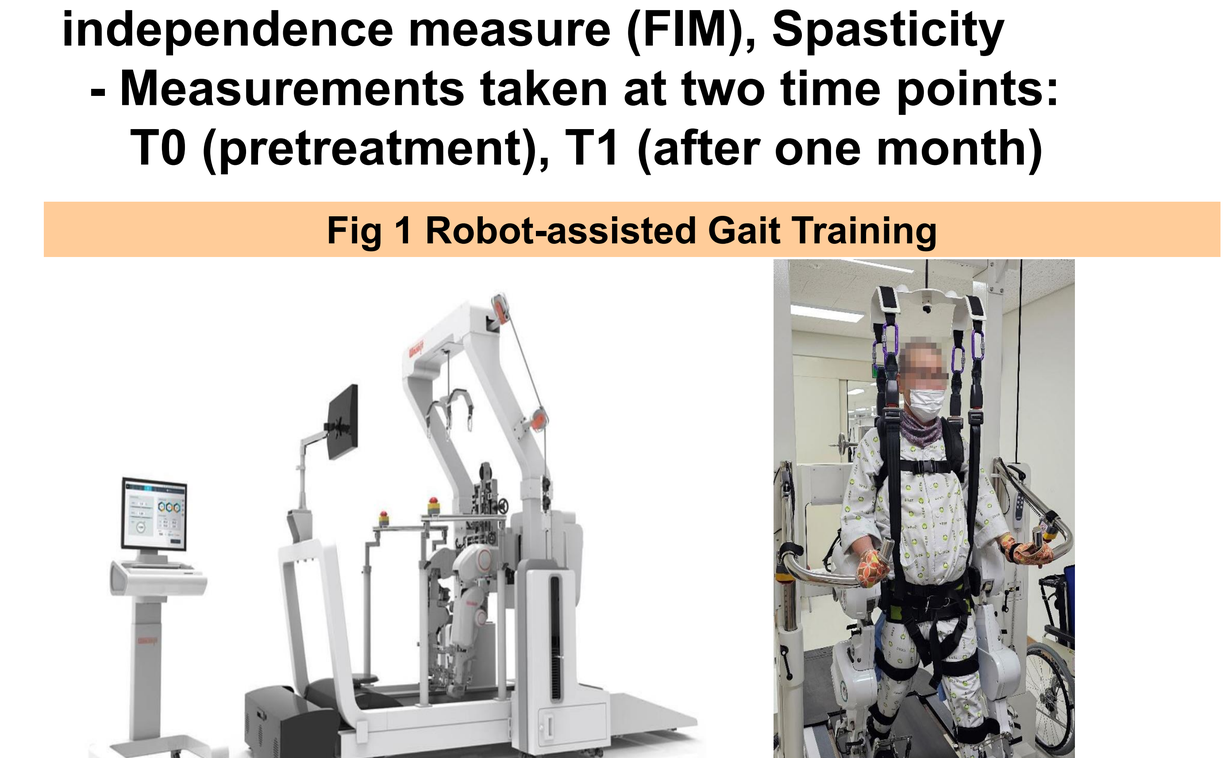
**- Measurements taken at two time points: T0 (pretreatment), T1 (after one month)**

**Fig 1 Robot-assisted Gait Training**



*WALKBOT®G for RAGT manufactured by P&S Mechanics Co., Ltd., Seoul, Korea*

**Fig 2 Inhibitory rTMS**




*Magpro R30 for rTMS manufactured by MagVenture Inc. USA*

## Results

**Table 1. Demographic data of the participants**

| | Group1 | Group2 | P-value (Mann-Whitney U test) |
|---|---|---|---|
| **Age (year)** | 74 [72, 78] | 74 [73, 77] | 0.9209 |
| **Weight (kg)** | 68 [65, 80] | 64 [60, 65] | 0.1033 |
| **Height (cm)** | 167 [159, 173] | 160 [157,165] | 0.2172 |
| **Post-stroke duration (month)** | 49.7 [31.0,113.5] | 30.8 [24.2, 86.4] | 0.4597 |
| **K-MMSE** | 26 [24, 28] | 26 [26, 27] | 0.7267 |
| **K-MBI** | 70 [48, 77] | 65 [61, 73] | 0.8823 |
| **Sex (Male : Female)** | 12 : 1 | 5 : 0 | |
| **Hemiplegia side (Right : Left)** | 3 : 10 | 2 : 3 | |
| **Stroke location (Supratentorial : Infratentorial)** | 10 : 3 | 5 : 0 | |

**Table 2. Results in measurements of the participants in the Group 1 and Group 2**

| | Group 1 | | | Group 2 | | |
|---|---|---|---|---|---|---|
| | **T0** | **T1** | **P-value (Wilcoxon signed-rank test)** | **T0** | **T1** | **P-value (Wilcoxon signed-rank test)** |
| **FAC** | 2 [2, 3] | 3 [2, 3] | 0.250 | 3 [3, 3] | 3 [3, 3] | 0.500 |
| **MI** | 58 [48, 58] | 58 [49, 58] | 0.500 | 53 [48, 54] | 53 [48, 54] | 0.500 |
| **BBS** | 24 [12, 32] | 29 [19, 34] | 0.011 * | 31 [30, 35] | 37 [30, 37] | 0.045 * |
| **TUG** | 42 [25, 70] | 40 [19, 69] | 0.003 * | 40 [28, 45] | 33 [28, 40] | 0.041 * |
| **10MWT** | 36 [16, 70] | 35 [15, 67] | 0.003 * | 34 [27, 37] | 31 [27, 34] | 0.041 * |
| **MBI** | 70 [48, 77] | 71 [53, 79] | 0.003 * | 65 [61, 73] | 69 [68, 78] | 0.043 * |
| **FIM** | 82 [54, 86] | 84 [58, 88] | 0.001 * | 77 [75, 86] | 84 [80, 91] | 0.042 * |
| **Spasticity** | 0 [0, 1] | 0 [0, 1] | 0.500 | 0 [0, 0] | 0 [0, 0] | 0.500 |

**Table 3. Changes in measurements of the participants in the Group 1 and Group 2**

| | △ T1 − T0 | | |
|---|---|---|---|
| | **Group 1** | **Group 2** | **P-value (Mann-Whitney U Test)** |
| **FAC** | 0 [0, 0] | 0 [0, 0] | 0.819 |
| **MI** | 0 [0, 0] | 0 [0, 0] | 0.820 |
| **BBS** | 1 [0, 3] | 2 [1, 6] | 0.415 |
| **TUG** | 2 [1, 3] | 0 [0, 10] | 0.688 |
| **10MWT** | 2 [1, 4] | 0 [0, 6] | 0.452 |
| **MBI** | 2 [1, 7] | 5 [3, 6] | 0.371 |
| **FIM** | 3 [2, 5] | 5 [3, 8] | 0.274 |
| **Spasticity** | 0 [0, 0] | 0 [0, 0] | 0.469 |

*** p-value < 0.05**
**Values are presented as Median [Q1, Q3] or the number of patients**
**Spasticity was evaluated using MAS Grade. Gr.0, Gr.1, Gr.1+, Gr.2, Gr.3, Gr.4 is represented by 0,1,2,3,4,5 point respectively.**
**T0, before the intervention; T1, 1 month after training.**

**Demographic data of participants showed no statistically significant difference in both groups. Although BBS, TUG, 10MWT and MBI, FIM between pre-intervention and post-intervention were improved in both groups, the changes(△T1-T0) in FAC, MI, BBS, TUG, 10MWT, MBI, FIM were not statistically significant difference between Group 1 and Group 2.**

## Conclusion

**Our result showed that combined inhibitory rTMS + RAGT did not reach statistical superiority over RAGT only. These results are considered likely due to small sample size and limited treatment time. Further research with expanded sample sizes is warranted to validate these findings, along with a more evaluation of treatment duration, intensity, and treatment session.**