A New Instrument for Early Detection of Alzheimer's Disease

Tetsuya MURAOKA*, and Tomohiro NAGATA**

*Department of Industrial Electronics Engineering, Polytechnic University in Tokyo
(Tel : +81-42-341-3331; E-mail: muraoka@tokyo-pc.ac.jp)
** Department of Industrial Design, Polytechnic University in Tokyo
(Tel : +81-42-341-3331; E-mail: nagata@ tokyo-pc.ac.jp)

Abstract: The paper describes a new instrument for early detection of Alzheimer's disease. A new instrument for early detection of Alzheimer's disease is constructed on both the questionnaire for the investigation of living environment, and the lists for the functional tests of the sense, the physiology, and the left and right brains. When the medical doctor has made a diagnosis of Alzheimer's disease, the demented patient does not recover the indication adding available treatments. Then, the indication of a patient only takes a turn for the worse. For the demented patient can be kept his/her life style, Alzheimer's disease can make an early detection using a new instrument before a diagnosis of the dementia. And the indication of a demented patient can be delayed by the available medical treatments.

Keyword：Alzheimer's disease, Early detection of Alzheimer's disease

1. INTRODUCTION

Nowadays, the Alzheimer's disease goes on increasing from the youths to the elderly. Alzheimer's disease does not have a recollection about that matter if he/she has given the care assistant so much trouble. Accordingly, the Alzheimer's disease is almost impossible to keep the ordinary lifestyle [1]. Alzheimer's disease will make slow progress by the medical treatments if it can be early detected.

Then, we have newly made the question and answer style's instrument for early detection of Alzheimer's disease. Early case of Alzheimer detected by a new instrument can be kept the ordinary lifestyle to the end of his/her life if the demented patient will make slow progress by the medical treatments.

2. DEFINITION OF DEMENTIA AND STANDARD FOR DIAGNOSIS

The demented patient forgot all of the experiences, and consequently he/she was interfered with the labor, the everyday life and the personal relation. In American Psychiatric Association, the dementia defines as many acquired injuries occurred in the brain, i.e., memory, abstract thinking power, judgment, function of cerebral cortex, and character. American Psychiatric Association had first published to the diagnostic and statistical manual of mental disorders (DMS) I in 1952 [2]. Then, the Psychiatric Association had published to the DMS-II in 1968 [3], the DMS-III in 1980 [4], the DMS-III-R in 1987 [5], and the DMS-IV in 1994 [6]. DMS-III-R in 5 kinds of publications is most popular diagnostic manual. Table 1 shows the diagnostic manual published in the DMS-III-R [5].

Psychiatric doctor is performed on both the diagnosis and the treatment of the demented patient. And so he/she has to profound knowledge on both the psychiatry and the physical medicine.

Two kinds of the typical dementia are the Alzheimer's disease and the vascular dementia. The cerebral infarction due to the thrombus of vascular dementia can be correctly diagnosed on a lot of medical data, and it is eliminated by the bypass operation. Case of vascular dementia will be got well if the medical treatment does quickly perform to him/her [7], [8].

Table 1 Diagnostic manual in the DMS-III-R.

Degree	Indication of dementia
(1)Light degree	Both the ability for self-support and the judgment fulfill to function properly, but the labor is sometimes influenced by the diagnosis.
(2)Middle degree	Self-support is difficult, and consequently the support by care assistant is sometimes required in the everyday life.
(3)Serious degree	Don't have the ability for self-support, and conse-quently the support by care assistant is required in all of the everyday life.

Alzheimer's disease is occurred by the accumulation of beta amyloid [9]. When the medical doctor has diagnosed his/her illness as Alzheimer's disease using DSM-III-R, the indication of demented patient is hopeless. Then, the indication of a demented patient only takes a turn for the worse. If it has detected to the indication of dementia using a new instrument long before a diagnosis of the Alzheimer's disease, the progress of Alzheimer's disease will be delayed on both the medical treatment using the medicine for the functional recovery of neurotransmission, and the everyday nap and walking [10].

3. A NEW INSTRUMENT FOR EARLY DETECTION OF ALZHEIMER'S DISEASE

A new instrument for early detection of Alzheimer's disease is constructed on both the
questionnaire for the investigation of living environment, and the lists for the functional tests of the sense, the physiology, and the left and right brains.

In addition to that, the question and answer method is adopted in a part of questionnaire at a new instrument for early detection of Alzheimer's disease [11], [12].

For instance, the software for the functional tests of both the vision and the hearing has made out by using the programs of both the picture and the sound stored in a computer.

After the test, the useful comments obtained from the subject can be written in a questionnaire [13].

Accordingly, the data obtained by the functional tests can be stored in a memory of the computer.

Table 2 Investigation of living environment and measurement of Physiological Function.

Family name:	Given name:	Age:
Sex: Male , Female	Occupation:	
Chracter:		
Physiological function	Systolic blood pressure	mmHg
	Diastolic blood pressure	mmHg
	Pulse pressure	mmHg
	Heart rate	pulse rate/minute
Eating habits	Do you have usually food containing a lot of salt?	Yes No
	Do you have usually a lot of eggs, fishes and meats?	Yes No
	Do you have an unbalanced diet?	Yes No
	Do you have any liquor? (Brand name: ,	Yes No ml/day)
	Do you have any smoke (Brand name: ,	Yes No pack /day)
Feeling of suppression	Do you have a worry? What is your worry?	Yes No
Feeling of freedom	Do you have a hobby? What is your hobby?	Yes No
Function of movement	What kind of sports do you play?	
Living environment	Do you have a family?	Yes No
	Do you have any friends?	Yes No

3.1 Living environment and physiological function

Both the living environment and the social adaptability of the subject can be investigated in the tests using a new instrument for early detection of Alzheimer's disease. For instance, the relation of the subject in the society, and the eating habits are investigated. And the decline of physiological function, i.e., the blood pressure and the heart rate is measured. Table 2 shows the investigative items on both the living environment and the physiological function.

3.2 Sensing function

In the five senses, i.e., sight, hearing, smell, taste, and touch, both the sight and the hearing are easy to obtain the objective data. Because the eyesight, the hearing and their response are reduced in proportion as he/she grows elder. So we will make the tests on both the visual and hearing functions.

3.2.1 Visual function

It is difficult for the elderly people to find the information of shorter wavelength. Moreover, his/her eyesight is reduced for the cataract. Accordingly, the eyesight of subject can be measured by using Landolt's rings.

3.2.2 Hearing function

It is difficult for the elderly people to hear the high-frequency sounds in the audible range. Nine kinds of tones, i.e., 200Hz, 315Hz, 500Hz, 800Hz, 1kHz, 1.25kHz, 2kHz, 3.15kHz, and 8kHz have made for the investigation of the relations between the frequency and the hearing information. Their sound pressures are 40 to 50dB. The standard stimuli are 3 kinds of the typical audio-frequency, i.e., 200Hz of comfortable tone, 3.15kHz of maximum hearing sensitivity, and 8kHz of high frequent noise, and the compared stimuli are 9 kinds of above tones including the standard stimuli. One of the standard stimuli is heard to the subject during 5 seconds. Then, the same tone with the standard stimulus is choice in 9 kinds of the compared stimuli by the subject.

Table 3 shows the tests on both the visual and hearing functions.

Table 3 Sensing Function

Visual function	Eyesight: Right eye , Left eye
Hearing function	200Hz , 3.15kHz , 8kHz

3.3 Function of left hemisphere in brain

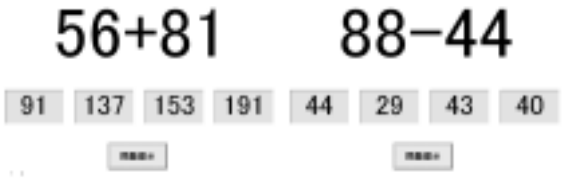
The left hemisphere in brain is called a logical brain, and it is in charge of the logical considerations, i.e., language and calculation in everyday life. When the function of left hemisphere in brain has damaged for the dementia, the logical function is reduced at once. Accordingly, the function of left hemisphere in brain has to investigate for the early detection of Alzheimer's disease.

3.3.1 Memory of number

Five random figures using Arabic numerals, i.e., 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 have each put on the center of a frame at one second intervals. Five random figures are retained in the subject's memory. Then, the subject can be made a reproduction of five random figures order. Relations between the fixation of impression and the defects of memory are elucidated from the results of mental test.

3.3.2 Calculation

The subject can be tried two times the addition and subtraction of two figures respectively. He/She will confirm to take a figure up one place at the addition of two figures and to take a figure down one place at the subtraction of two figures shown in Fig. 1.



(a) Addition (b)Subtraction

Fig. 1 Addition and Subtraction of two figures.

3.3.3 Picture's color

Six children, i.e., three boys and three girls put on varied caps and costumes. The subject will be able to find a child, i.e., boy or girl put on specified cap and costume in six children. The reductions on both the shape recognition and the color visual function of the subject are elucidated from the results of mental test.

3.3.4 Scale

The subject will correctly estimate the length of a rope and the volume of water in a glass shown in Fig. 2.

(a)Length of a rope (b)Volume of water in a glass

Fig. 2 Correctly estimate the length of a rope and the volume of water in a glass.

3.3.5 Product's name

The subject can guess the product's name by looking the picture, i.e., glasses, an orange, and a bunch of grapes and the picture by reading the product's name, i.e., an apple, the train, and a sunflower.

3.3.6 Animal's call

The subject can guess the animal by listening the animal's call, i.e., a dog, a cat, and a horse.

Table 4 shows the functional tests of left hemisphere in brain.

3.4 Function of right hemisphere in brain

The right hemisphere in brain is called an image brain, and it is in charge of the original sense. As the demented index, the function of the right hemisphere in brain would not be appropriately. But the function of right hemisphere in brain is necessary to investigate at one of the demented study.

Table.4 Function of left hemisphere in brain.

Memory of Number	Reproduction of five random figures. First test: , Second test: , Third test:
Calculation	Addition and subtraction of two figures. Addition: , Subtraction: , Addition:
Picture's color	A child put on specified cap and costume. First time: , Second time: , Third time:
Scale	Length of a rope: Volume of water in a grass:
Product's name	Product's name by looking the picture. Broom: , Shoes: , Glass:
	Picture by reading the product's name. Apple: , Shoes: , Glass:
Animal's call	Dog: , Cat: , Horse:

3.4.1 Identification of random pattern

Six kinds of random patterns are different in the form, the size, and the direction respectively. The subject can find a similar pattern with a standard pattern in six patterns shown in Fig. 3.

Fig.3 Find a similar pattern with a standard pattern in six patterns.

3.4.2 Presumption of finished model

The subject watches five pieces of the square pole, the cone, and the car respectively. He/She presupposes of the finished each model from five pieces shown in Fig. 4.

Fig. 4 Presumption of the finished each model based on five piceces

3.4.3 Abstract sound

The subject can be heard the broken sound of a glass, the drum, and broken sound of a rubber balloon respectively. He/She will be reminded of the occurred each scene from their sounds.

Table 5 shows the functional test of right hemisphere in brain.

Table.5 Function of right hemisphere in brain.

Identification of random Pattern	Find a similar pattern with a standard pattern. First test: , Second test: , Third test:
Presumption of finished Model	Presumption of the finished each model based on five pieces. Square pole: , Cone: , Car:
Abstract sound	Remind of the occurred each scene from abstract sounds. Broken sound of a glass: Drum: Broken sound of a rubber balloon:

4. CONCLUSION

A new instrument for early detection of Alzheimer disease has constructed from the investigative items with both the investigation of living environment, and the functional tests of the sense, the physiology, and the left and right brains. The question and answer method is adopted in a part of questionnaire at a new instrument for early detection of Alzheimer's disease. The data obtained from the tests using a new instrument for early detection of Alzheimer disease shown on Table 2 to Table 5 is stored in a memory of the computer. Hereafter, we will be confirmatory tests for early detection of Alzheimer's disease using a new instrument obtained by the present study.

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