Vestibular Function in Schizophrenia

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The sensory-integrative treatment approach for the schizophrenic adult was indirectly examined by checking vestibular reactivity using Fukuda's stepping test. Eighty-two schizophrenic patients with the age range between 21 and 64 were included in this study. The data were compared with the results obtained by Fukuda's examining 500 normal individuals.
As the results of this study, 72 out of 82 patients show the abnormal degree of vestibular reactivity, which indicates highly possible involvement of vestibular system in schizophrenia.

Key Words
Occupational therapy,
Sensory integration,
Vestibular function,
Schizophrenia,
Fukuda's stepping test.

INTRODUCTION

In most psychiatric hospitals, the stable group of residents found today is a chronic population diagnosed as schizophrenia. Statistics indicates that more than 60% are schizophrenia (1).

In early seventies, occupational therapists began to use one approach for schizophrenic patients which is based upon sensory integrative theory. King's applying the theory for chronic schizophrenia, she proposes defective proprioceptive feedback mechanisms, with the vestibular component in particular being both underreactive and underactive (6). This results in poor subcortical integration of sensory stimuli and inadequate feedback information necessary for the development of all other perceptual-motor systems. This hypothesis is supported by the studies that had identified abnormal vestibular reactivity in the schizophrenic individual (2–5) and by empirical observation of movements, posture, muscle tone, and general behavior in schizophrenic population.

However, to support her assumption mentioned above, she has not provided statistical evidence.

In this study, vestibular reactivity in schizophrenic was examined and King's assumption was tested.

SUBJECTS AND METHODS

A total of 82 schizophrenic patients participated in this study from Takeda Hospital in Sapporo and Jimmeikai Hospital in Nishinomiya. They were identified for this study meeting the following criteria : (1) diagnosed as schizophrenia ; (2) no medical history of neurological, genetic, or orthopedic diseases ; and (3) no additional psychiatric diagnosis such as

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mental retardation, manic-deppressive psychosis and organic brain syndrome.

The subjects' age range is between 21 and 64.

The method to assess the level of the vestibular function is Fukuda's stepping test. The test is for obtaining evidence of imbalance of labyrinthine function which is manifested by imbalance or the muscles in the lower extremities during stepping. In the test, three concentric circles having radii of 50cm, 100cm, and 150cm were drawn on a brown paper as in Figure 1, which is taped on the floor. The circles were divided into sections by lines passing through the center at 30 degree angles. The subjects were blindfolded and asked to stand at the center of the circles with feet together. Arms were raised forward at 90 degree. Elbows and wrists were extended. Subjects then stepped in place by flexing knees and hips relatively high, as if marching, without straining and at normal walking speed for 50 steps. When the 50 steps were completed the subjects were asked to stay in the last position. The angle of rotation of the body around its vertical axis and the distance as well as the direction for displacement of the body from the original position, if there were any, were measured by the circles and the lines drawn.

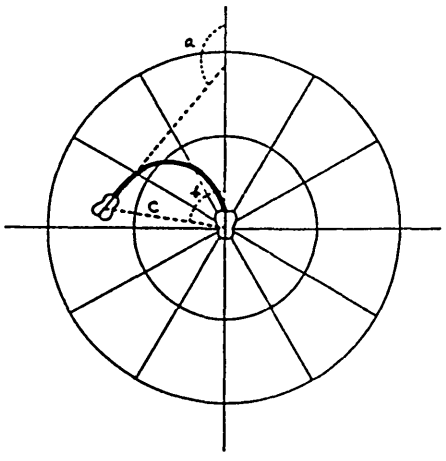

Figure 1. Locus of stepping

RESULTS

The test results are shown in Table 1 and 2, and more specifically and individually on Figure 2. The data were collected in terms of the angle of rotation and angle & distance of displacement from the original stance.

Comparing the scores on sex and age range, *t* test was used. Between female and male, there was no significant difference statistically.

As for age ranges, the angles of rotation and displacement revealed significant differences. In angle of rotation, patients in the age range of thirties scored beyond 20 degree more than the twenties and sixties. In angle of displacement, there were stastically significant differences inbetween twenties and sixties, thirties and sixties, and fourties and sixties.

In any case, the patients in their sixties scored lower than the rest.

Although the precise normative data are not avalable, Fukuda concluded his examination of 500 normal persons as following :

1. Most normal subjects could complete 50 steps in the original position.
2. Forward progression of the body up to 50cm after 50 steps respectively could be observed in some normal persons. An angle of rotation within 30 degree on each side could be observed as well.
3. Backward displacement of the body during stepping was rarely observed in normal persons. (7)

Table 1. Data of the Stepping Test.

Sex	Number	Age	Angle of rotation	Angle of displacement	Distance of displacement
		M±SD	M±SD	M±SD	M±SD
M	42	42.7±11.8	39.8±31.8	29.1±25.2	48.1±32.8
F	40	44.9±12.1	36.4±32.1	27.5±31.4	67.7±45.0
Total	82	43.8±12.0	38.1±31.9	28.3±28.2	57.7±38.8

Table 2. The age range distribution of the Distance and the Angles.

Age Range	Nunmber	Angle of rotation	Angle of displacement	Distance of displacement
		M±SD	M±SD	M±SD
20-29	12	26.5±17.5	30.3±23.5	52.8± 40.1
30-39	19	48.2±36.6	32.2±31.0	56.3± 45.2
40-49	22	40.5±39.4	25.9±19.2	49.1± 38.3
50-59	19	38.8±24.0	32.6±39.4	66.8± 35.2
60-69	9	25.2±18.7	13.3±8.1	74.1± 35.2

In this study, there were 72 patients out of 82, who scored beyond the normal range stated by Fukuda. The result is apparent in Figure 2 (as marked in higher density) and Table 3. More than the half of the subjects scored in either one of the three elements to the abnormal degree, and approximately 44% of them scored to the abnormal degree in the combination of the two angles, angle of rotation and distance of displacement, and all three.

DISCUSSION

Stimulated by King's work, occupational therapists have began to investigate the relationship between schizophrenia and the physical features, such as slowness in motion, incoordination of the whole posture, poor coordination in doing things in both gross and fine movement. (9–14)

At present study, the result indicated approximately 80% of the total schizophrenic patients having either one of

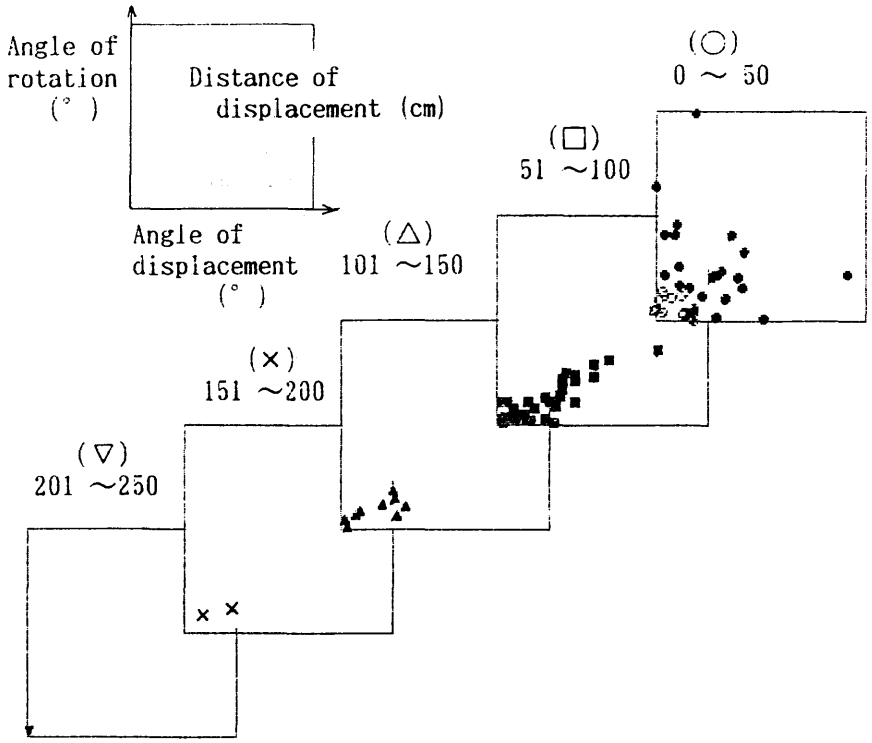

Figure 2. Total data of the distance and the two angles from 82 patients. The diagram is indicated above.

abnormal rotation, displacement, and the combination of them, and of highly possible involvement of the vestibular function in schizophrenia.

The result coincides with the studies mentioned above. King's sensory integrative approach assumes abnormal vestibular reactivity schizophrenia. The result of this study supported this assumption.

However, the Fukuda's examination of the normal persons, which was the basis for comparison in this study, was carried out in the fifties. The high score obtained in this study may reflect the difference in the life styles now and then. The standardization of this test is necessary, especially in terms of age.

Contrary to our anticipation of possible higher score in sixties, the angles of rotation and displacement were significantly lower in comparisons with some of the age ranges. In the angle of rotation the score in sixties was much lower than thirties. As for the angle of displacement, the score in sixties was significantly lower than those of twenties, thirties, and fourties. Does this indicate the course of the disease itself? The further investigation is necessary.

The standardization of the test may be of help.

Whenever this kind of studies are done for the physical features in schizophrenia, the effect of anti-psychotic medication

Table 3. The abnormal degree of the three elements.

	Nunmber
Angle of rotation over 30 °	13
Angle of displacement over 30 °	6
Distance of displacement over 50cm	21
Angle of rotation over 30 ° , Angle of displacement over 30 °	10
Angle of rotation over 30 ° , Distance of displacement over 50cm	11
Angle of displacement over 30 ° , Distance of displacement over 50cm	0
Angle of rotation over 30 ° , Angle of displacement over 30 ° Distance of displacement over 50cm	11
Total	72

becomes an issue. Considering the earlier researches on vestibular functions being done with the results of the involvement in the disease (2–4, 15) even before the development of antipsychotics, the result is possibly the part of the nature of schizophrenia itself.

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