A Study on Cognitive Activity Programs for Elderly Person with Mild Cognitive Impairment

Bo-Kyoung Song[1], Byung-Il Yang*[2]

*[1]Professor, Department of Occupational Therapy, Kangwon National University, 346 Hwangjo-gil, Dogye-eup, Samcheok-si, Gangwon-do, 24949, Republic of Korea
[2]Professor, Department of Physical Therapy, SangIi University, 83 Sangjidae-gil Wonju-si, Gangwon-do, 26339, Republic of Korea
bksong@kangwon.ac.kr[1], ybi4485@sangji.ac.kr*[2]
Corresponding author*: mobile Phone: +82-010-6688-4485, ybi4485@sangji.ac.kr

Abstract

Background/Objectives: This study is to investigate how the difference of short term memory and sustained attention in cognitive activity programs (CAP) applied to the elderly person with mild cognitive impairment (MCI).

Methods/Statistical analysis: 18 Elderly with MCI were classified into three groups, experimental group 1 (EG1) performed activities of daily living based CAP (ADL-CAP), and experimental group 2 (EG2) implemented a workbook based CAP. Control group (CG) did not receive any special intervention. For short term memory and sustained attention, the evaluation form used a digit span test (DST), digit symbol substitution test (DSST) and attention questionnaire scale (AQS). In statistical analysis, One-way ANOVA was used to investigate the differences in DST, DSST, and AQS after intervention among three groups, and an independent sample T-test was performed to confirm the DST, DSST, and AQS after intervention between EG.

Findings: In EG1, short term memory and sustained attention showed a significant difference, and in EG2, only the sustained attention showed a statistically significant difference among three group. and In the comparison of short memory and sustained attention after intervention between the two experimental groups, there were significant differences in DST, DSST, and AQS after intervention in EG1. Improvements/Applications: CAP helped elderly with MCI improve short term memory and sustained attention on intervention such as ADLs based CAP and workbook-based CAP. In particular, ADLs based CAP tailored to the characteristics of the subject can affect the short term memory and sustained attention by enhancing the subject's participation.

Keywords: Mild cognitive impairment, Short term memory, Sustained attention, Cognitive activity programs, Mild cognitive impairment

1. Introduction

With the rapid increase of the aging population in recent times, the number of patients with degenerative brain diseases such as dementia has also rapidly increased, requiring significant support from the health and medical systems. Unlike cerebrovascular diseases, dementia has a negative effect on daily life activities, due mainly to the deterioration of perception and cognitive functions such as spatiotemporal recognition, attention, memory, and judgment [1]. Certain drugs can help improve the cognitive functions of elderly patients with dementia, but they nonetheless have limitations. It is important to suppress dementia by early detection and screening for mild cognitive impairment (MCI) [2]. MCI is a cognitive impairment that does not affect independent activities of daily living (ADLs), however, if left unattended, it is highly likely to develop into dementia [3]. Attention can be classified under various forms, of which the basic one is called sustained attention. Sustained attention is the cognitive ability to maintain activity for a certain period of time, and it acts as an important factor in learning new knowledge or remembering information. Additionally, one of the characteristics of MCI patients is a problem with working memory, which stores and manipulates information for a particularly short period of time due to memory deterioration. Short-term memory impairment leads to difficulties in finding familiar objects or performing complex ADLs [4]. A dementia prevention program is being developed, and one of the most recently used methods is a workbook-based cognitive activity program

(CAP). The popularity of this method is due to the fact that, compared to other CAPs, the workbook can be easily purchased and used by the target at home and in the community. The workbook-based CAP can improve attention and memory through the use of objects, name-waiting tasks, and constructed problems, but different results have been reported depending on the subjects' characteristics [5]. Therefore, it is necessary to develop another type of CAP that can push past the workbook-based CAP's limitations, and to apply it appropriately to the subject's cognitive level and characteristics. The ADL-based CAP was reported to be effective in improving cognitive impairment based on the familiar living environments of elderly individuals with MCI [6]. In particular, this CAP can be easily applied in communities where there is a lack of institutions that can provide specialized cognitive rehabilitation [7,8]. The purpose of this study is to investigate the effects of the application of CAPs among the elderly with MCI and the effects of different CAPs on sustained attention and short-term memory. We intend to use this study's findings as basic data for effective interventions with MCI patients.

2. Materials and Methods

2.1. Subjects

This study was conducted among 18 of 30 elderly individuals (aged 65 years and over) with MCI. Following a screening test, 12 were excluded due to physical impairments that made them unsuitable for participation. The selection criteria were (1) confirmed MCI through the Korean version of the Mini-Mental State Examination (MMSE-K), and (2) ability to communicate and follow instructions sufficiently to proceed with the program. After randomly classifying 16 selected subjects, experimental group 1 (EG1) performed an ADL-based CAP, experimental group 2 (EG2) performed a workbook-based CAP, and the control group (CG) did not perform any special intervention. Prior to the study intervention, the homogeneity of the general characteristics, sustained attention, and short-term memory among the three groups were confirmed. Moreover, before the intervention was carried out, the purpose of the study and the experimental procedure were explained to the subjects. The study was conducted with the subjects' consent.

2.2. Materials

The digit span test (DST), the digit symbol substitution test (DSST), and the attention questionnaire scale (AQS) were used to investigate short-term memory and sustained attention before and after the intervention. The two CAP interventions were conducted in 12 fifty-minute sessions each, 3 times a week for a total of 4 weeks, and evaluation was conducted before and after the intervention.

2.3. Methods

The ADL-based CAP included familiar daily life activities and social activities within the local community. This program involved a memory stimulation activity introducing the task performed today and an intervention recall activity following the intervention. Prior to the execution of the program, participants were asked to select their preferred cognitive activities through a pre-interview. The workbook-based CAP made use of the workbook program designed by the National Health Insurance Service (NHIS). This program was modified and supplemented, according to the subject's level, for cognitive training designed to stimulate memory, concentration, and frontal functions. The CG visited once a week to have their health checked and did not perform any special interventions. And the same test as EG was performed. Data were analyzed using SPSS 21.0. Among the subjects' general characteristics, descriptive statistics were used for age, cognitive test, and MMSE-K, and the normal distribution of the three groups was confirmed by applying Kolmogorov-Smirnov. One-way ANOVA was used to investigate the differences in DST, DSST, and AQS after intervention among the three groups, and the TUKY post hoc test was used. Additionally, an independent sample T-test was performed to confirm the DST, DSST, and AQS of the two groups. Statistical significance was $\alpha = 0.05$.

3. Results and Discussion

3.1 Subjects' general characteristics

As shown in Table 1, there were six male (33.3%) and 12 female (66.7%) participants in the study, with an average age of 78.17 years. The MMES score was 21.00 points. EG1 was composed of two males (33.3%)

and four females (66.7%), and the average age was 77.83 years. The age was 78.83 years old, two cases (33.3%) of the control group, four cases (66.7%) of women, and 77.83 years of age were confirmed. EG1's MMSE-K score was 20.83 points, EG2's was 21.50 points, and the CG's was 20.67 points. There was no significant difference in age, gender, MMSE, DST, DSST, or AQS in the three groups prior to the intervention (p>0.05) [Table1].

Table 1 Subjects' general characteristics (N=18)

	Variable	Total (n=18)	EG1 (n=6)	EG2 (n=6)	CG (n=6)	p
Age (point)		78.17±4.32	77.83±5.50	78.83±2.71	77.83±5.04	
Gender	Male	6(33.3)	2(33.3)	2(33.3)	2(33.3)	
	Female	12(66.7)	4(66.7)	4(66.7)	4(66.7)	
MMSE-K (point)		21.00±1.33	20.83±1.17	21.50±1.38	20.67±1.51	
DST (point)		04.38±1.27	04.83±1.17	03.67±1.63	04.67±0.52	
DSST (point)		42.48±4.78	40.65±2.34	45.52±5.65	44.87±5.42	
AQS (point)		16.44±3.93	15.83±5.64	18.67±3.14	14.83±1.17	

M ± SD: mean ± standard deviation; EG1: experimental group 1; EG2: experimental group 2; CG: control group; MMSE-K: mini mental state examination-Korean version; DST: digit span test; DSST: digit symbol substitution test; AQS: attention questionnaire scale

3.2 Comparison of short-term memory and sustained attention after intervention among three groups

As shown in Table 2, in DST conducted to investigate the difference in short-term memory among the three groups after intervention, EG1 improved to 4.83±1.17 points before intervention and 8.83±1.17 points after intervention. EG2 improved to 3.67±1.63 points before intervention and 6.00±1.41 points after intervention. It improved to 4.67±0.52 points before the intervention and 5.50±0.5 point after the intervention, and there was a statistically significant difference among the three groups (p<0.000). In DSST conducted to investigate the difference in concentration after intervention, EG1 scored 40.65±2.34 points before intervention and 48.65±2.76 points after intervention, EG2 scored 45.52±5.65 points before intervention and 48.32±5.42 points after intervention, and the CG scored 41.26±4.85 points before intervention. There was a statistically significant difference among the three groups (p<0.001). Finally, in AQS, EG1 scored 15.83±5.64 points before intervention and 22.17±3.60 points after intervention, EG2 scored 18.67±3.14 points before intervention and 21.00±3.03 points after intervention, and the CG scored 14.83±1.17 points before intervention and 16.67±1.37 points after intervention. Here, too, there was a statistically significant difference among the three groups (p<0.001) [Table 2].

Table 2. Comparison of DST, DSST, and AQS among the groups after intervention (N=12)

Variable	EG1 (n=6)	EG2 (n=6)	CG	F	p
DST	4.00±0.89[a]	2.33±0.82[b]	0.83±0.75	22.213	0.000***
DSST	8.00±2.79[a]	2.80±1.91	3.62±2.10	8.858	0.003***
AQS	6.33±3.14[a]	2.33±0.52	1.88±0.98	9.865	0.002***

***p< 0.00, M ± SD = mean ± standard deviation; a,b: post hoc test; EG1: experimental group 1; EG2: experimental group 2; CG: control group; DST: digit span test; DSST: digit symbol substitution test; AQS: attention questionnaire scale

3.3 Comparison of differences in short-term memory and sustained attention between experimental groups after ADL-based CAP and workbook-based CAP interventions

As shown in Table 3, in the DST conducted to investigate the differences in short-term memory between EG1 and EG2, the former improved to 4.83±1.17 points before the intervention and to 8.83±1.17 points after the intervention, and the latter improved to 3.67±1.63 points before and 6.00±1.41 after intervention, thereby

showing a statistically significant difference (p<0.01). In DSST, which was tested to determine differences in sustained attention before and after intervention, EG1 scored 40.65±2.34 points before intervention and 48.65±2.76 points after intervention, and EG2 scored 45.52±5.65 points before intervention and 48.32±5.42 points after intervention, again showing a statistically significant difference (p<0.00). Lastly, in AQS, EG1 scored 15.83±5.64 points before intervention and 22.17±3.60 points after intervention, and EG2 scored 18.67±3.14 points before intervention and 21.00±3.03 points after intervention, also showing a statistically significant difference (p<.01) [Table 3].

Table 3. Comparison of DST, DSST, and AQS between two groups

Variable	EG1 (n=6)	EG2 (n=6)	t	p
DST	4.00±0.89	2.33±0.82	3.371	0.007**
DSST	8.00±2.79	2.80±1.91	3.762	0.004***
AQS	6.33±3.14	2.33±0.52	3.038	0.012**

***p< 0.00, M ± SD = mean ± standard deviation; EG1: experimental group 1; EG2: experimental group 2; CG: control group; DST: digit span test; DSST: digit symbol substitution test; AQS: attention questionnaire scale

3.3 Discussion

MCI is defined as a cognitive impairment that, due to a mild decrease in memory and attention span, affects higher-order cognitive functions but does not affect activities of daily living [3]. Unlike elderly patients with dementia, the elderly with MCI can improve cognitive impairment through physical activity and cognitive activity programs rather than drug treatment [9]. In the elderly with MCI, working memory is impaired in relation to daily life activities, which presents difficulties in task performance. Cognitive rehabilitation guidelines and specific workbook-based CAPs suggested to enhance cognitive function in many studies have been presented at home and abroad as effective intervention tools for subjects with MCI [10]. In this study, a workbook-based CAP was carried out with contents such as categorizing figures and seasons based on NHIS guidelines. Through this, there was a significant difference in the DST and AQS. It is thought that this may have positively helped the participants to participate and improve their attention by inducing continuous social interaction among them. The DSST showed differences between two groups before and after intervention. In the workbook-based CAP, the amount of time each subject can focus on another should be considered, and the difficulty level should be adjusted according to the level of help, lack of understanding, and voluntary participation, which were relatively low [11]. The workbook-based CAP was different from the individual level of each subject, making it difficult to effectively carry out the program. Therefore, in applying workbook-based CAP, it is important to select individual workbook items suitable for an individual's age and cognitive level and to appropriately present the difficulty level to maximize the participant's participation. In setting up an intervention plan, social daily life, which is a diverse and meaningful activity, has a positive effect on the quality of life, so it is necessary to promote ADLs and socialization that take into consideration culture and values [12]. This study took into consideration the subjects' daily lives and cultural backgrounds as well as the life cognitive program. This seems to have played a positive role by eliciting interest and active participation from the subjects. Consequently, there was an improvement in DST, DDST, and AQS. However, the DSST showed lower performance because of the high age and different educational level of each individual [13].The two types of programs applied in this study did show a significant difference in DST, DDST, and AQS between the two groups. Although the subjects did not experience any cognitive improvement in ADL-based CAP, there was a substantial difference when affecting both working memory and sustained attention. The two CAPs obviously have different individual characteristics. Therefore, based on the results of this study, it is thought that it can help to understand how each program helps each item of cognitive function by comparing the two programs.

4. Conclusion

The purpose of this study was to investigate how ADL-based CAP and workbook-based CAP help working memory and sustained concentration in elderly individuals with MCI. It has yielded the following

conclusions: First, both CAPs led to significant improvements in DST, DSST, and AQS. Furthermore, workbook-based CAP led to a significant improvement in DST. Second, given a comparative analysis of workbook-based CAP and ADL-based CAP, there was a significant improvement in DSST and AQS. Therefore, ADL-based CAP and workbook-based CAP can be used as effective cognitive therapies for elderly individuals with MCI, and they are expected to contribute to increasing the value of occupational therapy services. In particular, it is thought that ADL-based CAP tailored to the subjects' characteristics can improve short-term memory and sustained attention by enhancing the subject's participation.

5. References

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