CHARACTERISTICS OF ASSESSMENT OF MOTOR AND PROCESS SKILLS AND RIVERMEAD BEHAVIORAL MEMORY TEST IN ELDERLY WOMEN WITH DEMENTIA AND COMMUNITY-DWELLING WOMEN

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ABSTRACT

The purpose of this study was to demonstrate the characteristics of the Instrumental Activities of Daily Living (IADL) ability, evaluated by the Assessment of Motor and Process Skills (AMPS), and everyday memory functions (the memory necessary for daily life), assessed by the Rivermead Behavioral Memory Test (RBMT) in elderly people with dementia compared with a community-dwelling group. We divided the RBMT into three categories: prospective memory (PM), retrospective memory (RM), and PM+RM. The study was performed with 102 women, those with dementia who lived in a healthcare facility or three group homes (n=52) and those who were cognitively well and lived in their own homes (n=50). Subjects were over 68 and under 92 years old. We assessed them by Mini-Mental State Examination (MMSE), AMPS and RBMT. The results of the MMSE, AMPS, and RBMT revealed that the community-dwelling group's averages were higher than those of the Dementia group. No associations were found between AMPS motor skills and MMSE or PM, RM, and PM+RM in both groups. There were slight associations between the AMPS process and RM in both groups, but none between AMPS process skills and PM in either group. From that result, we found that IADL performance ability and everyday memory were not simultaneously damaged. Moreover, analyzing a scatter chart revealed some subjects had a PM deficit even though they were at the IADL independent level. In conclusion, occupational therapists need to assess both IADL performance and everyday memory, including PM, in elderly people.

Key Words: Elderly people, Dementia, IADL, Prospective memory

INTRODUCTION

There are two major types of symptoms of early dementia: everyday memory deficits and Instrumental Activities of Daily Living (IADL) deficits. IADL abilities are required for independent living in a community. IADL deficits are more complicated than those of Activities of Daily Living (ADL). It is well known that manifest cognitive impairment affects one's ability to perform IADL. Some studies have been conducted on the association between various types of cognition and IADL.[1] IADL are affected in the early period of dementia, whereas impairment

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in basic ADL usually occurs in later stages.[2]

However, how IADL ability affects everyday memory has not been investigated, and in previous studies this ability was determined by self-assessment or by interviews with the dementia subjects or their caregivers, [3,4] which may be biased. Also, occupational performance of the IADL ability was not a focus of those studies.[5,6] Sensitive instruments are needed for measuring IADL performance and memory ability in people with mild dementia. We adopted the Assessment of Motor and Process Skills (AMPS)[7] for determination of IADL performance ability because AMPS measures actual IADL tasks. The evaluator, who is certified by the AMPS Project, assesses the subject's task performance in detail. The studies by Hartman *et al.* have shown that AMPS is a sensitive tool to detect the IADL deficits of early dementia.[8]

In evaluating memory, the Mini-Mental State Examination (MMSE)[9] is often used as a short screening scale. However, this instrument is too general to provide any information on IADL performance and cognitive functions. Moreover, the Wechsler Memory Scale-Revised (WMS-R)[10] and the Benton Visual Retention Test[11] cannot detect everyday memory deficits. The Rivermead Behavioral Memory Test (RBMT), however, allows for the comprehensive assessment of overall everyday memory.[12] The RBMT can assess prospective memory (PM).[13] PM is a fundamental aspect of cognition, which is necessary for people to live their everyday lives effectively. Huppert *et al.* found that PM is more vulnerable than retrospective memory (RM) to the effects of cognitive disorders due to dementia.[14] The WMS-R does not include PM tasks, but RBMT includes both PM and RM tasks. Although previous studies have examined the association between IADL and several memory abilities, the studies were done only through testing in examination rooms on subjects seated at desks.[9-11] Previous research has not focused specifically on everyday memory functions.

The main purpose of this study was to demonstrate the characteristics of the MMSE, AMPS and RBMT in elderly people with dementia compared with normal community-dwelling individuals.

MATERIALS AND METHODS

1. Design

This study was a between-group design. Data were collected from August 2004 to July 2005.

2. Participants

The subjects were 102 women divided into two groups. Subjects were over 68 and under 92 years old. One group consisted of 52 women with dementia who lived in a health care facility or in three group homes for dementia patients in Aichi and Mie Prefectures in Japan. The second group consisted of 50 women living independently in their own homes. Exclusion criteria included severe sensory deficit or history of a stroke that interfered seriously with physical functioning (e.g., sight, speech, or limb function).

3. Ethical considerations

All participants' names were coded from the start of the study through data collection and analysis so that individuals could not be identified. This study was approved by the ethical committees of our university. Ethical approval for the study was obtained by writing from the patients of the dementia group and their families, and from subjects in the community-dwelling group.

4. Research methods

1) MMSE

MMSE is a standardized tool that assesses dementia. The MMSE which includes eleven questions requires only 5–10 minutes. The maximum score is 30. The validity and reliability have been demonstrated by Folstein *et al.*[9] The cut-off score for dementia is 23/24.[9]

2) AMPS

AMPS is a standardized tool that assesses IADL ability and is based on the evaluation of the quality of the performance skills displayed in the individual actions in IADL tasks.[7] Subjects are observed when they perform two of the possible 83 standardized AMPS tasks that reflect their natural routines. The AMPS has been internationally standardized through several studies of over 46,000 persons with a variety of neurological, cognitive, medical, psychiatric, and developmental disorders. The cross-cultural validity of the AMPS measures has been demonstrated in Japan.[15] Motor skills are test items used to rate the level of skill observed when one moves oneself or task objects. Process skills are test items used to rate the level of skill observed when one (a) selects, interacts with, and uses tools and materials, (b) carries out individual actions and steps, and (c) modifies performance when problems are encountered.[7] Fisher described process skills as the observable actions that a person takes as he or she logically sequences the actions of the IADL task over time, selects and uses appropriate tools and materials, and adapts his or her actions when problems are encountered.[7] Motor and process ability are scored on 36 skill items during observation of each of two IADL tasks that the individual is familiar with (e.g., making a hot or cold instant drink, washing dishes by hand, serving tea or coffee and cookies on a tray, or tossing a salad with dressing served in individual bowls). The assessment uses a 4-point scale (4=competent, 3=questionable, 2=ineffective, and 1=deficit).

The person's ability measures are adjusted by a computer program to account for (1) skill item difficulty, (2) task difficulty, and (3) the individual evaluator. The raw scores are then entered into the AMPS computer-scoring program, and a many-faceted Rasch analysis converts the person's ordinary raw AMPS skills item score into linear personal ability measures. In AMPS, the logit is used for measure.

Duran and Fisher found that women scored higher on the process scale than men, so partial association analyses were performed controlling for gender bias.[16] As a consequence, in this investigation, we only studied female subjects. The AMPS was administered according to the instruction manual.[7]

3) RBMT

The RBMT was originally designed for rehabilitation of adults who have memory problems and neurological damage.[12] It also has norms for elderly people.[17] The highest score for the RBMT is 24. The standard RBMT battery tests include verbal and nonverbal recall, recognition, and basic orientation. There are three PM tasks: remembering an appointment, remembering a belonging, and remembering to deliver a message. There are five RM tasks: face and picture recognition, recall of name, prose recall, route recall, and orientation.

The Japanese version of the RBMT is a reliable and valid test for everyday memory problems.[17] According to Matsuda *et al.,* the cut-off for Alzheimer Disease (AD) is 13/14.[18] The RBMT was administered according to the Japanese version instructions.[19]

5. Statistical Analysis

Each subject was assessed using the MMSE, AMPS, and RBMT. All assessments were conducted within a one-week period. Scoring was standardized in accordance with the respective manuals, MMSE,[9] AMPS,[7] and RBMT.[19] The data were subjected to statistical analysis using internal consistency Chronbach alpha, which was 0.787 in the dementia group and 0.821 in the

Akiko Mori and Kimiya Sugimura

normal group. When an evaluation is obtained (p), the logit is expressed like a natural logarithm by dividing the log (p/1-p) by (1-p) as when the evaluation is not obtained.

First, *t* test and distribution analysis were conducted to find out whether subjects' ages and years of education affected the IADL performance and everyday memory ability of the dementia and community-dwelling groups. In the AMPS motor and process skills, the *t* test was used, and Mann-Whitney's U test was used to examine qualitative variables of MMSE and PM, RM, PM+RM between the dementia group and the community-dwelling group. Significance level was set at less than 0.05.

Next, Spearman's correlation was used to examine the relation between AMPS and MMSE or PM, RM, PM+RM. The significance level was set at less than 0.05. Analysis was done using SPSS version 13.0 (Chicago, IL, 2005).

RESULTS

1. Baseline characteristics of dementia and community-dwelling groups

The average age was 81.2 (SD=5.3) years old in the dementia group, with a range of 69-92. The average age was 80.0 (SD=5.0) years old in the community-dwelling group, with a range of 69-86. The average years of education was 9.1 (SD=1.9) years in the dementia group, and 8.9 (SD=1.8) years in the community-dwelling group. There were no significant differences in average age (p=0.189) and years of education (p=0.712) between the dementia and the community-dwelling groups by *t*-test.

2. Difference in MMSE, AMPS, RBMT results between dementia group and community-dwelling group

The results of the MMSE, AMPS, and RBMT were significantly different between the dementia group and the community-dwelling group; the community-dwelling group averages were higher (Table 1).

3. Relationship between IADL performance and everyday memory

There were no correlations between AMPS motor and MMSE, PM, RM and PM+RM in both groups. There was a slight correlation between AMPS process skills and MMSE in both the

Table 1 Differences in Mini-Mental State Examination (MMSE), Assessment of Motor and Process Skills (AMPS) and Rivermead Behavioral Memory Test (RBMT) between dementia and community-dwelling groups.

	Dementia (n=52)			Community-dwelling (n=50)			
	M	SD	R	M	SD	R	p-value
MMSE	17.6	4.1	15–23	27.2	2.2	24–30	** 1)
AMPS Motor	0.47	0.48	0.01–2.3	1.76	0.87	0.2–2.8	** 2)
AMPS Process	0.82	0.49	0.02–1.9	1.83	0.45	1.00–2.21	** 2)
RBMT (PM+RM)	6.9	6.7	0–14	18.2	4.4	13–23	** 1)
RBMT (RM)	5.8	4.3	0–9	15.6	3.7	11–19	** 1)
RBMT (PM)	0.8	1.0	0–3	2.6	2.2	0–6	** 1)

1) Mann-Whitney's U test   2) t-test   **p<0.01
M = Mean   SD = Standard deviation   R = Range

dementia group (r=0.380; p=0.008) and community-dwelling group (r=0.450; p=0.002). Similarly, there was a slight association between AMPS process skills and PM+RM in the dementia group (r=0.390; p=0.011) and in the community-dwelling group (r=0.420; p=0.005). There was also a significant correlation between AMPS process skills and RM in both the dementia group (r=0.410; p<0.01) and the community-dwelling group (r=0.480; p<0.001). No correlation was found between AMPS process skills and PM in either the dementia group (r=0.110; p=0.414) or the community-dwelling group (r=0.060; p=0.685) (Table 2).

Table 2 Speaman's correlation coefficients (r) of Assessment of Motor and Process Skills (AMPS) with Mini-Mental State Examination (MMSE) and Rivermead Behavioral Memory Test (RBMT) for dementia and community-dwelling groups.

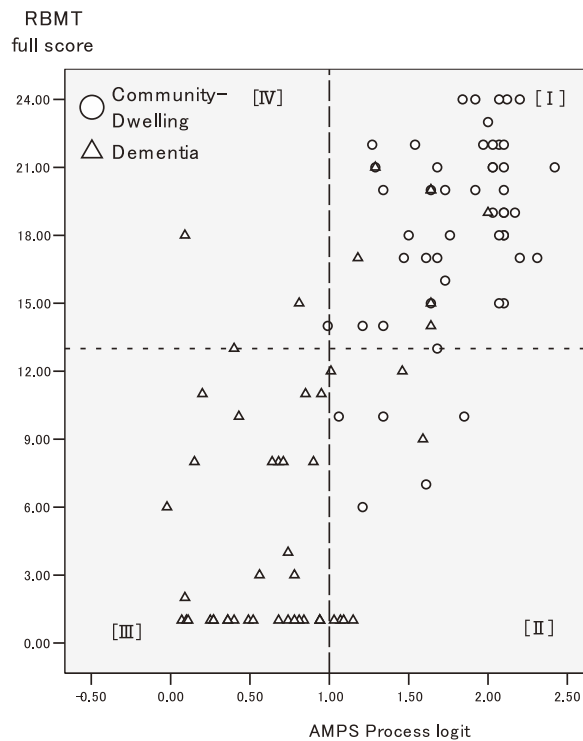|	AMPS Motor				AMPS Process			
	Dementia (n=52)		Community-dwelling (n=50)		Dementia (n=52)		Community-dwelling (n=50)	
	r	p	r	p	r	p	r	p
MMSE	0.013	0.927	0.278	0.051	0.380*	0.008	0.450*	0.002
RBMT (PM+RM)	0.026	0.855	0.292	0.052	0.390*	0.011	0.420*	0.005
RBMT (RM)	0.162	0.261	0.286	0.054	0.410*	0.000	0.480*	0.000
RBMT (PM)	0.115	0.417	0.189	0.188	0.110	0.441	0.060	0.685

* p<0.05

Fig. 1 Correlation between Assessment of Motor and Process Skills (AMPS) and Rivermead Behavioral Memory Test (RBMT) full score.
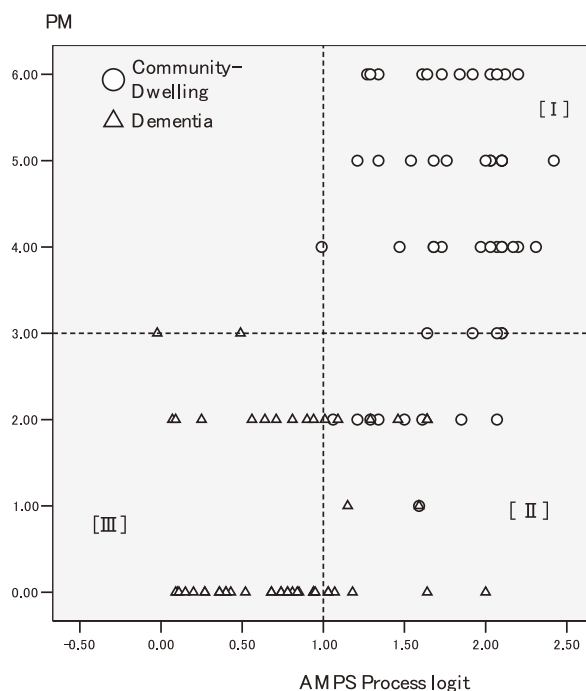
Fig. 2 Correlation between Assessment of Motor and Process Skills (AMPS) and Rivermead Behavioral Memory Test (RBMT) Prospective Memory (PM).

4. Analysis by scatter chart

The distribution of the subjects' scores on the process skills and PM+RM are presented in Fig. 1. When we drew a line on 1.0 *logit*, which was independent of the level of AMPS process skills, on the process skills, 40 of the dementia subjects were below 1.0 *logit* and 12 were above the cut-off score. All community-dwelling subjects were above 1.0 *logit*. Process *logit* was able to distinguish between community-dwelling and dementia subjects.

In addition, we drew a line at the AD cut-off score of RBMT (13/14), and the scatter chart was divided into four phases. The first phase was above the cut-off for both the process and RBMT. Forty-four community-dwelling subjects and six dementia subjects were in this phase. The second phase included values above the process cut-off and below the RBMT cut-off. Six community-dwelling people and seven subjects with dementia were included in this phase. In the third phase, both the process and RBMT scores were below the cut-off. The 36 subjects in this phase all had dementia. The fourth phase had values below the cut-off for AMPS and above it for RBMT. The three subjects had dementia in the fourth phase.

In Fig. 2, we assumed that the PM cut-off was 3, so there were three phases. In the first phase, where both values were above the cut-off for the process and RBMT, the 39 subjects were all community-dwelling. In the second phase, which included values above the process cut-off and below the PM cut-off, there were 12 dementia subjects and 11 community-dwelling subjects. In the third phase, which was below both the process and PM cut-off, there were 40 subjects all of whom had dementia.

DISCUSSION

It is well known that patients with dementia have frequent IADL and everyday memory disability in early stages of the illness.[20] Although it was supposed that everyday memory ability declines from an early stage of dementia, there was no significant evidence to substantiate this assumption. Therefore, we considered more sensitive assessments, because most memory tests do not reflect real everyday memory ability. We used the RBMT to evaluate everyday memory since it has a high association with everyday action and evaluates everyday memory in detail by observation of tasks.[17]

Furthermore, how IADL ability correlates with everyday memory has remained an unsolved issue. Thus, this study was designed to examine the correlates between IADL performance and everyday memory ability. The results showed no correlations between AMPS motor and MMSE, PM, RM and PM+RM in both groups. There were slight associations between the AMPS process and RM, PM+RM in both groups. On the other hand, no correlation was seen between the AMPS process and PM in either the dementia or community-dwelling groups. Therefore, IADL performance ability and PM ability did not decline simultaneously. From Fig. 1, the process skills were clearly different between the dementia and community-dwelling groups on the 1.0 *logit*, which is an independent level. However, in the PM+RM, results showed that the dementia subjects were below the cut-off value, while the community-dwelling people were above it. Fig. 2 shows the phase II subjects in both the dementia and the community-dwelling groups. Part of the persons in the phase II had PM deficits, and it became clear that some had sufficient IADL.

For a patient with dementia to be able to live on his or her own, IADL and everyday memory ability are essential. The AMPS and RBMT can be used to determine the level of disability. We also discovered that some of the subjects had sufficient IADL abilities but suffered from deficits in PM, which affects daily activities, such as forgetting appointments or not taking prescribed drugs on time. However, these subjects did not have a deficit of routine IADL performance ability. Through intervention with early dementia subjects, occupational therapists (OTs) should focus on which of the three phases (Fig. 2) the subjects are in. Due care must be especially given to subjects in phase II who show sufficient IADL ability despite PM deficits.

There have been many studies on assessment of dementia and intervention by OTs.[21,22] For example, OTs can rightly assess Mild Cognitive Impairment (MCI). The diagnosis of MCI has been established,[23] and the importance of this disease is widely emphasized. Reisberg *et al.* suggested that if someone with MCI has a Clinical Dementia Rating (CDR) of 0.5 or Global Deterioration Scale (GDS) of 3, there is cognitive impairment and several memory tests are below 1.5 SD.[24] Recently, the following 5 criteria have been emphasized for MCI diagnosis: 1. Subjects appear to be consciously aware of their memory impairment which is confirmed by their family; 2. They have low memory functions compared to other people of the same age; 3. General cognitive abilities are normal except for memory; 4. ADL abilities are maintained; and 5. They do not have dementia.[25] These criteria imply that people in the phase II in Fig. 2 could have MCI disease. Using only the 1-4 criteria would make an accurate diagnosis of MCI difficult. However, by using AMPS together with RBMT, we can determine the diagnostic criteria 1 and 2 from RBMT and 3 and 4 from AMPS.

From this study, some subjects in the community-dwelling group were clearly below the cut-off value for PM, so it is inappropriate for them to be classified in the normal group. Patients with dementia have difficulties in social situations and everyday living. Observing their activities on both IADL and everyday memory tasks by using AMPS and RBMT can make it possible for OTs to provide appropriate help. To achieve that, OTs have to assess IADL ability and PM ability. In the future, we intend to study how IADL performance ability and PM ability affect some stages of dementia, and ways in which OTs must develop an approach to MCI.

Akiko Mori and Kimiya Sugimura

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REFERENCES

1) Marthuvarath, P.S., Geoge, A., Gerian, P.J., Mathew, R. and Sama, P.S.: Instrumental activities of daily living scale for dementia screening in elderly people. *Int. Psychogeriatr.*, 17, 461–474 (2005).
2) Doble, S.E., Fisk, J.D. and Rockwood, K.: Identifying ADL changes in the early stages of cognitive impairment. *Gerontologist*, 38, 114–115 (1998).
3) Morris, J.C., Storandt, M. and Miller, J.P.: Mild cognitive impairment represents early stage Alzheimer's disease. *Arch. Neurol.*, 58, 397–405 (2001).
4) Willis, S., Allen-Burge, R., Dolan, M.M., Bertrand, R.M., Yesavage, J. and Taylor, J.L.: Everyday problem solving among individuals with Alzheimer's disease. *Gerontologist*, 38, 569–577 (1998).
5) Peterson, R.C., Smith, G.E., Waring, S.C., Ivnik, R.J., Kokmen, E. and Tangelos, E.G.: Aging, memory, and mild cognitive impairment. *Int. Psychogeriatr.*, 9, 65–69 (1997).
6) Barberger-Gateau, P., Fabrigoule, F., Rouch, I., Letenneur, L. and Dartigues, J.F.: Neuropsychological correlates of self-reported performance in instrumental activities of daily living and prediction of dementia. *J. Gerontol. Ser. Psychol. Sci. Soc. Sci.*, 54, 293–303 (1999).
7) Fisher, A.G.: Assessment of Motor and Process Skills. Administration and Scoring Manual (5th Ed). (2003a), Fort Collins, CO, Three Star Press.
8) Hartman, M.L., Fisher, A.G. and Duran, L.: Assessment of functional ability of people with Alzheimer's disease. *Scand. J. Occup. Ther.*, 6, 111–118 (1999).
9) Folstein, M.F., Folstein, S.E., and McHugh, P.R.: "Mini Mental State Examination": A practical method for grading the cognitive state of patients for the clinician. *J. Psychiatr. Res.*, 12, 189–198 (1975).
10) Tabert, M.H., Manly, J.J., Liu, X., Pelton, G.H., Rosenblum, S., Jacobs, M., Zamora, D., Godking, M., Bell, K., Stern, Y. and Devenand, D.P.: Neuropsychological prediction of conversion to Alzheimer disease in patients with mild cognitive impairment. *Arch. Gen. Psychiatr.,* 63, 916–24 (2006).
11) Steck, P.H.: A revision of A.L. Benton's Visual Retention Test (BVRT) in two parallel forms. *Arch. Clin. Neuropsychol.*, 20, 409–416 (2006).
12) Parrott, A.C.: Human research on MDMA (3,4-methylene- dioxymethamphetamine) neurotoxicity: cognitive and behavioural indices of change. *Neuropsychobiology*, 42, 17–24 (2000).
13) Cockburn, J. and Smith, P.T.: Anxiety and errors of prospective memory among older people. *Br. J. Psychol.*, 85, 273–282 (1994).
14) Huppert, F.A. and Beardsall, L.: Prospective memory impairment as an early indicator of dementia. *J. Clin. Exp. Neuropsychol.*, 15, 805–821 (1993).
15) Goto, S., Fisher, A.G. and Mayberry, W.L.: AMPS applied cross-culturally to the Japanese. *Am. J. Occup. Ther.*, 50, 798–806 (1996).
16) Duran, L.J. and Fisher, A.G.: Male and female performance on the assessment of motor and process skills. *Arch. Phys. Med. Rehabil.*, 77, 1019–1024 (1996).
17) Kazui, H., Watamori, S., Honda, R., Tokimasa, A., Hirono, N. and Mori, E.: The validation of the Japanese version of the Rivermead Behavioural Memory Test-A test for everyday memory. *Shinkei kenkyu no Shimpo (Advances in Neurological Sciences)*, 46, 307–318 (2002). (in Japanese)
18) Matsuda, A., Kazui, H., Hirono, N. and Mori, E.: Validity of the Japanese version of Rivermead Behavioural Memory Test for evaluation of everyday memory functions in patients with mild Alzheimer's disease. *No to Shinkei–Brain & Nerve*, 54, 673–678 (2002). (in Japanese)
19) Watamori, T.: The Japanese version of Rivermead Behavioural Memory Test (Description and observation), pp. 5–25 (2002) Chiba Test Center. (in Japanese)
20) Nygård, L.: Instrumental activities of daily living a stepping-stone towards Alzheimer's disease diagnosis in subjects with mild cognitive impairment? *Acta Neurol. Scand. Suppl.,* 179, 42–46 (2003).
21) Oakley, F. and Sunderland, T.: The Assessment of Motor and Process Skills as a measure of IADL functioning in pharmacologic studies of people with Alzheimer's disease: A pilot study. *Int. Psychogeriatr.*, 9, 197–206 (1997).
22) Cooke, K.Z., Fisher, A.G., Mayverry, W., and Oakley, F.: Differences in activities of daily living process

skills of persons with and without Alzheimer's Disease. *Occup. Ther. J. Res.*, 20, 87–105 (2000).

23) Luis, C.A., Loewenstein, D.A., Acevede, A., Barkerm, W.W. and Duara, R.: Mild cognitive impairment: Direction for future research. *Neurology*, 61, 438–444 (2003).

24) Reisberg, B., Ferris, S.H., Leon, M.J. and Crook, T.: The global deterioration scale for assessment of primary degenerative dementia. *Am. J. Psychiatry*, 139, 1136–1139 (2003).

25) Petersen, R.C., Smith, G.F., Waring, S.C., Ivnik, R.J., Tangolos, E.G. and Kokmen, E.: Mild cognitive impairment; clinical characterization and outcome. *Arch. Neurol.*, 56, 303–308 (1999).