PS-1

AI-Driven Telerehabilitation for Older Adults with Mild Cognitive Impairment

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Introduction

- With the rising prevalence of aging populations, accessible interventions for Mild Cognitive Impairment (MCI) are critical. MCI, a high-risk transitional state to dementia, is considered the most opportune window for intervention to maintain or enhance cognitive function. This study evaluates the clinical efficacy of Zenicog®, an AI-driven, self-guided, home-based cognitive rehabilitation program designed to overcome logistical barriers of conventional therapy.

Method

- **Design:** Randomized two-period crossover trial
- **Setting:** A university hospital
- **Participants:** Total of 70 older adults (aged 65 years or older) with MCI (indicated by a K-MMSE2 score between 18 and 26) : 35 subjects with Group AB (intervention-first), 35 subjects with Group BA (control-first)
- **Interventions:** Each participant was given a tablet PC on which AI-guided mobile cognitive rehabilitation program (Zenicog®) was installed, and instructed to go through total 24 sessions of 30-minutes training within 5 weeks. (Figure 1)
- **Main Outcome Measures:** Cognitive assessments included MMSE, digit span, trail making test A & B. Primary analysis focused on Period 1(T1), comparing Group AB (intervention) to Group BA (control).
- **Secondary Outcome Measures:** psychosocial measures, usability and adverse events.

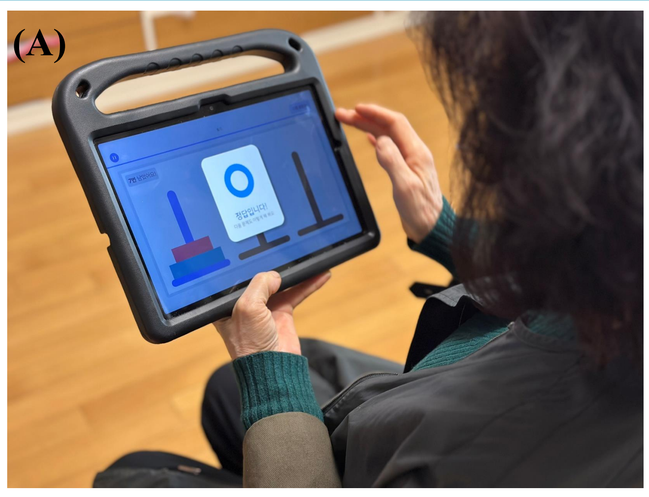


Figure 1. (A) Representative image of a participant utilizing the Zenicog® system. **(B)** Schematic overview of the Zenicog® for artificial intelligence-based telerehabilitation system.

Results

A total of 70 participants were recruited, with 35 allocated to each sequence group (AB and BA). After accounting for dropout (n = 2 in Group AB, n = 6 in Group BA), 62 participants (n = 33 in Group AB and n = 29 in Group BA) completed the study.

At the end of Period 1 (T1), a Mann–Whitney U-test revealed that Group AB (who received the intervention) showed significantly higher MMSE scores than Group BA (who received no treatment) (median [IQR]: 28.0 [27.0, 29.0] vs. 26.0 [26.0, 26.0]; $p < 0.001$). No other cognitive or functional outcomes showed statistically significant between-group differences at T1.

Descriptive statistics for all outcome measures across the three time points (T0, T1, and T2) by group are presented in Table 1. A gradual improvement in MMSE was observed in both groups following the intervention period. Other measures showed smaller or inconsistent changes across periods.

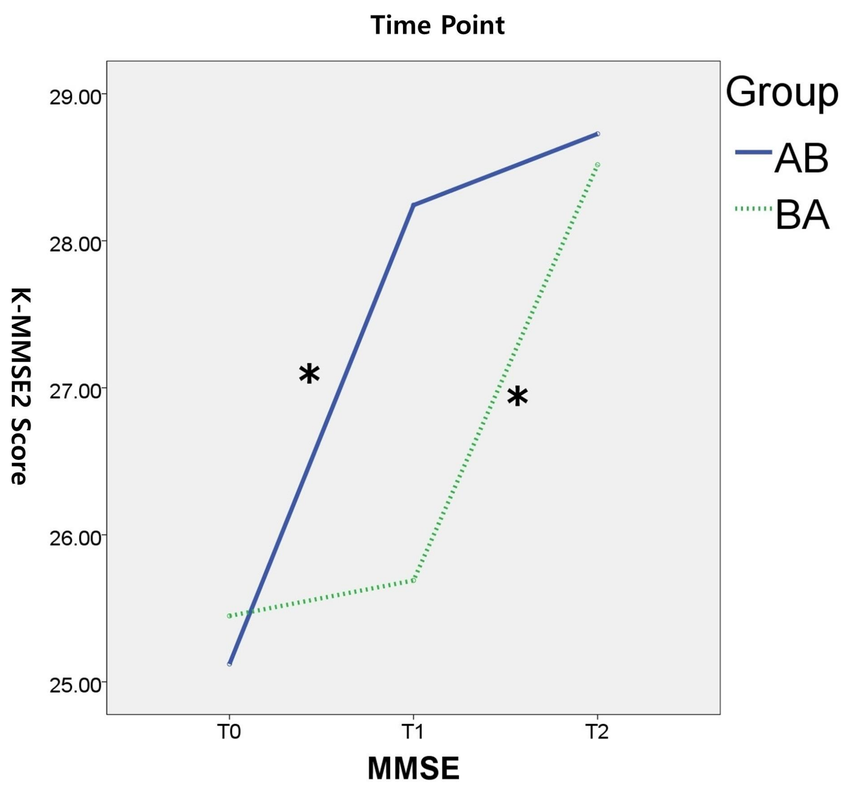
Crossover analysis confirmed significant K-MMSE2 gains occurred only during the intervention periods for both groups (Figure 2).

Table 1. Descriptive Statistics of Outcome Measures by Time Point and Group

	MMSE	DSF	DSB	TMT-A	TMT-B	CES-D	EQ-5D	SES	S-IADL
Group AB (n=33)									
- T0	25.1 ± 1.3	5.2 ± 1.1	3.7 ± 0.7	46.7 ± 17.6	133.1 ± 67.6	11.3 ± 12.9	0.78 ± 0.12	28.3 ± 6.2	2.2 ± 1.6
- T1	28.2 ± 1.2	5.5 ± 1.1	3.7 ± 0.9	38.4 ± 15.4	101.9 ± 42.8	6.0 ± 7.2	0.81 ± 0.10	29.1 ± 5.3	1.8 ± 1.2
- T2	28.7 ± 1.3	5.8 ± 1.2	4.0 ± 1.0	39.5 ± 18.9	100.3 ± 61.0	7.1 ± 8.5	0.80 ± 0.11	30.2 ± 6.1	1.2 ± 1.0
Group BA (n=29)									
- T0	25.4 ± 0.9	5.3 ± 1.1	3.5 ± 0.6	41.0 ± 17.6	120.8 ± 56.5	8.4 ± 7.1	0.80 ± 0.10	28.9 ± 4.4	1.5 ± 1.7
- T1	25.7 ± 0.7	5.2 ± 1.4	3.6 ± 0.9	39.1 ± 19.4	116.7 ± 52.1	7.4 ± 12.0	0.83 ± 0.07	30.9 ± 4.1	1.3 ± 1.5
- T2	28.5 ± 1.3	5.5 ± 1.1	3.8 ± 0.7	34.0 ± 13.1	110.1 ± 68.4	6.3 ± 10.5	0.83 ± 0.10	32.3 ± 4.8	1.0 ± 1.4

Note. Values are presented as mean ± SD. Group AB = Intervention first, then no treatment; Group BA = No treatment first, then intervention. T0 = baseline, T1 = post-period 1, T2 = post-period 2. MMSE = Mini-Mental State Examination; DSF = Digit Span Forward; DSB = Digit Span Backward; TMT = Trail Making Test; CES-D = Center for Epidemiologic Studies Depression Scale; EQ-5D = EuroQoL 5-Dimension; SES = Self-Efficacy Scale; S-IADL = Seoul-Instrumental Activities of Daily Living.

Figure 2. Mean Changes in MMSE scores



Conclusion

- AI-driven, self-guided telerehabilitation is a feasible and effective strategy for improving global cognitive function in MCI patients. Its scalability and minimal supervision requirements make it a viable alternative to clinic-based therapy in aging societies.

Acknowledgement

- Funding for this work was provided by the Korean Health Technology R&D Project, administered through the Korea Health Industry Development Institute (KHIDI) and supported by the Ministry of Health and Welfare of the Republic of Korea (Grant No. RS-2023-00263587).