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## Effect of Robot-assisted Gait Training on Gait Automaticity in Parkinson's Disease: A Pilot Study

Seo Jung Yun[1*], Hyun Haeng Lee[2], Woo Hyung Lee[3], Seung Hak Lee[1], Byung-Mo Oh[1], Han Gil Seo[1†]

Seoul National University Hospital, Department of Rehabilitation Medicine[1], Konkuk University Medical Center, Department of Rehabilitation Medicine[2], Seoul national University College of Medicine, Department of Biomedical Engineering[3]

**Purpose**

Gait automaticity is known to be reduced in patients with Parkinson's disease (PD) due to impaired habitual control. Robot-assisted gait training (RAGT), which provide training with high intensity and repeatability, has been suggested to improve gait speed and balance in these patients. The aim of this pilot study was to investigate the effect of RAGT on gait automaticity as well as gait speed and balance in patients with PD.

**Methods**

Patients with idiopathic PD (H&Y stage 2.5 or 3) received 12 sessions of RAGT, 45-min, 3 days a week, for 4 consecutive weeks using an exoskeleton-type gait robot (Walkbot_S; P&S Mechanics, Seoul, Korea). Primary outcome was the percentage of dual-task interference measured by 10 meter walking test (10MWT) under single- and dual-task conditions. Cognitive dual-task walking was measured using Wechsler Forward Digit Span, and physical dual-task walking was measured with a tray with two cups of water. Patients were also evaluated with Berg Balance Scale (BBS) and Korean version of the Falls Efficacy Scale-International (KFES). All outcomes were measured before (T0), after (T1) and 1 month post-treatment (T2).

**Results**

Eleven patients with idiopathic PD were participated (Table 1). Cognitive dual-task interference was significant increased (p=.026) at T1, but not at T2. No significant changes were found for physical dual-task interference at T1 and T2 (Table 2). Single-task gait speed of 10MWT was significantly improved at T1 (p=.041), but not at T2 (p=.445). On the other hand, there were no significant changes in dual-task walking speed of 10MWT. A significant improvement was also found on the BBS at T1 and T2 (p.004 and p=.024, respectively), but no significant changes were found on KFES (Table 3).

**Conclusion**

In this pilot study, the gait automaticity in patients with PD was not improved by RAGT using an exoskeleton-type robot despite improvement in walking speed and balance. Additional therapeutic components may be needed to improve gait automaticity using RAGT in patients with PD.

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Table 1. Patients' demographics and baseline characteristics (N=11)

| | |
|---|---|
| Male/female (n) | 5/6 |
| Age (yr) | 66.46 ± 5.66 |
| Disease duration (mo) | 112.91 ± 50.19 |
| Hoehn & Yahr stage 2.5/3 (n) | 8/3 |
| MMSE-K (score) | 28.55 ± 0.93 |

Mini Mental State Examination-Korea; MMSE-K

**Table1_Patients' demographics and baseline characteristics**

Table 2. Changes in percentage of dual-task interference (%)

| | | T0 (n=11) | T1 (n=11) | T2 (n=10) | Within-group comparisons | |
|---|---|---|---|---|---|---|
| | | | | | T1 - T0 | T2 - T0 |
| Step velocity† | Dual task (cognitive) | -15.78 (7.78) | -.21.50 (7.62) | -20.75 (6.40) | .026* | .203 |
| | Dual task (physical) | -21.23 (7.42) | -21.10 (5.79) | -23.51 (12.55) | .929 | .646 |

Percentage of dual-task interference; (dual-task performance – single-task performance)/single-task performanc e, T0; Before treatment, T1; After treatment, T2; 1 month post-treatment, †Mean (SD), *p<.05 by Wilcoxon signe d-rank test

**Table2_Changes in percentage of dual-task interference**

Table 3. Changes in the outcome variables between T0, T1, and T2

| | | T0 (n=11) | T1 (n=11) | T2 (n=10) | Within-group comparisons | |
|---|---|---|---|---|---|---|
| | | | | | T1 - T0 | T2 – T0 |
| 10MWT† (m/s) | Single task | 1.13 (0.23) | 1.24 (0.28) | 1.17 (0.34) | .041* | .445 |
| | Dual task (cognitive) | 0.94 (0.25) | 0.98 (0.24) | 0.92 (0.26) | 1.000 | .721 |
| | Dual task (physical) | 0.89 (0.22) | 0.98 (0.23) | 0.90 (0.29) | .075 | .721 |
| BBS†† | | 52.00 (8.00) | 54.00 (4.00) | 54.00 (5.25) | .004* | .024* |
| KFES†† | | 28.00 (9.00) | 30.00 (13.00) | 32.50 (15.75) | .235 | .086 |

T0; Before treatment, T1; After treatment, T2; 1 month post-treatment, 10MWT; 10 Meter Walking Test, BBS; Ber g Balance Scale, KFES; Korean version of the Falls Efficacy Scale-International, †Mean (SD), ††Median (IQR), *p<.05 by Wilcoxon signed-rank test

**Table3_Changes in the outcome variables between T0, T1, and T2**