ORIGINAL ARTICLE

Effectiveness of the Movable Seat Surface Evaluated from the Difference in the Start Time of Muscle Activity and Anticipatory Postural Adjustment

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Abstract: Objective: To examine the effects of a movable seat surface with forward tilting and forward locomotion mechanisms from muscle activation time and anticipatory postural adjustment of the trunk and lower limbs in the forward reach task.
Methods: There were 15 healthy adults, and the muscles to be examined were the deltoid muscles, which are the main muscles for reach movement, as well as the left and right external oblique muscles, the left and right erector spinae muscles, and the left and right rectus femoris muscles. The subjects performed a forward reach task using a fixed and a movable seat surface, that was created, and the examiner analyzed the reach time and the start time of each muscle activity.
Results: The reach time did not differ between the two conditions, but the start time of the erector spinae muscle was later than that of the other muscles in the movable condition. Anticipatory postural adjustment associated with reach task was not confirmed.
Conclusion: It was suggested that the movable seat surface enhances the stability of the trunk movement at the beginning of the reach movement and contributes to the reach movement with less sway of the center of gravity.

Keywords: seat surface, reach task, electromyography

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Introduction

The sitting posture is the central posture in life, and healthy adults spend a lot of time sitting in their daily lives. McCrady et al. [1] investigated the time spent sitting on workdays and holidays by healthy adults and reported that they spend 400 minutes or more per day sitting on holidays. Burton et al. [2] investigated the sitting time at home for middle-aged people in their 40s and 60s and reported that they tend to spend their leisure time in the sitting position as they get older. It is speculated that this tendency is more pronounced in the elderly. Wattanapan et al. [3] reported that among stroke patients, those who were able to acquire a sitting posture at discharge had high mobility and ability of activities of daily living. From these studies, we believe that intervention in the sitting posture of disabled persons and elderly people who are the target of rehabilitation is especially important from the viewpoint of life support.

The authors are developing a seating surface that can support trunk function even during movement as an intervention in the sitting posture of the subject. Previous studies on reach movements in the sitting posture [4, 5] found that in reach movements exceeding the upper limb length, it was necessary to reach while tilting forward and flexing the trunk and hip joints, and there is a possibility that the seat structure that assumes only static posture maintenance is not sufficient. We are developing a seat surface to assist the original trunk and pelvic movements that occur during the forward reach.

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The feature of this seat surface is that it tilts forward, and can be moved forward to assist the reach movement without changing the positional relationship between the pelvis and the trunk. This seat surface is designed to move forward with weight load to the front and return backward while tilting backward owing to the weight load to the rear. This seat surface may assist in the movement of the upper limb. This is because it tilts forward to assist the tilting movements of the pelvis and lower parts of the trunk. It also moves forward to help the trunk tilt forward and rotate.

In a co-author's study using this movable seat surface for healthy adults [6], it was possible to perform forward reach with less anterior tilts and rotation of the trunk than the normal seat surface. In addition, it was clarified that the muscle activity of the external oblique muscle in the first half of the reach and that of the erectus spinal column muscle in the latter half of the reach were less than those of the normal seating surface. Due to such characteristics of muscle activity, this seat surface may be effective for subjects with weakened trunk function. However, since this study focused on the total amount of muscle activity after the start of reach movement, it was not sufficient to evaluate the postural control required for the sitting-reach movement.

Sufficient postural control ability is indispensable for the performance of voluntary movements [7, 8], and the strategy including anticipatory postural adjustments (APA) that act functionally prior to movement is important. It is said that this APA has a role of minimizing the sway of the center of gravity caused by movements [9], and in the temporal phase, it is often divided from 200 msec before the start of movement to 50 msec after the start of movement [10]. Shimura et al. [11] investigated the relationship between exercise speed and APA appearance time in healthy adults. As a result, when the weight is attached to the upper limb in the standing position and the upper limb is lifted, the movement speed of the upper limb decreases, and the start time of biceps femoris activity is delayed relative to the deltoid muscle, which is the main muscle of movement. In addition, Sadeghi et al. [12] verified the APA of the trunk and lower limbs in patients with and without chronic LBP. The task was to raise the upper limbs in the standing position. As a result, APA of the transversus abdominis muscle and oblique abdominal muscle was confirmed in those without back pain, and the gastrocnemius muscle was confirmed in patients with back pain. It is possible that the difference in the exercise strategy when raising the arms between the two groups may have an effect.

Thus, it has been reported that APA that precedes the activity of the main muscle movement is confirmed in voluntary movements such as reach movements of the upper limbs, and its appearance is influenced by the movement speed and individual movement strategies. However, these have been studied in a standing position in which body sway due to movement is likely to occur. The movable seat surface we made this time has a backrest, and the specifications are such that the movement starts from the state where the back of the subject is attached to the backrest. Therefore, it is expected that the posture using this movable seat surface will not collapse, but studies to examine the timing of muscle activity start in the reach task in such a sitting posture have not been sufficiently conducted. The purpose of this study is to clarify the effectiveness of the movable seat surface from the viewpoint of the timing of the start of muscle activity, including APA.

Method

1. Subjects

The subjects were 15 healthy adults in their 10 s to 30s. The average age, height, weight, BMI, upper limb length, and leg length of the subjects were: 22.5 ± 2.7 years old, 171.9 ± 5.2 cm, 60.4 ± 9.0 kg, 20.4 ± 2.5, 73.5 ± 3.2 cm, and 44.9 ± 3.1 cm, respectively. All the subjects were right-handed, so the right side was the reach side. We included participants with a standardized BMI (18.5–25) and no orthopedic, ophthalmologic, otolaryngological, or neurological history. Excluded were those with: BMI exceeding the standard value, back pain, musculoskeletal disease that impaired reach movement, and those who were unable to follow the explanation.

2. Experimental preparation and equipment

2-1. Surface EMG

EMG was measured using TELEMYO DTS EM-801 (Noraxon), a transmitter (EMG probe) was attached to the derived muscle, and the sampling frequency was set to 1000 Hz and the filter characteristic was set to 15 to 500 Hz. The electrodes were made of silver, and the distance between the electrodes was 2 cm. The measurement region of muscle activity was disinfected with alcohol, skin resistance was reduced with a skin pretreatment agent, and the electrode was attached to the body with a seal. The lead-out muscles are the: anterior deltoid fibers on the reach side, which act as the main muscles of the reach movement, external oblique muscles that are the trunk flexors, lumbar spine erectors that are the trunk extensors, and thigh straight muscles that are the hip flexors. The left and right muscles were measured except for the deltoid muscle. The electrode attachment region of the deltoid muscle was placed on the line connecting the acromion and thumb, one lateral finger distal from the anterior acromion, referring to a

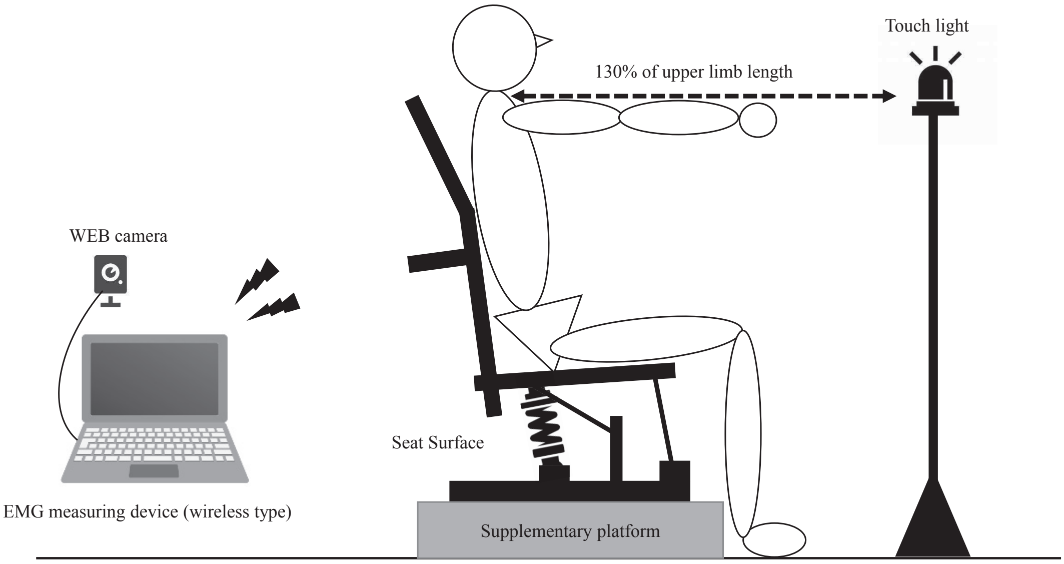

Fig. 1. Experimental environment.
The WEB camera was placed so that the achievement of the reach movement could be confirmed.
The seat surface produced does not move as shown in the figure under fixed conditions, but under movable conditions it tilts forward and moves forward.

previous study [13]. Similarly, the erector of the lumbar spinal column is located 2–3 cm outside the spinous process along the fiber run in the abdominal muscle. The external oblique muscle is located below the outer side of the 8th rib, along the run of the muscle fiber, and the rectus femoris was placed 10% proximal from the center of the line connecting the anterior iliac spine and the upper part of the patella.

2-2. Movement task

The movement task was a forward-reach task. Figure 1 shows the experimental environment and the arrangement of the measuring instruments. The starting posture and the method of performing the reach movement were based on previous research [14]. Specifically, the starting limb position was seated with the back resting on the back, the foot was grounded on the floor with ankle dorsiflexion of 0°, and the hand on the reach side was held on the thigh. Reaching was performed by the subject's dominant hand, and the upper limbs on the opposite side of the reach were kept in a comfortable position on the body side so as not to affect the sitting posture. The subject reached a switch connected to a sensor light at the level of the acromion at 130% of the length of the upper limb and reached a free speed to return to the starting posture. After sufficient practice, the reach movement was performed 5 times in this trial, but to clarify the breaks for each trial, after returning to the starting posture, resting for 3 seconds was followed by the next trial. Afterwards, the seat surface condition was changed, and the task was repeated.

2-3. Seat surface and experimental conditions

In this study, we used a seat made by the co-author (Fig. 2). The size of the seat surface is 40 cm in width × 41 cm in depth, and the seat back angle is 95°, which is the same as that of a general wheelchair. It has a spring structure under the chair, and when the user moves his/her weight backward while sitting down, the spring contracts, the seat surface tilts up to 4° and stops. When the weight is moved from the buttocks to the feet, the elastic force of the spring works, the seat surface leans forward up to 8.7°, its midpoint moves forward by 6.5 cm and moves upward by 3.5 cm. Previous studies [15] reported that tilting the chair forward by 10° or more has little benefit to subjective sitting comfort and spinal muscle activity, especially in the elderly. As we expected that the seating surface we created in this study will be used by elderly people in the future, we set the forward tilt angle to 10° or less. The spring under the chair has a hydraulic damper mechanism; therefore, the moving speed of the seat surface is almost constant both forward and backward.

The experimental conditions were fixed and movable. The seat surface angle at the beginning of the experiment was 4° backward tilt, which is the angle used in general wheelchairs in both conditions. The seat height was adjusted to 4 cm below the length of the lower leg [16]. Under the fixed backward tilt condition, it does not move as it is, and under the movable condi-

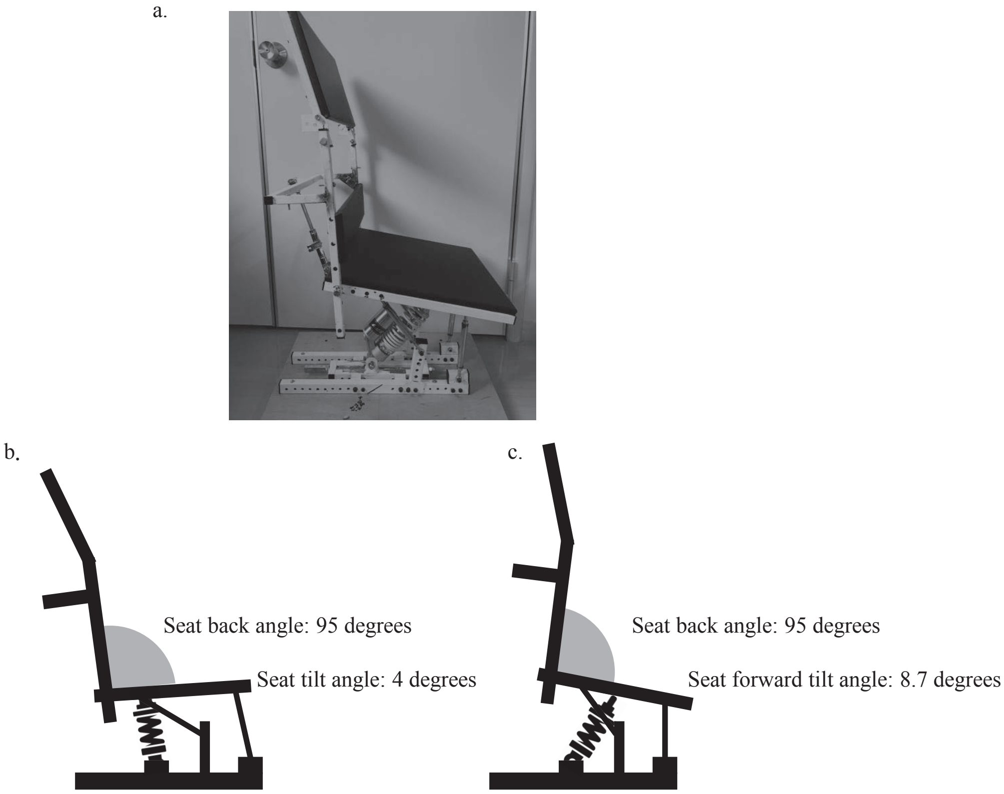

Fig. 2. Seat surface and movable range.
(a) is a photo of the movable seat surface used. (b) and (c) are diagrams that schematically show the movable seat surface, and (b) is the starting state of fixed and movable conditions. (c) is the state of maximum forward tilting.

tion, the seat tilts forward and moves forward within the above range.

3. Data analysis

Three trials between the 1st and 5th trials were adopted as trials for data analysis. We measured the timing of the muscle activity start and reach time when the subject underwent a reach task under fixed and movable conditions. In this study, we analyzed data from the start of the operation to touching the target. The start point of the reach movement was the timing when the activity of the anterior deltoid muscle fiber was observed. Moreover, the timing of touching the target object was judged from the blinking of the sensor light on the WEB camera that was shooting the sagittal plane. From these times, the reach time for each subject was analyzed.

Data analysis of muscle activity was performed using Myo Muscle Master (Noraxon). The analysis was performed after rectifying all the waveforms to be analyzed, referring to a previous study [17]. The definition of the onset of muscle activity refers to the method of Dean et al. [16]; use the average amplitude when resting for 10 seconds as the baseline, and when muscle activity was over 3SD of baseline and continued 25 ms or more. Using the obtained activity start time of each muscle, other muscle activity start times were calculated when the activity start time of the right deltoid anterior fiber, which is the main motion muscle, was set to 0 s.

4. Statistics

Comparing the reach time and the start time of muscle activity in the reach task obtained under fixed and movable conditions. As for the statistical processing method, we performed a paired t-test for the difference in reach time between conditions and the difference in activity start time for each muscle, and if normality is not recognized, the Wilcoxon signed-rank test was performed. A one-way ANOVA was performed to determine the difference in muscle activity start time between conditions, and a post-hoc test was performed by the Sidak method when a significant main effect was observed. Friedman's test was used for non-normal distribution, and a post-hoc test was performed using the Wilcoxon signed-rank test when a significant main effect was observed. However, the significance level was modified by Bonferroni correction. The significance level was set at 0.05. IBM SPSS Statistics 25 was used for analysis.

5. Ethics

This study was carried out with the approval of the Sapporo Medical University Ethics Committee (approval number 24-2-33).

Result

1. Reach time

Figure 3 shows the reach time from the start of the deltoid muscle activity until the sensor light is touched. It was 1.57 ± 0.42 seconds under fixed conditions and 1.64 ± 0.40 seconds under movable conditions. As a result of statistical processing, no significant difference was found.

2. Start time of muscle activity

Figure 4 shows the other muscle activity start times (s) when the deltoid muscle activity start time is 0 s, in order from the earliest activity start time. Under fixed conditions, in order from the earliest, start time was 0.14 ± 0.24 for the right external oblique muscle, 0.36 ± 0.64 for the left external oblique muscle, 0.58 ± 0.39 for the right spinal erector, 0.58 ± 0.43 for the left erector, 0.30 ± 0.41 for the right rectus femoris, and 0.26 ± 0.21 for the left rectus femoris. As a result of statistical processing, no significant difference was found in the muscle activity start time within the conditions. No APA was confirmed to appear between 200 ms before the start of exercise and 50 ms after the start.

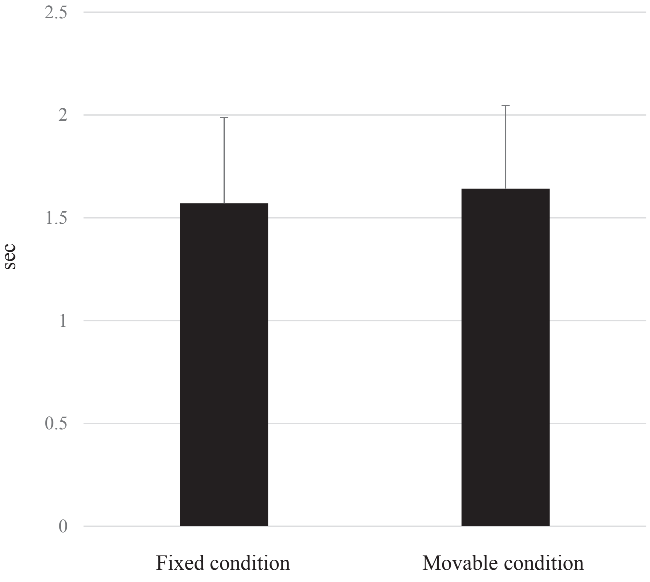

Fig. 3. Reach time under each condition.

Similarly, under the movable condition, in order from the earliest, the start time (sec) of muscle activation was 0.22 ± 0.36 for the right external oblique muscle, 0.21 ± 0.14 for the left external oblique muscle, 0.79 ± 0.49 for the right spinal erector, 0.89 ± 0.52 for the left spinal muscle, 0.17 ± 0.22 for the right rectus femoris, and 0.39 ± 0.20 for the left rectus femoris. As a result of statistical processing, a significant difference

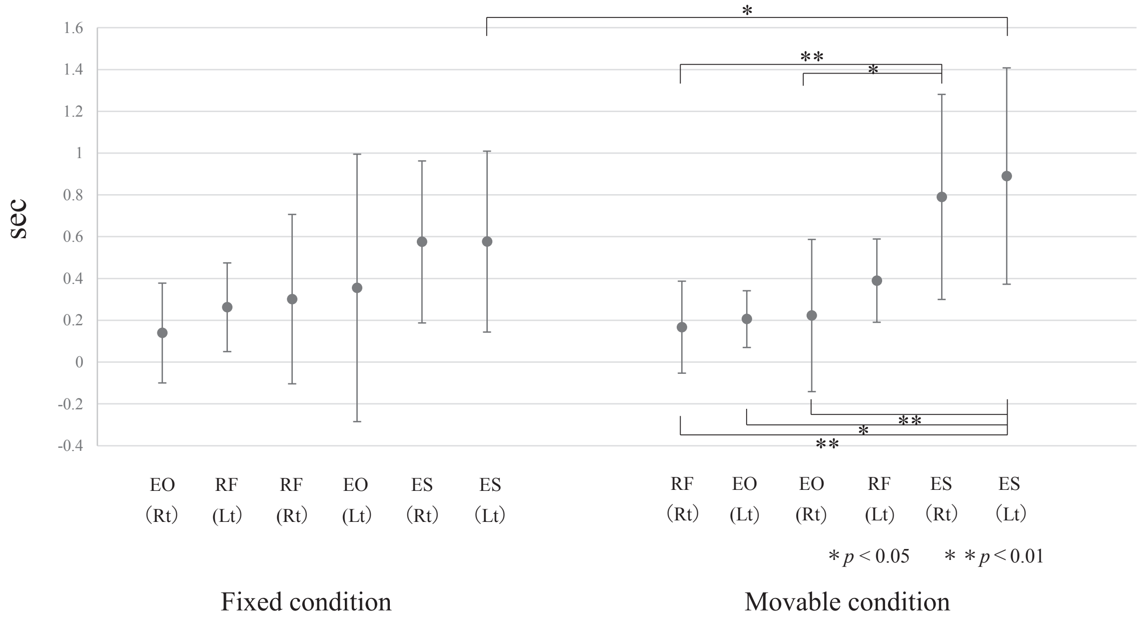

Fig. 4. Start time of muscle activity under each condition.
In each condition, the activity start time of each muscle is shown when the activity start time of the anterior fiber of the right deltoid muscle is 0 s. The positive direction means that the activity start time is later than that of the anterior deltoid fiber.
EO, external oblique muscle; ES, erector spinae; RF, rectus femoris.

was found within the conditions ($F_{5,48} = 2.439, p < 0.05$). As a result of the analysis of variance, the erection of the right spinal column was significantly later than that of the right external oblique muscle and the right rectus femoris ($p < 0.05$, $p < 0.01$, respectively). In addition, the erectors of the left spinal column had a significantly later onset time than the right external oblique, left external oblique, and right rectus femoris muscles ($p < 0.01$, $p < 0.05$, $p < 0.01$, respectively). No APA was confirmed to appear between 200 ms before the start of exercise and 50 ms after the start.

Furthermore, when the same muscles were compared between the fixed and movable conditions, a significant difference was observed only in the left erector spinae muscle, and a delay in the activity start time was confirmed under the movable conditions ($p < 0.05$).

Discussion

In this study, we examined the effectiveness of the movable seat surface from the reach time and the start time of muscle activity in healthy adults. As a result, there was no significant difference in reach time between the fixed seat surface and the movable seat surface. Analysis of the muscle activity start time showed that there was no significant difference in the activity start time of each muscle on the fixed seat surface, and the activity was started from the right external oblique muscle. On the movable seat surface, it was confirmed that the activity of the left and right erector spinae muscles was delayed compared to the abdominal oblique muscle and the rectus femoris muscle, and the activity was started from the right rectus femoris muscle. From these results, it was shown that there is no difference in the time required to perform the reach task, but the movement strategies may differ between the two seat surfaces.

1. Appearance of APA

In the movement strategy, APA, which is thought to occur with voluntary movement, could not be confirmed within the phase of −200 ms to +50 ms in this study. This may be related to the seat surface specifications under the fixed and movable conditions used in this study.

APA was first reported in 1967 by Belen'kiĭ et al. [9]. They state that when the upper limbs are raised as quickly as possible in the standing position, the muscle activity of the biceps femoris on the ipsilateral side and the erector spinae muscle on the contralateral side was confirmed before the main motion muscles. This is considered to play a role in compensating for the instability of the body caused by voluntary movement. Since this research, the frequency of APA occurrence and changes in related muscle activity mainly due to exercise load in a standing position have been studied [11, 12, 18]. Although there are few studies on APA in the sitting position, Bigongiari et al. [19] investigated APA in ball-grabbing motion in a sitting position where the back and sole of the foot were not grounded in healthy children. As a result, it has been reported that posture control ability develops with age and increases the amount of APA activity. Thus, APA, which acts as posture control, has been studied in a standing or sitting posture in which the back and sole do not touch the ground. In comparison with these studies, in the present study, the purpose is to adapt the movable seat surface to the elderly and subjects with movement disorders in the future. So, it has started that the reach task is started when the back is attached to the back and the sole of the foot is grounded on the floor. This may lead to less sway of the center of gravity associated with forward reach, and APA associated with reach may not have been confirmed.

2. Start time of muscle activity

Among the muscle activities involved in postural control, the comparison of the start time of other muscle activities with respect to the main motion muscle revealed a difference in the movement strategy between fixed and movable conditions. That is, under the fixed condition, the activity was started from the external oblique muscle on the reach side, and under the movable condition, the activity was started from the rectus femoris muscle on the reach side. In the movable condition, the left and right erector spinae muscles were activated later than the external oblique and rectus femoris muscles. It is considered that this is because the movable seat surface supports the movement of the trunk in the reach task. Kamisaki et al. [5] performed a forward reach task at a distance that can be reached only by the upper limbs, a distance that can be reached using the trunk and upper limbs, and a distance of 33% and 66% between those distances. As a result, hip flexion was hardly seen at the upper limb length, but at all distances beyond the upper limb length, the hip flexion angle increased with increasing reach distance and the anterior tilt of the trunk increased. In addition, in a study by Nakaya et al. [6], a collaborative researcher who performed muscle activity and motion analysis using the same seat surface as in this study, the movable seat surface has less activity in the external oblique muscles at the beginning of movement in the first half of the reach than the fixed seat surface, and less forward tilting and rotation of the trunk. As described above, the movable seat surface used mainly assisted the anterior tilting of the trunk necessary for the forward reach movement and could contribute to the reduction of the muscle activity amount and the movable range at that time. Furthermore, this time, from the timing of muscle activity start, in the reach task, as shown in the fixed condition, the trunk is flexed by the activity of the external oblique muscle, the erector spine erector, which is an antagonist muscle, works almost simultaneously with the flexion of the trunk and hip joints, and the simultaneous contraction of the trunk is maintained. On the other hand, by using the movable seat surface, it assists the anterior movement of the trunk to increase the stability at the beginning of movement of the trunk. Spine upright muscle activity may have been delayed relative to the oblique and rectus femoris muscles. The same reason is considered that only the contralateral erector spinae muscle was significantly delayed in the comparison between the conditions. In addition, six subjects were asked about the ease of movement under each condition in five stages of "very easy to move, easy to move, neither, hard to move, and very difficult to move." All respondents answered, "easy to move" on the movable seat surface, but under fixed conditions, 1 responded "difficult to move" and 5 responded "neither" From this, the movable seat surface is a seat surface that subjectively feels easy to move, and there is a possibility that it is a seat surface that is easy to reach in terms of muscle activity, start time of muscle activity, and movement strategy as seen from motion analysis. Under the movable conditions, while the stability of the trunk was maintained, it was necessary to load the seat forward while keeping the sole and buttocks in contact with the ground to operate the seat surface. Therefore, it is possible that the rectus femoris muscle acted first and prioritized the flexion of the hip joint. It is necessary to verify how much muscle activity is required to operate the movable seat surface in the future.

In addition, the delay in the onset time of erector spinae muscle activity, which was shown this time, is an important finding when considering adaptation to the elderly and persons with disabilities who have an imbalance in muscle tone. Yokoyama et al. [20] investigated the sagittal plane angle of the spine with age, and the thoracic spine entrance angle, thoracic kyphosis, and C2–C7 sagittal vertical axis increased and the round spine posture increased with age from late middle age. It is known that such spinal deformity leads to deterioration of ADL ability and motor function, and shortens the functional reach distance [21]. In the case of such a subject, it may be difficult to make the trunk extension motion under fixed conditions confirmed this time. In addition, in subjects with central nervous system disorders such as cerebral palsy, it is often clinically experienced that trunk extension activity easily affects the whole-body extension pattern due to abnormal muscle tone. That is, for such a subject, the movable seat surface that may delay the extension activity of the spinal column may support movement while avoiding excessive effort and posture collapse at the start of the reach movement.

Conclusion

In this research, we showed the effectiveness of the movable seat surface for healthy adults and the future clinical application from the difference in start time of muscle activity. Since support for the trunk function of the subject is often static, we consider that the effect of dynamic support, including wheelchairs and seating system devices that match body movements is a necessary research theme. To verify the effect of the movable seat surface prepared this time, it is necessary to clarify not only the reach task but also the daily activities such as eating and writing on the subject. In addition because the movable seat surface used this time was designed so that it moves due to body weight movement, it is necessary for the subject to have a certain level of motor function. Therefore, we would like to study the mechanism, direction, and degree of seat movement in the future.

Conflicts of interest statement

The authors have no conflicts of interest relevant to this article.

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ORIGINAL ARTICLE

Factors Associated with the Frequency of Doing Domestic Chores After Mild to Moderate Stroke

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Abstract: Background: While many studies research factors that affect Instrumental Activities of Daily Living after stroke, few studies research factors that affect domestic chores after stroke. This study aims to investigate factors that affect domestic chores after stroke.
Methods: In this cohort study, 29 stroke patients were followed from the time they entered the rehabilitation ward to one month after discharge. Participants were included if they had been independently doing domestic chores before stroke onset and were independently walking inside the hospital after stroke onset. Variables were selected from demographics, physical function, cognitive function, psychological function, and functioning. The Spearman correlation between the domestic chores score of the Frenchay Activities Index (FAI) after stroke and variables was calculated.
Results: The Timed Up and Go test ($r = 0.41$, $p = 0.03$), the Stroke Self-Efficacy Questionnaire ($r = 0.54$, $p < 0.01$) and the Functional Independence Measure motor domain ($r = 0.57$, $p < 0.01$) were significantly associated with the domestic chores domain of the FAI. Unlike previous studies, cognitive function and depression also didn't show a statistical relationship with domestic chores after stroke.
Conclusion: Our results show that stroke patients should improve their self-efficacy to resume domestic chores after stroke, in addition to physical and cognitive functions. The results are also consistent with previous studies about the research relationship between self-efficacy and functioning.

Keywords: Stroke, domestic chores, IADL, self-efficacy, balance ability

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1. Introduction

Stroke is a main cause of mortality [1] and the leading cause of adult long-term disability in industrialized countries [2]. Despite the decreasing incidence rate, better survival rates are expected to lead to increased prevalence rate and the need for efficient rehabilitation and healthcare policies for patients with stroke [3].

In describing activities of daily living (ADL) as a measure of long-term outcome of stroke, it is important to distinguish between basic ADL (BADL) and instrumental ADL (IADL) [4]. BADL are self-maintenance skills, such as bathing, dressing, and toileting. In this study, IADL refer to more complex activities, including domestic chores, social activities, and gainful work [5]. Because IADL are activities that typically must be performed by the stroke survivor to continue living in the community [6], it will be difficult to predict whether patients can resume IADL or domestic chores while they are hospitalized. Among IADL, "domestic chores" is the area where occupational therapy support is needed for independent living [7]. Walsh et al. [8] found that two-thirds of stroke survivors need help with domestic chores up to five years after stroke. Besides, domestic chores are affected by various factors such as mobility, cognitive function, family support, and lifestyle [9], and stroke patients may be unable to resume the domestic chores that they performed before.

The International Classification of Functioning, Disability, and Health (ICF) defined preparing meals and doing housework as domestic chores [10]. Studies in Japan have defined preparing meals, cleaning, washing clothes, and shopping as items of domestic chores because these activities support living [11]. According

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to the Statistics Bureau of Japan 2017 [12], these are the following characteristics regarding the implementation time for housework among Japanese individuals; women spend more time doing housework than men in all ages; women spend less time doing housework after 65 years of age, while men spend more time doing housework after 65 years of age; people living with a partner spend more time doing housework than people living alone.

There are two types of IADL assessment tool. One assesses the patient's ability to perform IADL, e.g., the Lawton scale, and the other assesses the frequency at which IADL is performed, e.g., the Frenchay Activities Index (FAI). We chose FAI as the assessment tool for IADL and domestic chores as it assesses the frequency at which patients perform IADL, which provides a motr correct reflection of daily living than the tool that assesses the patient's ability to perform IADL.

IADL generally require higher physical functions, such as walking abilities [3, 9, 13], balance abilities [13], cognitive functions such as memory [14], executive function [9, 15], and psychological function such as self-efficacy [13, 16]. Conversely, IADL is negatively affected by paralyzed limb function [17], cognitive dysfunction [15], and depression [15, 18]. As stated, while several studies analyzed factors that affect IADL after stroke, only few studies evaluated the factors affecting domestic chores after stroke. Moreover, these studies use tools that assess the patient's ability to perform IADL, and few studies use the tools that assess the frequency at which patients perform IADL. Therefore, this study aimed to clarify the factors that affect frequency of doing domestic chores after stroke. In this study, domestic chores include preparing meals, washing dishes, washing clothes, cleaning, and shopping.

2 Materials and Methods

2.1 Participants

The dataset utilized in this study was acquired between 2015 and 2018 from the rehabilitation ward. All participants were patients with first-time stroke (cerebral infraction, cerebral hemorrhage, or subarachnoid hemorrhage). Other inclusion criteria were as follows: First, the patients were independent in walking in the hospital. In the current study, this was defined by an FIM score of 6 or 7 in the walking domain, indicating that participants were included if they used a stick or orthosis. Second, they had been independent in domestic chores before stroke onset. In the current study, this was defined by FAI score of 15 in the domestic chores domain, indicating that they had usually done preparing meals, washing dishes, washing clothes, cleaning, and shopping before stroke onset. Patients were excluded if they had severe hyper-brain dysfunction, such as aphasia, apraxia, and unilateral spatial neglect, or other serious conditions other than stroke that could affect the study outcome.

All participants underwent a 60–180-min supervised rehabilitation program daily while they were in the rehabilitation ward. The program consisted of physical and occupational therapies for all participants and speech therapy if needed. In addition to individual rehabilitation, they underwent walking practice that was tailored to individual abilities with a nurse or caregiver. After hospital discharge, they used a home help service or rehabilitation as needed.

2.2 Procedure

The researcher approached individuals who met the inclusion criteria during hospitalization and we included them as the participants. A written informed consent was obtained from the participants. Demographic data and clinical characteristics were collected from the medical records of our hospital. Other outcome measures except for post-stroke FAI, including the subscale of domestic chores, were assessed during the hospitalization. The assessment time of these outcome measures were the final assessment before they were discharged from the hospital. Pre-stroke FAI and subscale of domestic chores were assessed by retrospectively recalling the performance of domestic chores and other IADL before stroke onset. Post-stroke FAI and subscale of domestic chores were assessed by face-to-face interviews at their residence post discharge (1 month) from the hospital. Ethical approval was provided by the researchers' host university and written consent was obtained from all participants.

2.3 Outcome measures

2.3.1 Functioning

2.3.1.1 Basic activities of daily living

BADL was assessed using the Functional Independence Measure (FIM) [19]. FIM is an 18-item, 7-level scale that was developed to assess the functional independence of patients with neurological impairments. FIM consists of the motor domain (FIM-M) and cognitive domain (FIM-C). FIM-M includes 13 items related to ADL, and the total score is 91 points. Moreover, FIM-C includes 5 items associated with communication and socialization.

2.3.1.2 Instrumental activities of daily living

IADL was measured using FAI [20]. It comprises 15 items (preparing meals, washing dishes and clothes, cleaning, local shopping, heavy housework, social outings, walking outdoors, active hobby, driving a car/traveling on bus, outing/car rides, gardening, household and/or car maintenance, reading books, gainful work), and each item was scored from 0 to 3. In the FAI, the frequency of each activity is assessed; the higher the frequency of the item, the higher is the score. The FAI consists of a single summary score, ranging from 0 (inactive) to 45 (highly active). Previous studies showed that the FAI is a valid, reliable, and sensitive measure of social activity and IADL in patients with stroke [21, 22]. The FAI was developed to provide information on the level of activities observed before and after stroke [21]. Pre- and post-stroke FAI were assessed to show the levels of premorbid and post-stroke activities. Pre-stroke FAI and both pre- and post- stroke performance of domestic chores in the FAI were used as variables.

2.3.1.3 Domestic chores

In this study, we defined preparing meals, washing dishes, washing clothes, cleaning, and local shopping as domestic chores in the items of the FAI. Preparing meals and washing clothes are scored three points if performed most days in a week, and the other items are scored three points if performed at least weekly.

2.3.2 Demographic data and clinical characteristics of stroke

Information on sex, age, and number of family members was obtained as demographic data. For clinical characteristics of stroke, data on the etiology, stroke type, and affected hemisphere were collected.

2.3.3 Physical function

Balance ability was assessed using the Berg Balance Scale (BBS) and Timed Up and Go (TUG) test. The BBS is a 14-item measure of balance and risk for falls in older adults through direct observation on a scale of 0 (inability to complete the task) to 4 (independent task completion) [23]. The TUG test was developed to evaluate functional mobility of frail elderly individuals and measure mobility speed [24]. The participants sat down in a chair and then were timed with a stopwatch to determine how quickly they could stand up and walk 3 m, turn a corner, walk back, and sit down again. The severity of paralysis was assessed using the Stroke Impairment Assessment Set – motor function (SIAS-M). The SIAS includes 22 items based on nine types of dysfunction. Each item could be scored as 3 or 5 points. SIAS-M includes 5 items that assess abilities of affected arms and legs, with a total score 25 points.

2.3.4 Cognitive function

Attention was assessed using the Trail Making Test parts A and B (TMT-A and TMT-B, respectively) and WAIS-III subtest of the symbol digit substitution test (SDMT). In TMT-A, the respondent is instructed to connect randomly arranged circles containing numbers from 1 to 25 following the number sequence and perform it as quickly as possible. The task in TMT-B is similar to that in TMT-A, but the respondent has to alternate numbers and letters. In the SDMT, a coding key showed nine abstract symbols, each paired with a number. Below the key, a series of symbols were presented, and the participants were asked to write down the corresponding numbers as quickly as possible. The number of correct substitutions in a 120-s interval was used as the score. Executive function was assessed using the Tower of Hanoi (TOH) and Behavioral Assessment of the Dysexecutive Syndrome Dysexecutive Questionnaire (BADS-DEX). The TOH consists of a wooden structure with a rectangular base with three evenly spaced pegs and several wooden discs. BADS-DEX includes a 20-item questionnaire on executive-type behavioral problems. Each item is scored on a scale of 0 (not at all) to 4 (always), and the maximum score is 80 points. The higher the score, the stronger the trend of dysexecutive function. Memory was assessed using the Rivermead Behavioral Memory Test (RBMT). The RBMT is designed to tap the participant's memory in performing daily tasks. The RBMT assesses different types of memory, such as associative memory, prospective memory, visual memory, verbal memory, topographic memory, control, and recognition strategies [25]. RBMT produces a global score from 0 to 24 points.

2.3.5 Psychological function

Depression was assessed using the self-rated, 15-item, Geriatric Depression Scale (GDS). The GDS includes 15 items on depression, asked over several weeks. Subjects answer each question with "Yes" or "No," and scores on the GDS range from 0 to 15. A score < 5 indicates no depression, a score from 5 to 10 indicates suspected depression, and a score > 10 indicates probable depression. The GDS is a reliable and valid self-rating depression screening scale for older individuals and stroke survivors [26]. Self-efficacy was assessed using the 13-item Stroke Self-Efficacy Questionnaire (SSEQ). SSEQ was developed by Jones et al. [27]. This self-report questionnaire comprises 13 items regarding common functional tasks (e.g., getting comfortable in bed, walking, and dressing) and self-management (e.g., coping with frustration of the consequences of stroke). Subjects answer each question between 0 (not at all confident) and 10 (extremely confident), and total scores range from 0 to 130. The SSEQ has face validity, excellent internal consistency (Cronbach alpha, .90), and criterion validity with the Falls Efficacy Scale [28] (Table 1).

Table 1 List of outcome measures

Demographics		Age, Sex, Family	a
Clinical characteristics		Stroke type, Affected hemisphere,	
Physical function	severity of paralysis	Stroke Impairment Assessment Set (SIAS-M)	b
	balance ability	Berg Balance Scale (BBS), Timed up and Go Test (TUG)	
Cognitive function	attention	Trail Making Test A and B (TMT-A and TMT-B) Symbol Digit Substitution Test (SDMT)	
	executive function	Tower of Hanoi (ToH), Dysexecutive Syndrome Dysexecutive Questionnaire (BADS-DEX)	
	memory	Revermed Behaviral Memory Test (RBMT)	
Pshychological function	depression	Geriatric Depression Scale-15 (GDS-15)	
	self efficacy	Stroke Self Efficacy Questionnaire (SSEQ)	
Functioning	ADL	Functional Independence Measure (FIM)	
	IADL	Frenchay Activities Index (FAI)	c

a; collected from the medical records of our hospital, b; assessed during the participants were in the hospital, c; Pre-stroke FAI was assessed by retrospectively recalling the performance before stroke onset. Post-stroke FAI was assessed by face-to-face interviews in their home 1 month after discharge from the hospital.

2.4 Statistical analyses

All analyses of data were conducted using R 3-5-0 software. A significance level of .05 was established.

Descriptive statistics were used to describe the demographic data of age, sex, and family. The stroke characteristics included stroke type, affected hemisphere, score in the National Institute of Health Stroke Scale (NIHSS) at onset, assessment time from onset, functioning, and other outcomes. The post-stroke FAI score of each item of the domestic chores domain was presented. To investigate the relationship between post-stroke scores of domestic chores domain and other variables, the Spearman's rank-order correlation was used.

3 Results

Twenty-nine participants were enrolled in this study. The mean age of participants was 72.5 ± 7.8 years, ranging from 57 to 86 years. Seven participants (24.1%) were male. Moreover, 16 participants (55.2%) had cerebral infarction, 10 (34.5%) had cerebral hemorrhage, and 3 (10.3%) had subarachnoid hemorrhage. The right hemisphere was affected in 12 participants (41.4%), while the left hemisphere was affected in 16 participants (55.2%). The median NIHSS score at stroke onset was 5.5 (3–11.3), and the FIM summary score upon hospital discharge was 121 (117–123). This indicated that participants were mild to moderate stroke survivors, and their independence rate of ADL was relatively high (Table 2).

Table 2 Description of demographic data, stroke characteristics and pre- and post- stroke FAI summary score of participants (*n* = 29)

Demographic data	
Age (years)	72.5 ± 7.8
Sex - Male (n)	7 (24.1%)
Family - Living alone (n)	22 (75.9%)
Stroke characteristics	
Stroke type - Cerebral Infarction (n)	16 (55.2%)
- Cerebral Hemorrhage (n)	10 (34.5%)
- Subarachnoid Hemorrhage (n)	3 (10.3%)
Affected hemisphere - Right (n)	12 (41.4%)
- Left (n)	16 (55.2%)
- Middle (n)	1 (3.4%)
NIHSS score at stroke onset	5.5 (3–11.3)
Assessment time from stroke onset (days)	121.6 ± 62.3
Functioning	
FIM summary score at discharge from the hospital	121 (117–123)
FIM-M score at discharege from the hospital	88 (85–90)
FIM-C score at discharge from the hospital	33 (31–35)
pre-stroke FAI summary score	32 (29–34.3)
post-stroke FAI summary score	23 (15.5–27)

Values given as mean ± SD for ratio scale and median (Q1–Q3) for ordinal scale and n (%) for normal data NIHSS, National Institute of Health Stroke Scale; FIM, Functional Independence Measure; FIM-M, FIM motor domain; FIM-C, FIM cognitive domain; FAI, Frenchay Activities Index

The proportion of participants rating themselves at the highest level of actual participation was 58.6% for preparing meals, 65.5% for local shopping, 69.0% for cleaning, and 82.8% for washing dishes and clothes. In contrast, the proportion of participants who never participated in these activities was 27.6% for preparing meals, 24.1% for cleaning and local shopping, and 13.8% for

Table 3 The post-stroke score of each item of the domestic chores domain of the FAI (n = 29)

	Median (Q1–Q3): 13 (9–15) min-max: 0–15			
	Never	Under once weekly	1–2 times a week	Most days
Preparing meals	8 (27.6%)	2 (6.9%)	2 (6.9%)	17 (58.6%)
Washing dishes	4 (13.8%)	0 (0.0%)	1 (3.4%)	24 (82.8%)
	Never	1–2 times in 3months	3–12 times in 3months	At least weekly
Washing clothes	4 (13.8%)	1 (3.4%)	0 (0.0%)	24 (82.8%)
Cleaning	7 (24.1%)	2 (6.9%)	0 (0.0%)	20 (69.0%)
Local Shopping	7 (24.1%)	2 (6.9%)	1 (3.4%)	19 (65.5%)

Values given as n (%)

washing dishes and clothes (Table 3).

The average SIAS-M score was 22.9 ± 4.2. The FIM-M score was 86.9 ± 3.9, and pre-stroke FAI score was 31.5 ± 3.7. The TUG test ($r = 0.41$, $p = 0.03$), SSES ($r = 0.54$, $p < 0.01$), and FIM-M ($r = 0.57$, $p < 0.01$) results were significantly associated with the domestic chores domain of the FAI. The SIAS-M ($r = 0.36$, $p = 0.06$), TMT-B ($r = -0.34$, $p = 0.07$), TOH ($r = 0.35$, $p = 0.08$), BADS-DEX ($r = -0.37$, $p = 0.07$), and RBMT ($r = 0.37$, $p = 0.06$) scores had a mild but insignificant association the domain ($|r| > 0.3$). Other outcome measures were not significantly associated with the domestic chores domain of the FAI (Table 4). Of the 29 participants, two were missing data for TUG, one for SDMT, three for ToH, four for BADS-dex, three for RBMT, one for GDS-15, and one for SSEQ.

4 Discussion

The current study investigated post-stroke frequency of domestic chores using the FAI. By using a criterion of pre-stroke score of domestic chores domains on FAI was the maximum. We also investigated the participant's demographics, clinical characteristics, physical function, cognitive function, psychological function, and pre- and post-stroke functioning and their relationship to the frequency of post-stroke domestic chores. The strengths of our study are as follows: First, because our participants had been independent of domestic chores before stroke onset, we could analyze the impact of stroke on domestic chores purely. Second, it is easy, accurate, or precise to consider the influence of each factor by focusing on "domestic chores" in various IADL.

Blomgren et al. [4] investigated IADL in 237 young and middle-aged stroke survivors using FAI, with the proportion of participants rating themselves at the highest level of actual participation from a low of 43.9% for preparing meals to a high of 81.9% for local shopping. Our sample shows a similar trend for preparing meals. This implies that preparing meals was the most difficult to resume for patients with stroke in the domestic chores domain. This is because preparing meals is a complex activity that needs high cognitive functions, such as executive function [14] and practical balance ability, compared to washing dishes, washing clothes, and cleaning. Clearly, preparing meals is important for independent living [29] and an individual's sense of life satisfaction [30]. In contrast, washing dishes and washing clothes were activities that can be resumed after stroke. This implies that interventions for washing dishes and washing clothes are relatively easy to improve the independence of domestic chores after stroke.

The median FIM-M score of our sample was 88, but pre- and post-stroke median FAI scores were 32 and 23, respectively. This indicates that IADL can decrease despite full independence in BADL, as measured by the FIM. In a previous study, Edwards et al. [31] investigated stroke-related symptoms in patients with mild stroke. The results showed that, although 95% of participants had FIM scores of 110, approximately 40% and 35% reported problems on social integration and household management, respectively. There are several studies that showed similar results on ADL and IADL of patients with stroke [32]. Despite the difference in the assessment tools between this and previous studies, our results highlight the importance of assessment of IADL in patients with stroke, particularly those who can perform ADL independently.

The results of this study showed that the TUG test ($r = -0.41$, $p < 0.01$), SSEQ ($r = 0.54$, $p < 0.01$), and FIM-M ($r = 0.57$, $p < 0.01$) scores were significantly associated with frequency of domestic chores. The TUG test evaluates gait and balance performance [33]. Because the TUG test can be performed easily, it can be used as a screening tool for reflecting domestic chores after stroke. The concept of self-efficacy is described as the confidence in one's ability to perform a task or specific behavior. Thus, the strongest way of influencing

Table 4 Descriptive statisitics and spearman's correlation with the domain of domestic chores of FAI after stroke ($n = 29$)

	n	average or Median	Spearman's Correlation	*p*-value
Demographics				
sex - Male	29	7 (24.1%)	0	1
age	29	72.5 (7.8)	−0.13	0.49
family - Living Alone	29	22 (75.9%)	−0.23	0.22
Physical function				
SIAS-M (min-max: 0–25)	29	25 (23–25)	0.36	0.06
BBS (min-max: 0–56)	29	53 (50–55)	0.29	0.13
TUG (second)	27	11.9 (8.4)	−0.41	0.03*
Cognitive function				
attention				
TMT-A (second)	29	193.3 (126.8)	−0.22	0.26
TMT-B (second)	29	239.1 (129.8)	−0.34	0.07
SDMT (min-max: 0–133)	28	39 (32–51)	0.3	0.12
executive function				
ToH (min-max: 0–9)	26	4.5 (2–6)	0.35	0.08
BADS-DEX (min-max: 0–80)	25	17 (9–24)	−0.37	0.07
memory				
RBMT (min-max: 0–24)	26	18 (15–20)	0.37	0.06
Psychological function				
GDS-15 (min-max: 0–15)	28	5 (3–8)	−0.07	0.73
SSEQ (min-max: 0–130)	28	105 (83.3–117)	0.54	< 0.01*
Functioning				
FIM-M (min-max: 13–91)	29	88 (85–90)	0.57	< 0.01*
pre-stroke FAI (min-max: 0–45)	29	32 (29–34.3)	0.21	0.28

*$p < 0.05$. Values given as mean (SD) for ratio scale and median (Q1-Q3) for ordinal scale and n (%) for normal data

SIAS-M, the Stroke Impairment Assessment Set Motor function; BBS, the Berg Balance Scale; TUG, the Timed Up and Go test; TMT-A and TMT-B, the Trail-Making Test part A and B; SDMT, the symbol digit substitution test; ToH, the Tower of Hanoi; BADS-DEX, the Behavioral Assessment of the Dysexecutive Syndrome Dysexecutive Questionnaire; RBMT, the Rivermead Behavioral Memory Test; GDS-15, the self-rated 15-item Geriatric Depression Scale; SSEQ, the 13-item Stroke Self-Efficacy Questionnaire; FIM-M, the Functional Independence Measure Motor function; FAI, the Frenchay Activities Index

self-efficacy is a mastery experience through successful performance of a task [34]. These results imply that patients with stroke should improve not only physical or cognitive function but also self-efficacy to resume domestic chores after stroke. While participants of this study had a high independence rate of BADL with a high FIM-M score, it is still significantly correlated with domestic chores. This suggests that ADL is the basis of domestic chores, and it is important to evaluate BADL to reflect IADL.

Blomgren et al. showed that stroke survivors who are older, men, and living with a partner report low frequencies of performing IADL using FAI. However, in our study, age, sex, and living alone were not associated with domestic chores. This is possibly because participants of the current study had been independent in domestic chores before the onset of stroke compared to those in other studies. Adjustment for pre-stroke functioning should provide a better insight into possible mechanisms for such age and sex differences [35]. Unlike previous studies, cognitive function did not show a statistical relationship with domestic chores after stroke. Our study found similar trends with those of previous studies [36] that executive function or memory, rather than attention, with the more complex tests (TMT-B rather than TMT-A) had associations with domestic chores, while there were no significant associations between cognitive functions and domestic chores. In previous studies that examined the patient's ability to perform IADL, cognitive assessments were performed in the acute phase [14, 15] and the pre-morbid performance of IADL was not considered [14–16]. In the current study, cognitive assessments were performed in the subacute phase where the pre-morbid frequency at which patients performed IADL was considered in participants who were mild to moderate stroke patients and had been independent of domestic chores before the stroke. For these reasons, the cognitive function of our participants did not affect the frequency of domestic chores strongly.

While most previous studies that examined the patient's ability to perform IADL showed a significant relationship between post-stroke depression and functioning [15, 18], depression was not related to the frequency at which patients performed domestic chores in this study. LeBrasseur et al [18] demonstrated that the GDS score of chronic stroke participants living in the community was significantly associated with the management role domain (the organization and management of socially) and without the instrumental role domain (the ability to perform activities in the home and in the community). The instrumental role domain in their study is similar to the role of domestic chores in our study. Unlike previous studies, assessment time of depression and performance of domestic chores was slightly different in our study. Besides, our samples showed relatively low median GDS score of 5 points and the GDS is a dichotomous measure and was not sufficiently sensitive. Moreover, we investigated the frequency at which patients perform domestic chores, while previous studies have investigated the patient's ability to perform domestic chores. As stated, it is possible that depression was not related to domestic chores in this study.

4.1 Study limitations

The current study has several potential limitations. Samples were included if they were independent of walking after stroke and did not have severe hyper-brain dysfunction. These inclusion criteria resulted in selection of only patients with mild stroke (FIM-M median score, 85) without severe hyper-brain dysfunction. The sample size was relatively small, and the term from the stroke onset was not consistent. Given the small sample size, the results from this study provide a preliminary overview of the relationship between the different possible factors influencing the frequency at which patients perform domestic chores. Besides the small sample size made it difficult to use predictive or multivariate models for assessing the relationship between the possible factors for domestic chores and predictive power of those factors.

Future studies should include more participants and use predictive or multivariate models to look for factors predicting the frequency at which patients perform domestic chores after stroke. Besides, future studies should collect acute, sub-acute, and chronic phase data of stroke patients and conduct longitudinal research to improve the prediction accuracy.

4.2 Conclusion

We found that balance ability, basic ADL, and self-efficacy were statistically associated with post-stroke frequency of domestic chores. Our study extends these findings to include the domestic chores domain. Our results imply that stroke patients should improve not only physical or cognitive function but also self-efficacy to resume domestic chores.

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ORIGINAL ARTICLE

A Concept Analysis of Clinical Reasoning in Occupational Therapy

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Abstract: Introduction: Acquiring competence in clinical reasoning is regarded as key to meet the challenges of integrating knowledge into one's practice. Learners and educators need a shared understanding of what is clinical reasoning because they need appropriate means for reflection and feedback. However, the clinical reasoning concept needs revisiting in the current context, which is becoming increasingly diverse and complex. The purpose of this study was to analyse the clinical reasoning concept and develop a common framework.

Methods: Rodgers' concept analysis was selected for this theoretical study. Accordingly, a systematically search of multiple databases yielded 903 articles and 135 articles that met the inclusion criteria were extracted, and of these 30 articles randomly sampled for analysis. Data analysis was done following Rodgers' method of thematic analysis.

Results: The attributes were four 'therapeutic thinking processes' and two 'professional thinking skills.' The application contexts were 'clinical and non-clinical practice settings,' and 'professional education.' Moreover, the antecedents were 'professional factors' and 'practice factors,' and the consequences were 'professional developments' and 'professional attitudes and behaviours.'

Conclusion: The resulting framework of clinical reasoning can be the basis for developing pedagogies and assessment of clinical reasoning competence acquisition.

Keywords: allied health occupations, clinical competence, clinical reasoning, concept analysis, occupational therapy

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Introduction

Clinical reasoning (CR) in occupational therapy is a core-ability [1] that occupational therapists and students develop with clinical experience [2]. Acquiring competence in CR is regarded as key to meet challenges of integrating knowledge into one's practice in the changing practice contexts [3]. CR has become key now students and practitioners need to learn to deal with challenges such as meeting expectations of clients who are better informed than in the past; adapting to increasing diversity in the delivery of services and practical contexts outside the traditional institutional settings; and how to master an increasing body of knowledge [4].

However, CR includes tacit knowledge embedded into the experience of a practice, which is difficult to verbalise and to teach [5]. More recently, educators and learners alike started considering CR as an intersubjective process in which educators and learners co-construct CR [6]. For these reasons, they need a shared understanding of what CR is. Previous studies attempted to clarify what CR might be and its types through mainly qualitative researches [5, 7]. However, while scholars have re-conceptualized these understanding, the CR concept has not been sufficiently confirmed, expanded, or refuted through empirical studies [8].

In addition, Unsworth and Baker [9] argued that developing a standardized assessment scale is urgently needed. Developed in the past, the Self-Assessment of Clinical Reasoning and Reflection (SACRR) and the California Critical Thinking Skills Test (CCTST) were designed for the assessment of students' reasoning and

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reflection skills [10, 11]. However, these two scales were not developed based on the CR concept in occupational therapy. Also, the items of SACRR and CCTST are limited to scientific reasoning aspects of CR. Since a review of research literature did not reveal any other assessment tools, it appears that no valid, reliable assessments of CR exist [12]. Therefore, in addition to educational reasons, it is necessary to fully establish the recent evolving understandings in the profession regarding CR the future development of valid assessment methods [13].

Adding further complexity to this lack of clarity on how to operationalise and assess CR, some have started to reframe the concept in terms of professional reasoning and therapeutic reasoning [14, 15]. Professional reasoning broadens the CR concept to include the reasoning that occurs in non-medical environments, such as schools and community settings, as well as including reasoning done by occupational therapy teachers, clinical educators, and occupational therapy managers as they conceptualise their practice [15]. However, despite this proposed new terminology, research has not progressed on clarifying different features of CR concept. These evolving insights about the CR concept lend further support to the need to revisit the concept in the context of current occupational therapy practices that are becoming more diverse and complex [12]. In this paper, we will use the term CR, albeit including the professional and therapeutic reasoning that occurs in the non-traditional diversifying practice contexts, being mindful of the intersubjective process in which educators and learners co-construct CR [6].

In conclusion, based on the uncertainties in how CR is understood, we argue there is a need for analysing the concept of CR. While CR in occupational therapy is typified as scientific, narrative, pragmatic, ethical, interactive, and conditional reasoning [15], there is a need for developing a common framework that not only integrates the different types of CR, but one that also explains how CR occurs. Analysing the CR concept is essential, not only for supporting educators and learners in the development of learners' CR skills but clarifying the concept is also fundamental to the future development of assessment tools of CR. It is well known that concept analysis is well suited to such a double challenge [16]. Accordingly, the purposes of this study were to analyse the concept of CR and to develop a common framework that integrates the different types of CR in occupational therapy.

Methods

Study design

Rodgers' concept analysis [17] was selected for the following reasons [18]. First, the assumption of Rogers' methodology that concepts are dynamic lends itself to understanding the concept of CR, which is sensitive to temporal changes [8]. Secondly, Rodgers' methodology is an interpretive method and, particularly suited to study the CR concept, which explains processes taking place in persons' minds [5]. Finally, Rodgers' concept analysis provides a strategy suited for more fully explaining how concepts occur by identifying and defining their essential components, antecedents and consequences, and application contexts [16, 17].

Data gathering

Data gathering consisted of systematically searching and screening for relevant literature [17]. Search terms were 'occupational therapy,' and 'clinical reasoning,' or surrogate terms of 'professional reasoning,' 'therapeutic reasoning,' and 'narrative reasoning.' The searched databases were PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Health Source, SocINDEX, Education Resources Information Center (ERIC), OTseeker, Ichushi (Japan Medical Abstracts Society), J-STAGE (Japan Science and Technology Agency) and Medical online, using advanced search processes. The searches spanned the years 1983–2017, because CR as a concept was introduced into occupational therapy in 1983 [19]. The first author (SM) accessed the databases on October 23, 2017.

Figure 1 shows the flow for identifying and screening extracted papers in line with the PRISMA guidelines [20]. From the 903 studies identified, 504 were omitted because of double selection. A further 264 papers were excluded after titles and abstracts were screened for the following criteria: (a) the subject of articles is not CR; (b) not reported by occupational therapists; (c) not related to occupational therapy practice and education. Rodgers [17] suggests that 20% or about 30 articles of the retrieved literature be included in the sample. Accordingly, with 135 papers remaining, we randomly sampled 30 by Excel's random number table (see Table 1).

Data analysis

Thematic analysis was conducted in the following interactive back-and-force process: generating initial codes, searching for themes, reviewing themes, generating a thematic map of the analysis, and generating names for each theme [17, 21]. First coding the data was guided by using the following questions: What are the features of the concept? What factors are preceding the concept? What are the significant consequences of the concept? Moreover, what kind of situation and scope does the concept apply?

Subsequently, we identified (a) attributes and appli-

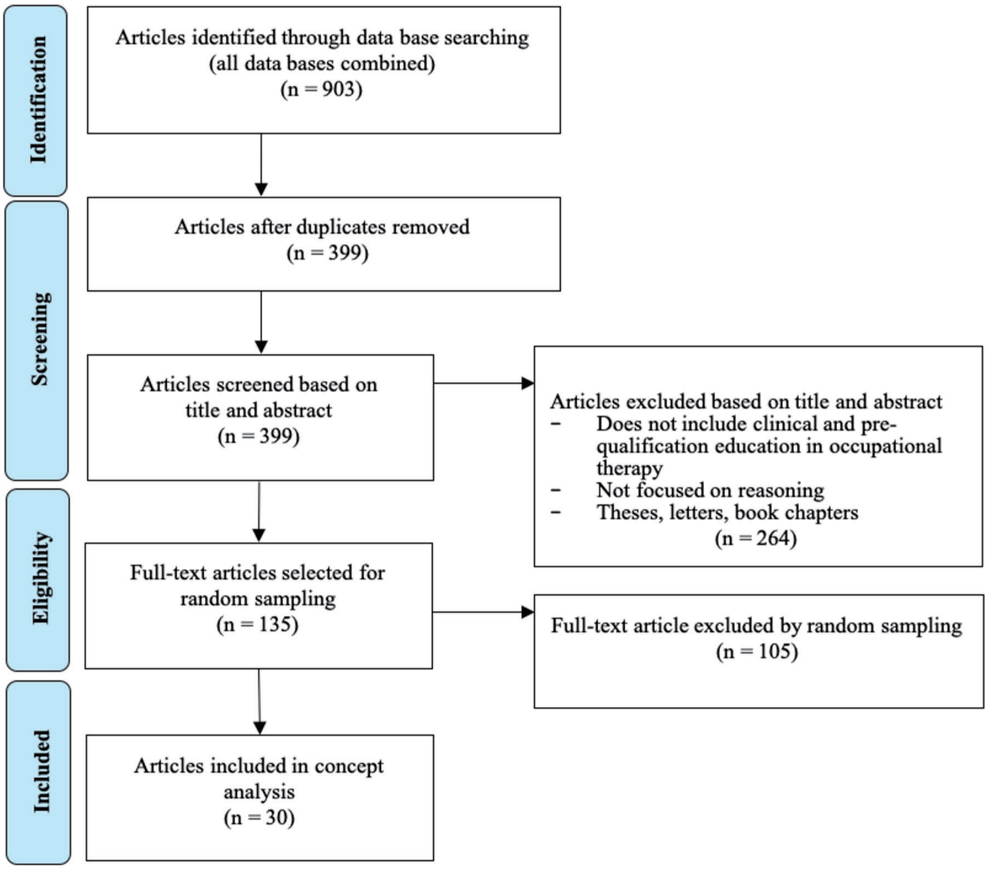

Fig. 1. The number of studies identified and screened for concept analysis. Diagram flow refers to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and data gathering methods of Rodgers' concept analysis.

cation contexts, (b) antecedents, and (c) consequences of the concept. (a) Attributes and application contexts comprised of the definition of the concept. (b) Antecedents were multiple conditions, behaviours, or attitudes that occurred before the concept. (c) Consequences were events or phenomena that occurred afterwards to the concept. This phase of analysis was an inductive coding process of continually organizing and reorganizing data until a cohesive, comprehensive, and relevant system of descriptors was generated [17]. MAXQDA 2018 (VERBI) software was used to support the qualitative data analysis. Besides, to reduce the bias of the authors (SM, YJ, PB) doing the analysis, records of the data analysis were audited by an author (SS) of this study team who was not involved in the actual data analysis.

Results

We clarified the attributes, preconditions, results, and application context of the concept through Rodgers' concept analysis of the CR literature. The attributes were four 'therapeutic thinking processes' and two 'professional thinking skills,' the application contexts were 'clinical and non-clinical practice settings' and 'professional education of occupational therapists (pre-qualification and continuing education).' Moreover, the antecedents were 'professional factors' and 'practice factors,' and the consequents were 'professional developments' and 'professional attitudes and behaviours' (see Figure 2). The numbers inserted in brackets in the below text correspond to numbers of the analysed articles listed in Table 1.

Attributes

Therapeutic thinking processes

'Therapeutic thinking processes' were an essence of CR in occupational therapy, in which occupational therapy practitioners and students used to organise and support clinical thinking [42]. It included the following four therapeutic thinking processes: (a) scientific evidence-driven thinking process, (b) professional ethics-driven thinking process, (c) practical contexts-driven thinking process, and (d) client's narrative-driven thinking process. Practitioners and students used these four types of therapeutic thinking processes together in their

Table 1 List of articles included for the analysis

[26]	Gee BM, Strickland J, Thompson K, Miller LJ. Exploring the influence of an e-learning sensory processing-based module for graduate level occupational therapy students on clinical reasoning: A pilot study. Occupational Therapy International. 2017; 24: 1–8.
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[46]	Alnervik A, Sviden G. On clinical reasoning: patterns of reflection on practice. The Occupational Therapy Journal of Research. 1996; 16(2): 98–110.
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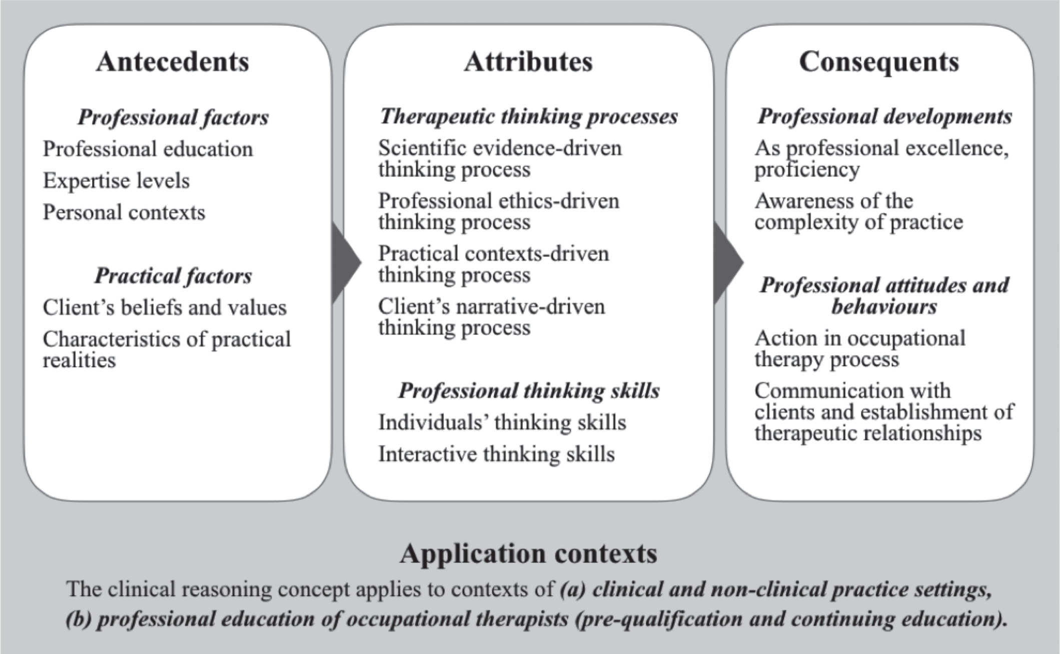

Fig. 2. Result of concept analysis of clinical reasoning in occupational therapy

daily practice, amounting to complex, multifaceted, and dynamic thinking processes [34, 38].

The scientific evidence-driven thinking process. Practitioners and students used the scientific evidence-driven thinking process to inform problem-definition, problem-analysis, and problem-solving in practice [28, 49, 53, 55]. This therapeutic thinking process was considered to professionalise occupational therapy practice [49], because it included a logical process based on hypothesis formulation and testing [55], facilitated systematic information gathering and interpretation [53], and selecting the best intervention to address clients' performance problems [42]. The scientific evidence-driven thinking process, conventionally called scientific reasoning, included diagnostic and procedural reasoning as used in medicine [49, 53]. Also, it was often mainly relied on by novice practitioners. The scientific evidence-driven thinking process reflected the scientific paradigm of the profession. In the modern occupational therapy paradigm, practitioners and students focused on the health condition, activity level/balance, and participation in daily occupations and/or occupational performance of clients [39, 44, 53].

The professional ethics-driven thinking process. Practitioners and students used the professional ethics-driven thinking process for focusing not on 'what could be done' in a therapy session, but on 'what should be done' [55] to determine priorities for execution in practice where a myriad of potential ethical dilemmas exists [43]. They used this therapeutic thinking process to find solutions when they were challenged with multiple ongoing and complex issues [43], or when clinical data contradicted their expectations and experience [43, 54]. A more recent phenomenon, the professional ethics-driven thinking process was used for decisions of professional ethics, because of changes within the structure of health care service delivery (e.g., the need to a focus on reducing costs), with competing interests of the health care system (e.g., prioritise the care given to clients), right of clients, and complicated choice of treatment (e.g., balance of benefit and risk) [39, 43]. Thus, the professional ethics-driven thinking process included dilemma recognition, dilemma analysis, self-monitoring to given standards and norms, and self-reflection [28]. Finally, it was used by practitioners and students to manage the influences of their personal contexts (e.g., values, knowledge, experiences, skills, and routines) [34, 39, 42, 49].

The practical contexts-driven thinking process. Practitioners and students used the practical contexts-driven thinking process to manage the influences of practical contexts when considering the therapeutic possibilities within a given occupational therapy setting [42, 48, 49]. Practical contexts included such aspects as time resources (e.g., time available for therapy sessions, an overall length of therapy programs, a therapist's schedule), space resources (e.g., physical environment, availability of equipment and tools, client familiarity with space), and social resources (e.g., social support network, health care insurance, rules within the facility) [34, 39, 42, 49]. These factors were the starting point of this thinking process. The practitioners and students used this therapeutic thinking process to integrate considerations of practical contexts into their decisions about intervention decisions or recommendations to clients [48, 49].

The client's narrative-driven thinking process. Practitioners and students used the client's narrative-driven thinking process when understanding clients as occupational beings and interpreting stories told by clients. They used this therapeutic thinking process to focus on the clients' life story and the meanings of occupations to clients. The client's narrative-driven thinking process facilitated creating prospects for and with clients and often together with clients' families [49, 51–53], to promote participation of clients and their families in occupational therapy [49, 53], and to revise interventions to meet the clients' needs [42, 44, 46]. In other words, occupational therapy students and practitioners used this therapeutic thinking process when they were focused on understanding clients' temporality (their past, present, and future), client's subjectivity and inter-subjectivity between clients and their families [42, 46, 49, 52, 53].

Professional thinking skills

'Professional thinking skills' of practitioners and students were core skills of occupational therapy practice [29, 30], and these skills were composed of (e) individual's thinking skills and, (f) interactive thinking skills.

Individuals' *thinking skills*. Practitioners and students used one's individual thinking skills for synthesizing or combining types of therapeutic thinking processes [45, 46, 49], which in the analysed articles were also referred to as mental manipulation or information processing skills [42, 45]. Differences in individuals' thinking skills were related to occupational therapists' accumulation of clinical experience [27, 41, 44], enhancing their various thinking directions (inductive and deductive approaches) and range, depth, precision, and speed of reasoning [39, 41, 55]. For example, while novice therapists were able to describe their CR, it appeared to be confined to the scientific thinking process [41]. Also, students could note clients' concerns but lacked an in-depth understanding of how disability had an impact on the life of individuals [47]. On the other hand, experienced therapists frequently weaved subjective and intersubjective perspectives into their understanding of clients [47], and they used intuitive thinking and complex reasoning types [39, 41, 45, 53]. Also, experienced therapists shifted rapidly and effortlessly from one form of CR to another (e.g., scientific to narrative reasoning) [44, 53].

Interactive thinking skills. Practitioners and students used the interactive thinking skills to plan, conduct and reflect on their practice [26, 50, 52, 55]. The interactive thinking skill was considered essential to interact with and better understand clients during face to face encounters [50]. It was 'know-how' that therapists used in the conduct of their work and how they derived a 'best' course of action with a client [38]. For example, experienced practitioners facilitated the delivery of meaningful occupational therapy experiences for clients through communication and collaboration with clients and other professionals in complex practice situations [35, 39, 42, 46]. Establishing these effective relationships were considered crucial to the success of the occupational therapy process [39, 50]. Besides, this thinking skill was based on individual knowledge and tacit knowledge, because it was also based on tacit understanding and habitual knowledge gained through experience [26, 41, 52].

Application contexts

The CR concept applied to clinical and non-clinical occupational therapy practice settings that include schools, workplaces, and communities. Practitioners and students used the CR concept as the language for the professional education of occupational therapists (pre-qualification education, continuing education). For example, using a CR-frame to organise clinical observations was an effective way to help entry-level occupational therapy students learn and apply the CR concept [42, 54]. Also, it was said that understanding and articulation of CR were desirable to facilitate the learner and educator communication and sharing of knowledge [28]. Thus, CR was recognised as having significant implications for occupational therapy practice and education [27, 41, 49]. However, the scope of the CR concept was limited to occupational therapy for clients as individuals and groups, but its application to practices for populations was not included in the analysed articles.

Antecedents

Antecedent included professional factors of occupational therapists and practical factors (see Figure 2). The professional factors included professional education, occupational therapists' expertise levels and personal contexts. Professional education included e-learning, experiential learning, and reflections in/on occupational therapy practice, which enhanced CR skills [26, 32, 36, 37]. Expertise levels included the knowledge and use of knowledge, perceived capability, and accumulated clinical experiences in specific areas [33, 34, 39, 41]. For example, CR was influenced by individuals' experiences, which different models of intervention with similar clients [55]. Expertise levels which related to the clinical experience in a specific area, influenced the types of CR preferred and the depth of understanding [38, 54]. Personal contexts included motivation, self-efficacy, beliefs, values routine, use of theory, and therapists' paradigms/world views [34, 39, 41, 49]. These personal contexts might affect the specific types of CR used individually, or of multiple CR types simultaneously [34]. The thinking processes used thus highly reflected personal contexts [27, 34].

The practical factors included clients' beliefs and values, relationships between clients and occupational therapy practitioners (or students), and characteristics of practical realities [29, 34]. Thus, CR was neither context-free nor value-free because it was influenced by a wide range of environmental, interpersonal, and intrapersonal factors and resources [45]. For example, factors affecting CR included client perceptions of what constitutes 'good therapy' [29]. The characteristics of practical realities included organizational, cultural, economic, social resources within occupational therapy practice [29, 34, 49], such as the power relationships of occupational therapy within the organization, reimbursement resources for treatment services, and the kinds of available space and equipment [49]. The client-therapist relationship and interaction were another important antecedent of CR because this affected the client's active participation in the therapeutic process and the use of narrative and interactive reasoning [34].

Consequences

Consequences included professional development and enhanced professional attitudes and behaviours as occupational therapists (see Figure 2). Professional developments consisted of professional excellence and proficiency, and awareness of the complexity of professional practice. This was mainly reported as the growth and development of students and novice therapists or as being different between novices versus experts [27, 44]. The use of CR language helped them develop more precise thought processes sooner and provided a vocabulary for self-assessment and improvement of their CR skills [44], and to communicate and share knowledge [28, 44]. Finally, CR helped to improve job satisfaction by making students and practitioners more aware of the complexity and depth of their work [44]. Thus, the usage of CR language was essential to professional development [50].

Professional attitudes and behaviours were included in the occupational therapy processes (e.g., implementation, modification, and explanation of occupational therapy plan, and collaboration with other professions), communication with clients in occupational therapy situations, and establishment of therapeutic relationships [28, 35, 42, 54]. CR helped practitioners and students understand the meaning of illnesses and disorders to clients [42], and enabled them to see possibilities for creating essential experiences for the client and to build on these experiences by showing clients a possible future [51]. So, professional attitudes and behaviours facilitated meaningful occupational therapy experiences with clients [39]. In other words, the use of CR enhanced the perception of the effectiveness of interventions [28]. Besides, the use of CR language helped to explain the rationales behind therapists' decisions to clients, family members, team members, and insurance carriers [44], and it helped to negotiate complex practice issues [35].

Discussion

A framework of the clinical reasoning concept

In light of the three historical phases of CR studies, as classified by Márquez et al., the data included in this study covered the exploratory phase (7 articles), transition phase (10 articles), and consolidation phase (13 articles) [8]. Therefore, we argue that the results of this concept analysis are valid from a historical perspective of CR research. The results of Rodgers concept analysis, which identifies attributes ('therapeutic thinking processes' and 'professional thinking skills'), antecedents ('professional factors' and 'practice factors'), and consequences ('professional developments' and 'professional attitudes and behaviours') were identified (see Figure 2), taken together provide a framework for the CR concept that not only explains types of CR but also explains how CR occurs.

As one dimension of the CR framework this study identified CR attributes as four 'therapeutic thinking processes' (Figure 2). These are comparable to previous studies that identify the types of thinking process as answers to the question 'what is CR' [9]. Schell theorizes eight types (scientific, diagnostic, procedural, narrative, pragmatic, ethical, interactive, and conditional reasoning) as forms of CR [15]. Based on our analysis of literature we propose that our four types of CR (four types of thinking processes) as an authoritative classification of the various CR types.

Also, we clarified a new dimension of CR, namely the attributes 'professional thinking skills' (Figure 2). To the best of our knowledge this is at best under-reported in CR literature. That we could produce this result of thinking skills may be reflective of recent professional issues in occupational therapy such as evaluation of internationally developed competencies, and promoting awareness among members of the public and other professional groups of what the profession does [22]. In relation to this, previous studies describe the difference between novice and expert as a difference in the types of reasoning used by therapists [15], but not as a difference in skill. However, it is important to distinguish expert and novice in terms of skills in addition to 'what' experts and novices perform [23]. The identified CR individuals' and interactive thinking skills affords one an additional dimension to clarify the development of CR skills from novice to expert.

In addition, the professional and practical factors, the CR antecedents, not only affect individuals, but also these affect the quality of CR [24]. Also, we clarified the professional developments and professional attitudes/behaviours that are CR consequences. On the other hand, conventional CR research topics focused on 'what CR is' and 'what promotes CR' [9, 25]. Thus, the antecedents and consequences identified in this study can be basic knowledge for informing educational approaches promoting the acquisition of CR.

Finally, the framework resulting from this study may be used to inform future research producing evidence of the efficacy of educational approaches and the authors are planning the development of a sufficiently reliable and valid assessment scale.

Limitations

The systematic search included English and Japanese articles, but because of random sampling by Rodgers' methodology [17], the analysed sample did not include Japanese articles (Table 2). However, as the number and scope of CR studies in Japan are still limited [12], we believe this did not affect the results of this study. Another methodological limitation was that we could not identify from the data, as per Rodgers' method for concept analysis [17], the exemplar as a typical example of CR. One possible reason is that the diversity of practice contexts in recent years [3] may have further affected the complexity of CR concepts identified in practice [25].

Conclusion

Our results identified that CR attributes were 'therapeutic thinking processes' and 'professional thinking skills,' the antecedents were 'professional factors' and 'practice factors', and the consequences were 'professional developments' and 'professional attitudes and behaviours.' The resulting framework of clinical reasoning can be the basis for developing pedagogies and assessment of clinical reasoning competence acquisition.

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CASE REPORT

Occupational Therapy in Integrative Visual Agnosia and Memory Disorder: A Case Report

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Abstract: Visual agnosia is a rare symptom in which the patient cannot recognize objects by visual perception. We report a case of integrative visual agnosia and memory disorder. A 70-year-old, right-handed man was diagnosed with cardioembolic stroke affecting the proximal left posterior cerebral artery. He had a short-term memory disorder. He could not name and explain how to use objects, or read characters, but could discriminate between objects to some extent and draw copies of simple figures. His recognition by tactile sense was comparatively preserved. He needed complete assistance with his life in the hospital ward. We provided him with training using preserved tactile sensation by errorless learning. We arranged the environment around him to promote his memory of the position of objects and to avoid misuse of daily objects. Improvement in the visual agnosia and memory disorder was slight. He became independent with his life in the hospital ward. However, he needed assistance in a new environment, such as an unfamiliar lavatory. The results suggest that a patient with visual agnosia may become independent early by appropriate training, despite insufficient visual perception and memory function. In our patient, the intervention period was too short to generalize the effects of training. Additionally, the memory disorder might have become an obstacle for generalization. Further improvement in visual perception, independence in daily activities, and quality of life, will need continuous support.

Keywords: visual agnosia, memory disorder, occupational therapy

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Introduction

Visual agnosia is a form of cognitive deficit in which the patient cannot recognize objects by visual perception. Visual agnosia is traditionally divided into two types, apperceptive visual agnosia and associative visual agnosia [1]. Humphreys advocated another type, integrative visual agnosia [2].

Integrative agnosia is thought to be an impairment of the perceptual integration that shapes elements into coherent wholes [2]. A patient with integrative visual agnosia can discriminate and draw copies of objects they see, but they cannot recognize them [2].

Visual agnosia is a rare symptom with few reports about the rehabilitation process. Here, we describe a patient with integrative visual agnosia and memory disorder induced by cardioembolic stroke.

The publication of this report was explained to the patient and his family with a written document, and informed consent was obtained from a family member.

Case Report

The patient was a 70-year-old, right-handed man who complained of headache and vision problems when he presented to our hospital. He was not paralyzed and did not have a sensory disorder. He had right homonymous hemianopsia, slight aphasia, memory disorder, and visual agnosia. His language was fluent, and he could have daily conversations with mild difficulty in finding words. He was diagnosed with cardioembolic stroke at the proximal left posterior cerebral artery by magnetic resonance imaging (Fig. 1).

He had a short-term memory disorder where he could not remember recent events but could partially learn repeated information. His visual perception was generally impaired and Visual Perception Test for Agnosia (VPTA) [3] results are shown in Fig. 2 left half. He could not name or explain how to use objects, or read

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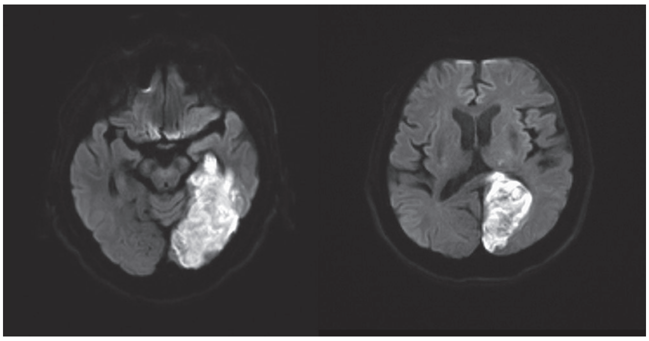

Fig. 1. The diffusion weighted image of brain

characters, but could partially discriminate objects and draw copies of simple figures after a long time. Recognition by tactile sense was comparatively preserved, as he could occasionally use objects properly when he touched them. He needed assistance and guidance with eating and personal hygiene since he could not recognize or use the appropriate objects, and with using the toilet because he could not reach the lavatory and wandered in the ward. Before the onset of stroke, he was completely independent in his daily life.

We started occupational therapy on the second day of admission. We focused on his preserved tactile function and that he could learn information with repetition. We provided him with therapy so he could perform activities of independent daily living by compensating with tactile sensation. We helped him learn how to eat, maintain personal hygiene, and toileting by repeatedly practicing in the hospital ward. We made him touch objects required for eating and personal hygiene, and learn strategies to aid recognition (Fig. 3 left). Further, we identified the position of objects needed for eating and personal hygiene at the table to promote memory and avoid misuse (Fig. 3 middle). For toileting, we made him touch the toilet bowl, toilet paper, and flush button repeatedly so he could recognize and use them by tactile sensation (Fig. 3 right). We identified the location of the toilet early in his therapy so the effect of therapy could be generalized to an early period in his hospital stay. We used errorless learning so whenever he made a mistake, we would stop as soon as possible and guide him to the correct way. His symptoms and assistance required were described to the nursing staff so he could continue his practice. We provided occupational therapy, physical therapy, and speech and language therapy 5 days a week.

His word finding difficulties improved, while the memory disorder remained. He was able to roughly recall daily events and practice the contents during therapy. His VPTA score improved (Fig. 2 right half), although visual agnosia persisted and other parameters were unchanged. He could independently eat, maintain personal hygiene, and recognize objects on the table without touching. He was able to reach the predetermined lavatory and excrete without requiring tactile sensation for recognition or assistance. While he became independent in his daily life in the limited environment of the hospital ward, assistance was needed in new environments such as an unfamiliar lavatory.

The patient was transferred to a rehabilitation hospital 36 days after initial admission for further treatment.

Discussion

Based on the medical evaluation and symptoms, the patient was considered to have integrative visual agnosia, and his damaged lesion corresponded with previous studies of integrative visual agnosia [2, 4].

While there are few studies about rehabilitation of patients with visual agnosia, compensatory strategies are beneficial [5]. Further, errorless learning is an effective approach for patients with memory disorders [6]. Based on the patient's spontaneous functional recovery, we used a compensatory approach and errorless learning to improve his independence in daily life. Our results suggest that patients with visual agnosia can become independent early through appropriate training, despite impaired visual perception and memory function.

However, the patient needed assistance in a new environment. Zihl reported a patient with integrative visual agnosia who trained for a visual search task and could generalize the effect to untrained tasks [7]. In contrast, Behrmann reported a patient who trained for a visual recognition task and could generalize to other tasks [8]. The current intervention period was limited to an acute phase, which could be considered too short to generalize the effect of training on his long-term recovery. Memory disorders may also be an obstacle for generalization in a new environment.

Few reports exist on the improvement in daily object recognition during long-term follow-ups [9, 10]. While our patient became independent in his daily life in the hospital ward, he needed further improvement. After discharge from the rehabilitation hospital, continuous support will be needed to improve his visual perception, independence in daily activities, and quality of life.

Conclusion

We have described a patient with integrative visual agnosia and memory disorder. The patient became independent early in his hospital ward stay by using preserved tactile function training. While the effects of this training did not generalize to a new environment,

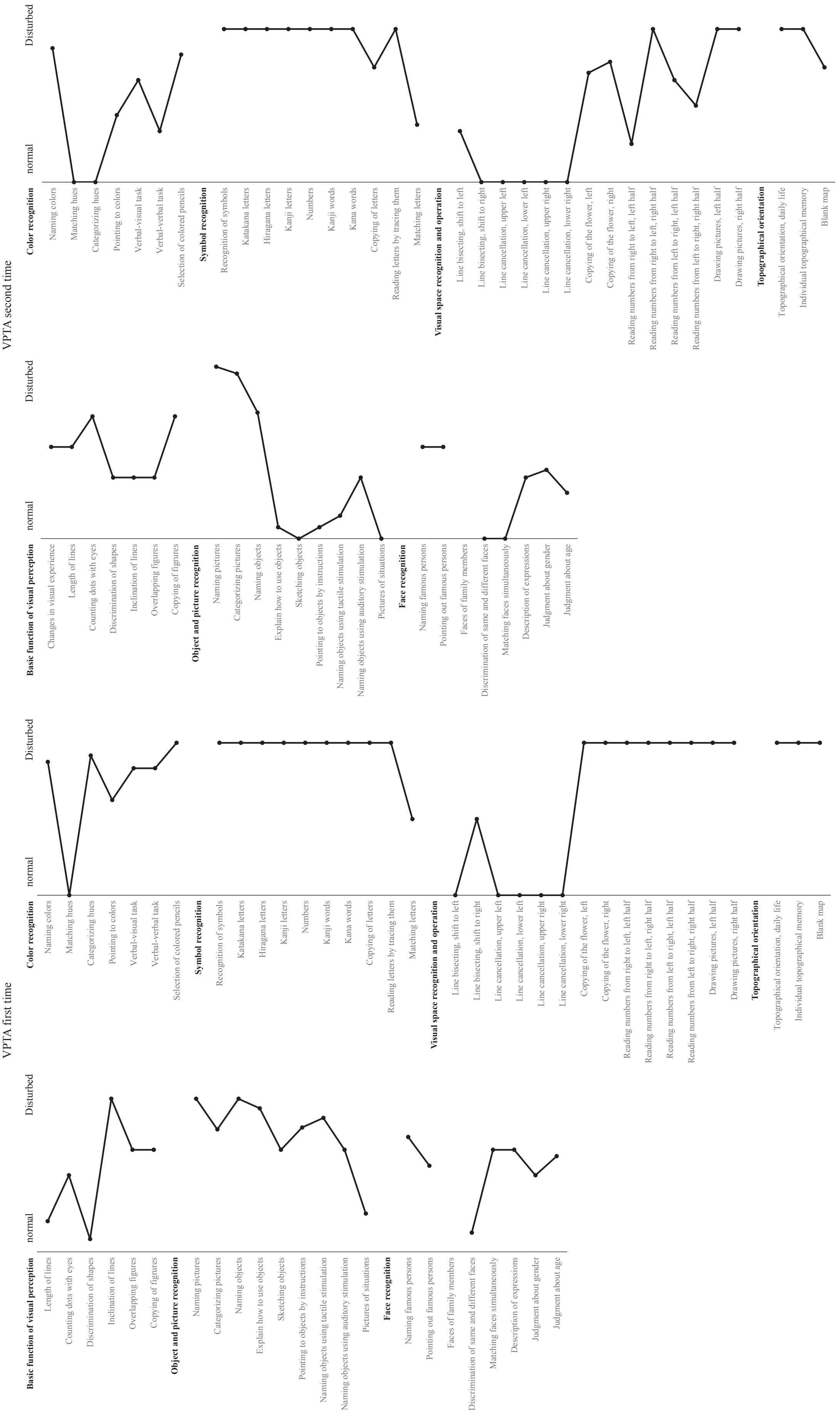

Fig. 2. The results of VPTA

Fig. 2. The scene of occupational therapy and environmental arrangement

this could be due to the short intervention period and his memory disorder.

Declaration of Conflicting Interests

The author declares that there is no conflict of interest.

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Analysis of Responses of a Healthy Subject and Subjects with Cerebellar Hemorrhage and Parkinson's Disease in Eye–Hand Coordination Pointing with Pencil Test

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Abstract: Purpose: The objectives of this study were to quantitatively analyze the reaction patterns of ataxia and Parkinson's disease cases that are cognitively harmless and to examine the characteristics of pathological reactions, such as ataxia, rigidity, and motor control, compared to the patterns of a healthy subject.
Methods: An eye–hand coordination pointing with pencil test (EHCPPT) app was developed that requires patients to tap a bullseye target with a pencil for screening testing. This app is intended to be used during regular check-ups of the elderly to help them maintain their home lifestyle through self-management of health. The EHCPPT consists of two tasks, both of which require the patient to tap a bullseye target as a test of eye–hand coordination in response to a stimulus sound. In one task, the sound is repeated rhythmically; in the other, it is generated irregularly and infrequently. The EHCPPT app is based on the "oddball paradigm" experimental design and can be administered in just a few minutes to measure the time lag between the sounds and taps as well as the distance between the target and tapped locations automatically.
Results: The data generated when the app was used by a healthy subject, an ataxia patient, and a patient with Parkinson's disease were analyzed. In each case, the data exhibited a distinctive pattern.
Conclusion: The EHCPPT app is simple and fast and shows potential as a screening test.

Keywords: eye–hand coordination, pointing test, tapping test

(*Asian J Occup Ther* **17**: 31−35, 2021)

1. Introduction

A finger-tapping test [1], a type of tapping task, is used in neurophysiological research and for the simple clinical evaluation of Parkinson's disease [2, 3] and cerebrovascular disorders [4, 5]. In recent years, researchers have begun exploring how finger-tapping relates to age and cognitive function as well as to the motor control functions of the hand and arm; studies have also reported relationships with attention capacity and short-term memory [6, 7]. A center-of-target tapping task is, by its nature, highly sensitive to coordinated movement; therefore, we believe that it can be used to evaluate poor physical yield and cognitive function. However, during examinations of elderly people, this test may produce poor or widely varying results caused by patient unfamiliarity or nervousness.

According to Kropotov, the oddball paradigm is generally considered an "active paradigm." In other words, it is a behavioral task that requires an action from the subject, such as pressing a button in response to deviants or silently counting the number of deviants [8]. Unlike the traditional speed test, which is administered under strict conditions, we opted for a bullseye-target tapping task. Therefore, we created an eye–hand coor-

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Table 1 Subject characteristics (case 2: ataxia; case 3: Parkinson's)

	Right Grip	Left Grip	TUG	GDS	SF8	MMSE	CDT	TMT-A	TMT-B	BI	Lawton
Case 2	11.5 kg	10.5 kg	14 s	3	9	28	9	250 s	321 s	80	2
Case 3	11.4 kg	8.7 kg	10 s	3	10	27	9	269 s	350 s	75	3

TUG: Timed up to go test; GDS: Geriatric depression scale 15; SF8: MOS 8-Item Short-Form Health Survey; MMSE: Mini-Mental State Examination 0 (severe) to 30 (normal), cutoff 23 points; CDT: Clock drawing test, 0 (severe) to 5 (normal), dementia at 3 points or less; TMT-A, TMT-B: Trail Making Test age 64 years and under, A 84.5 s, B 117.0 s; BI: Barthel Index; Lawton: Lawton's IADL (instrumental activities of daily living).

dination pointing with pencil test (EHCPPT) app. This app is available in both iOS and Android versions. The study investigated the usefulness of the test based on the contrast in performances between a healthy individual and patients with ataxia and Parkinson's disease.

2. Methods

2.1 Subjects

Case 1: Healthy subject: 23-year-old man; 16 years of education; working in the medical field.

Case 2: Ataxia patient: 69-year-old man; 16 years of education; 3 years since onset of cerebellar hemorrhage; scale for the assessment and rating of ataxia (SARA) score [9] of 11/40 points.

Case 3: Parkinson's disease patient: 70-year-old woman; 15 years of education; 5 years since Parkinson's onset; Hoehn and Yahr IV, Life Disability Classification II.

Cases 2 and 3 received regular home care from visiting nurses. No dementia was observed. A small level of assistance was required in their activities of daily living (ADLs) and instrumental activities of daily living (IADLs).

2.2 Measurement methods

2.2.1 Patient position during examination and measurement

The examination was conducted with the subject seated in a chair or wheelchair. The subject sat with their nondominant hand in a fist on the desk, forming a fist-sized barrier between their body and the top of the desk, and then performed the test with the dominant arm resting on top of the nondominant hand. The subject practiced tapping the tip of the stylus pen from a distance of at least 10 cm from the screen for each tap. During the examination, the bullseye-target tapping task was presented to the subject via the EHCPPT app running on an Apple iPad tablet (MP2F2 J/A). The subject held a stylus, which was used as the input device, in their dominant hand and tapped the bullseye target at the center of the concentric circles on the screen in synchrony with the stimulus sounds. Before the measurement, the researcher ran the application several times and made practice measurements.

2.2.2 EHCPPT app

The EHCPPT is an eye–hand coordination test that requires the subject to tap a bullseye at the center of six concentric circles in synchrony with stimulus sounds played at regular intervals. The details of the task are as follows. In Task A, the subject must tap in time with a low-pitched (1 kHz) tone played 60 times in 1 s intervals. In Task B, 65 low-pitched (1 kHz) tones and 35 high-pitched (2 kHz) tones are played at random, and the subject must tap only after hearing the high-pitched tone. Prior to this measurement, five healthy people in their 20s were measured, and the test–retest reliability was 0.95 on average (0.91–0.97).

2.2.3 Measurement data and processing

The app obtains the (x, y) coordinates (in pixels) of the iPad screen location at which the subject taps the stylus and converts them into (X, Y) coordinates (in mm) relative to the origin at the center of the bullseye. The coordinates are then stored along with the time at which the stylus makes contact. The measurement data are saved as a CSV file. For each tap of the stylus, the app measures the "deviation from target" (in mm), that is, the distance of the tap from the center of the bullseye, and the "simple reaction time" (in seconds), that is, the time lag between the tap and stimulus sound.

The experimenter counts an "omission error" (OE) if the subject fails to tap when the stimulus sound is played and a "commission error" (CE) if the subject taps by mistake.

2.3 Ethical considerations

This study was conducted with the consent of the subjects and the approval of the ethics review boards of Kyoto University Medical Center (approval number R1379) and Fuchinobe General Hospital (approval number 19-006).

3. Results

Table 1 shows the background data for cases 2 and 3. Figures 1-1, 2-1, and 3-1 summarize the data obtained

(1)

Task	Parameter	Case 1: Healthy	Case 2: Ataxia	Case 3: Parkinson’s
Task A	Deviation from target (mm)	0.11± 0.06	0.14± 0.12	0.21± 0.10
	Simple reaction time (s)	0.14± 0.06	0.52± 0.28	0.57± 0.15
	Omission error (count)	0	0	0
	Commission error (count)	0	15	5
Task B	Deviation from target (mm)	0.01± 0.05	0.28± 0.28	0.16± 0.07
	Simple reaction time (s)	0.55± 0.05	0.65± 0.12	0.78± 0.34
	Omission error (count)	0	24	24
	Commission error (count)	0	2	3

(2)

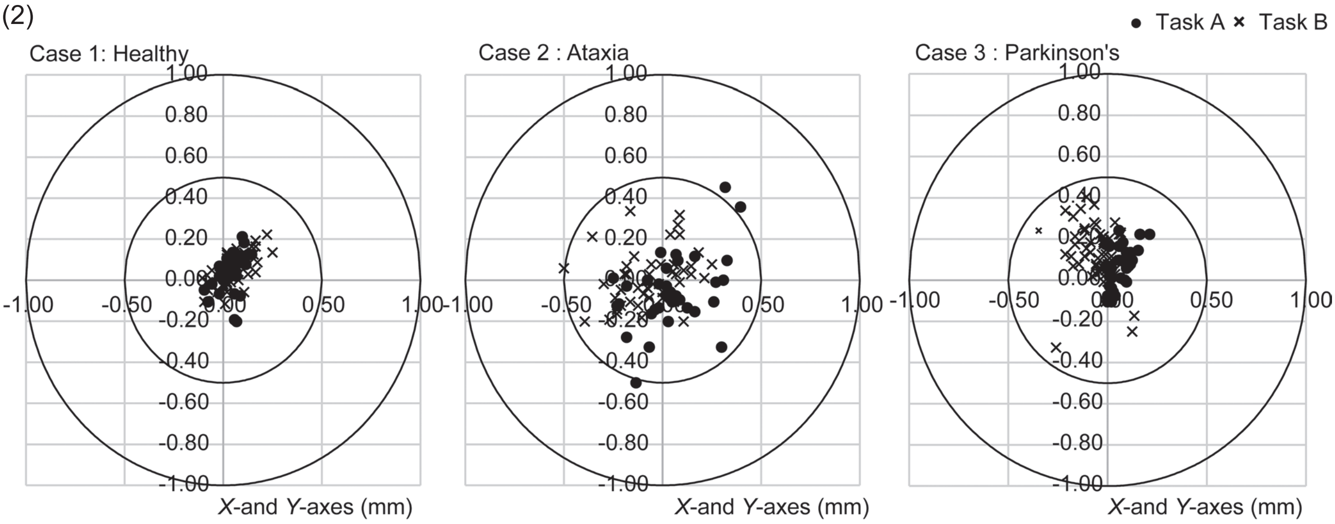

Fig. 1. (1) Results summary, task A, task B. (2) Results of deviation from target (mm).

using the EHCPPT app and the number of omission and commission errors for each task. Figures 1, 2, and 3 show the results over time for cases 1, 2, and 3, respectively.

As the results show that OE was 0 in all cases in task A, but CE was 15 and 5 in cases 2 and 3, respectively. In contrast, in task B, OE was 24 in both cases 2 and 3, and CE was 2 and 3 in cases 2 and 3, respectively (Fig. 1-1). Regarding the deviation from target, in case 2, the patient results in tasks A and B were observed to spread by two to three times more than those of the healthy subject, and in case 3, the task B results were spread by about two times more (Fig. 1-2). Regarding the degree of deviation from the target of cases 1 and 2, the initial deviation in patient results was small in task A compared to in those of the healthy subject, but increased in the latter half, resulting in more CE. The results were large at the beginning of task B and had many OEs (Figs. 1-1, 2-1). Regarding simple reaction time, in task A, this was a characteristic measurement result that repeated a cycle in which the deviation increased with each iteration. In task B, the measurement results were quite difficult (Figs. 1-1, 2-2).

Regarding the degree of deviation from the target of cases 1 and 3, there was a deviation in the patient results in task A compared to those of the healthy subject, and the deviation was large, especially in the latter half. There was little deviation from task B (Figs. 1-1, 3-1). Regarding simple reaction time, in task A, there was a large fluctuation in the first half, but subsequently there was a constant deviation. In task B, there was a large deviation and there were many OEs (Figs. 1-1, 3-2).

4. Discussion

SARA is a semiquantitative evaluation method that is easy to use in daily medical practice; however, its upper-limb ataxia outcome measures have been reported to vary widely across evaluators [9]. For Parkinson’s disease, the severity classification of Hoehn and Yahr is widely used; further, the Unified Parkinson’s Disease Rating Scale (UPDRS) is a standard evaluation index the reliability and validity of which have been verified, although this evaluation is time-consuming [10].

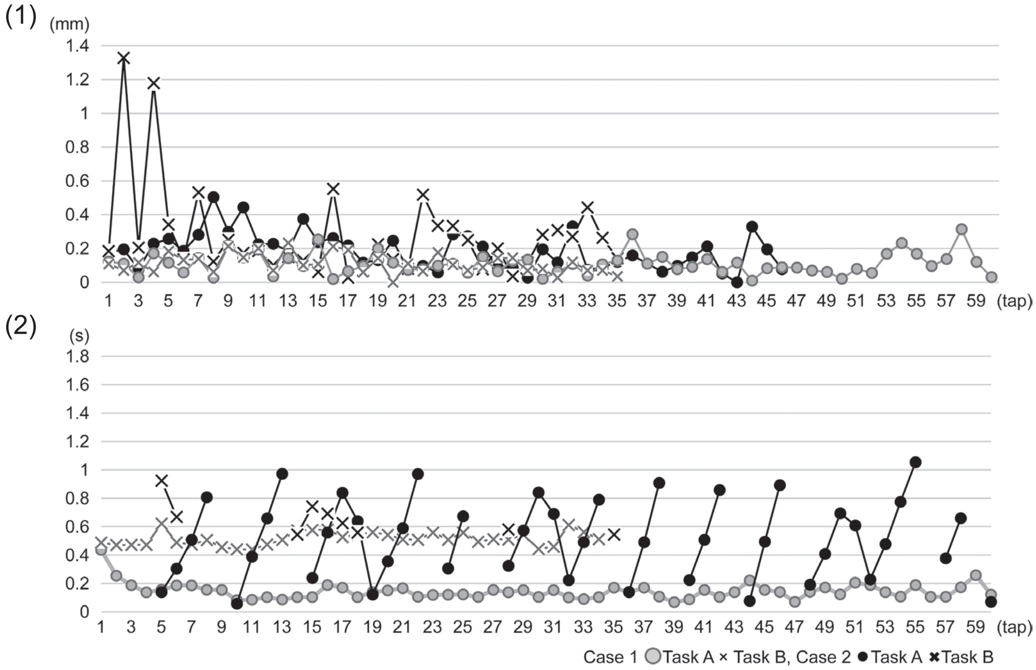

Fig. 2. (1) Degree of deviation from target (mm). (2) Simple reaction time (s) (case 1: healthy and case 2: ataxia).

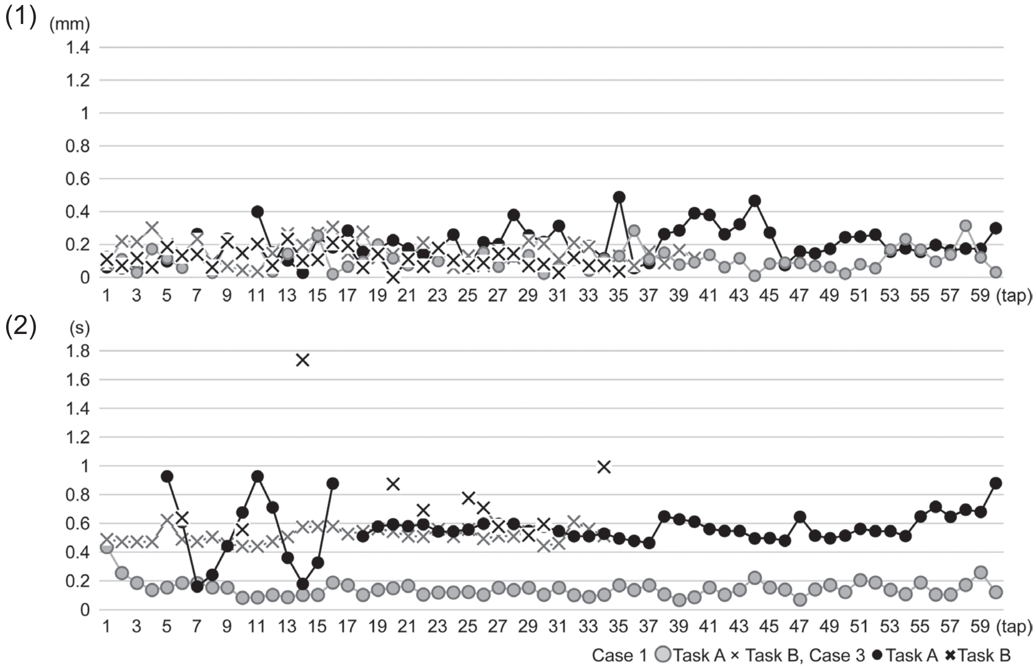

Fig. 3. (1) Degree of deviation from target (mm). (2) Simple reaction time (s) (case 1: healthy and case 3: Parkinson's).

In contrast, the EHCPPT measurements performed in this study were simple and rapid. Furthermore, our results suggest that the test may reveal disease-specific characteristics. In the ataxia case (Table 1, Fig. 2), the deviation from the target in task 2 was around twice that in task A, and the time lag was around 1.5 times greater. Task A requires movement control to match a constant rhythm. Because the patient suffered from a rhythm disorder, we expected them to show more erroneous reactions, difficulty with time control, and longer simple reaction time. Furthermore, we noticed that they tried to control their deviation from the target using strategies such as pressing their elbow to their body for stability, which resulted in a certain amount of deviation and early tapping. Task B required reaction to one sound at a time and therefore was less susceptible to the effects of rhythm disorders. However, the subject seemed to have faced difficulties in controlling the initiation of each motion and was unable to react in time before the next stimulus sound.

In the Parkinson's case (Table 1, Fig. 3), the deviation from the target in task B was less than that in task A, whereas the time lag (including standard deviation) was around 1.5 times greater. In task A, no omission errors were recorded, and the tapped area was smaller than that in the ataxia case. This patient may have faced difficulties in initiating motions independently but not in reacting to the stimulus sound. In task B, their muscle rigidity may have led to decreased deviation from the target but increased lag time from detection to reaction.

The study results suggest that disease-specific characteristics exist; however, the small sample size and the likelihood of individual differences in the use of spatiotemporal and spatial strategies to tap the target make this suggestion difficult to prove. In future work, in addition to increasing the number of cases, we will examine different parameters, for example, by calculating the average double product or comparing the tapped areas. We would also like to perform further investigations regarding whether the developed app can be used as a drug efficacy index, for example, for describing disease severity or on–off syndrome.

5. Conclusion

We developed an EHCPPT app as a screening test that requires patients to tap a bullseye target and performed measurements for three cases: a healthy subject, an ataxia patient, and a patient with Parkinson's disease. This app enables the assessment of disease-specific characteristics, suggesting that it may be useful as a screening test.

Conflict of interest disclosure

There are no conflicts of interest that need to be disclosed in connection with this research.

Acknowledgement

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■ORIGINAL ARTICLE

Effectiveness of the Parent-Child Social Skills Training Program for Children with Developmental Disorders: A quasi-experimental design

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Abstract: Purpose: This study explored the effectiveness of a new parent-child social skills training program addressing social skills and parenting stress among children with developmental disabilities and their parents.

Methods: Participants were 15 children (14 boys, 1 girl; 7–9 years old) with diagnoses related to developmental disability and a Full Scale IQ $\geq$ 70 and 17 parents (2 fathers, 15 mothers; 34–51 years old). Each session of this program lasted 110 minutes and occurred every 1–3 weeks for about 2 months. Social skills were measured by self-evaluation (Social Skills Scale for Elementary School Children, Social Skills Self-Rating Scale for Adults: SS-A), information provider's evaluation (Vineland Adaptive Behavior Scales, Second Edition, Japanese version: VABS-II), and practitioner's evaluation (Role-Play Test for Children and Parents: RPT-CP), and parenting stress was measured with the Parenting Stress Index (PSI) before, immediately after, and at a 3-month follow-up after intervention.

Results: VABS-II scores were significantly lower after the intervention ($z = -2.58$, $p = .011$, $r = -.65$). Children's RPT-CP scores also improved ($z = 1.705$, $p = .08$). The scores on SS-A, parents' RPT-CP, and PSI improved significantly at follow-up ($z = 2.832$, $p = .005$, $r = .71$; $z = 2.91$, $p = .004$, $r = .71$; $z = -2.34$, $p = .019$, $r = -.57$), and parents' RPT-CP scores were significantly higher at follow-up than post-intervention ($z = 2.333$, $p = .02$, $r = .58$).

Conclusions: This program effectively improved parents' social skills after the intervention, and parenting stress decreased at follow-up.

Keywords: developmental disorder, social skills training, parent, communication, elementary school

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Introduction

The Manual for the Diagnosis and Statistics of Mental Disorders, 5th Edition [1] classifies attention deficit hyperactivity disorder, autism spectrum disorder (ASD), and developmental coordination disorder as neurodevelopmental disorders described as "hidden" neuro-biological developmental disorders with high morbidity. Their prevalence is 5–6%, and they are some of the most common disorders affecting children of school age [1]. Approximately 6.5% of Japanese children have neurodevelopmental disorders [2], and many are enrolled in regular classes. Their social skills may be slightly below average in preschool, but difficulties establishing interpersonal relationships become evident in elementary school [3]. As a result, children with neurodevelopmental disorders experience isolation and rejection from peers, often leading to learning difficulties, interpersonal difficulties, school refusal, and depression. Some core deficits associated with ASD improve, but social deficits show relatively little improvement as the child ages [4]; therefore, social skills are prioritized as treatment targets [5, 6].

Parents of children with neurodevelopmental disorders, including ASD and mild intellectual disability, experience substantial childcare stress resulting from

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the child's behavior [7, 8] and are more depressed than parents of typically developing children [9, 10]. Parental mental health is related to parenting behavior [11], which in turn affects child development [12]. A study on the resilience of mothers of children with ASD [13] found that those with good social adaptation showed similarities in parenting, indicating that mothers can communicate with their children, find strengths in their children, and help them improve their skills. Kurani reported that when parents of children with severe intellectual disabilities actively worked with their children with an emphasis on social skills, children's development was promoted [14]. In other words, it is necessary to provide a program for the parents to promote the development of children with neurodevelopmental disorders and help them acquire more effective communication skills. Parents and children can use social skills at home to communicate with each other, and can it also be applied at school as the next step.

Social skills training (SST) can help children with neurodevelopmental disorders manage difficulties in interpersonal relationships and acquire social skills [15, 16]. The role of parents in SST for children with neurodevelopmental disorders has often been indirect, such as helping children use their learned skills [17, 18]. To enhance the effects of SST interventions, it has been suggested that parents be included in SST [19].

We have developed a parent-child SST program for learning social skills [20] for parents and children to learn the same target skills, do homework, and role-play to improve the target skills. This study aimed to examine the effects of this parent-child SST program on children with neurodevelopmental disorders and their parents, focusing on social skills and parenting stress.

Methods

Study Design

A quasi-experimental design (one group, before-and-after design) was used, and assessments were conducted at three time periods: before and immediately after the intervention, and at 3-month follow-up. Five occupational therapists at Bunkyo Gakuin University conducted the trial from August 2016 to March 2019. Ethical approval was granted from the ethics committee of the Faculty of Health Science Technology, Bunkyo Gakuin University.

Participants

Participants were children with developmental disabilities and their parents. Inclusion criteria included children in grades 2–4 with diagnoses related to neurodevelopmental disorders, with a Full Scale Intelligence Quotient (FSIQ) ≥ 70 on the Wechsler Intelligence Scale for Children-Third Edition. Participation was available to all parents. Open recruitment was conducted through the Bunkyo Gakuin University website, which included a program overview. Applicants filled out an application submitted by fax or email. The contents of the application form were age, grade, gender, diagnosis, FSIQ, and elementary school type. Those meeting the inclusion criteria were notified by email of the pre-intervention evaluation schedule. At the time of the pre-intervention evaluation, parents provided informed written consent. Information on the study was also given to the children, who provided written assent. Participants were free to withdraw from the study without consequence, in line with ethical considerations in research with human subjects in Japan.

A total of 16 children and 18 parents initially participated in the SST program. One child and one parent only participated twice and were excluded. Consequently, the participants were 15 children (14 boys, 1 girl; 7–9 years old) and 17 parents (2 fathers, 15 mothers; 34–51 years old) who completed the whole program (Table 2). Before the parent-child SST program, children were reported to have problems communicating with peers, cried, and were isolated. The age range was chosen because children around age 9 can objectively perceive themselves, but do not yet have a positive awareness of themselves, and tend to have a sense of inferiority. Therefore, promoting children's understanding of the viewpoint of others, respect for oneself and others, and compassion for others is important in this age. Therefore, we targeted children around age 9 (2nd–4th graders), in accordance with national guidelines by the Ministry of Education, Culture, Sports, Science and Technology [21].

Parent-Child SST Program

The program was conducted with six groups of two to four children. Each session lasted 110 minutes and occurred every 1–3 weeks for about 2 months (six sessions per group). The SST for children comprised two parts: learning time (to learn skills) and playtime (to apply skills). After observing children's learning time, the parents participated in a session for themselves. There were five SST target skills: seeing and recognizing, expressing positive feelings, making requests, expressing unpleasant feelings, and listening to others (Table 1), based on previous studies implementing programs for parents and children [17, 18, 22], basic skills in social skills education [23], and four basic skills by Bellack [16]. The first author, an occupational therapist certified as instructor of the Japanese Association of Social Skills Training (JASST), was in charge as the

Table 1 Content and Target Skills for the Six Sessions of the Parents-Children Social Skills Training Program

Session	Children SST		Parents SST
	Leaning Time	Playtime	
1	Orientation Looking closely and noticing	Picking up plastic bottle	Orientation Looking closely and noticing
2	Expressing positive feelings	Giant trump nervous breakdown	Expressing positive feelings
3	Making requests	Borrowed games	Making requests
4	Expressing unpleasant feelings	Pretending	Expressing unpleasant feelings
5	Listening to others	Exploration games	Listening to others
6	Production activities using skills with parents and children, farewell party		

Note. SST, social skills training.

Table 2 Children and Parents Demographic Characteristics

	n	*M* (*SD*)	Range
Children's age (years)	15	7.6 (0.8)	7–9
Boys	14		
Girls	1		
Diagnosis			
ASD	6		
PDD	3		
ADHD	2		
Mild intellectual disability	1		
Down's syndrome	1		
Soto's syndrome	1		
No diagnosis	1		
WISC-II FSIQ		95.3 (15.3)	76–122
School			
Normal class	15		
Use of program of resource rooms	3		
Parents' age (years)	17	44.1 (5.1)	34–51
Mothers	15		
Fathers	2		

Note. ASD, autism spectrum disorder; PDD, pervasive developmental disorder; ADHD, attention-deficit hyperactivity disorder; WISC-III FSIQ: Wechsler Intelligence Scale for Children-Fourth Edition

leader of the learning time in the SST for children and the SST for parents, and the co-leaders of the sessions were two occupational therapists who had completed a beginner training course in the JASST. In the children's program, three to four occupational therapists who specialized in the treatment of children with developmental disabilities participated as auxiliary staff.

Each session of the learning time involved a warm-up exercise, reporting homework, target skill learning, and explanation of the next homework. As a warm-up, children engaged in light exercise such as tug-a-war aimed at enhancing concentration for learning. To learn the target skill, an explanation of the skill's significance was given, and then a "bad model" (i.e., unfavorable behavior) was performed by staff. The children confirmed the points to be improved, and then a "good model" (i.e., preferable behavior) was presented. After the model presentations, children performed the role-play themselves, received feedback on the good points, and advice for improvement from the participants and staff. They then engaged in another role-play. Finally, homework was set up to use the target skill every day. The children were to practice the skills at home first, and then at school and in the community. Records were maintained on homework sheets, and parents were encouraged to help their children complete them.

The leader of the SST playtime for children was the co-leader of the learning time who also specializes in treatment of children with developmental disabilities. During the SST playtime for children, the staff actively reinforced and encouraged the use of the target skill in play, particularly when it was not being used. Furthermore, a table was presented on a large sheet of paper to provide visual feedback regarding the usage of the target skill in play.

In the parent program, after observing the children's learning time for the purpose of preparing them for skill learning, they practiced the skills in the same way that the children learned them. The differences in the learning time were the content of the warm-up (parents talked about what made them happy recently to have a positive focus), model presentation (only "good model" presentation), and homework (helping with the child's homework and recording the responses and impressions of using the learned skills in their life). The staff actively provided positive feedback after homework reports and role-plays, and praised the challenge of acquiring skills.

In the final session, the target skills were reviewed, and craft activities were completed by parents and children using these skills. To reinforce skill usage, children received a sticker as a token from their parent when they used learned skills; when skills were used by parents, they received stickers from the staff.

Outcome Measures

In the evaluation of social skills, it is necessary to measure the learned target skills accurately and assess general social skills widely and comprehensively [24]. Therefore, we selected methods for measuring social skills by referring to Aikawa's [25] three types of social skill evaluation: self-evaluation (e.g., self-report and self-monitoring), information provider's evaluation (e.g., parents and peers related to children), and practitioner's evaluation (e.g., interview, behavior observation, and role-play methods). In this study, children's social skills were measured through self-evaluation, information provider's evaluation, and practitioner's evaluation, while parents' social skills were assessed through self-evaluation and practitioner's evaluation. Evaluations were performed at three time points: before and immediately after the intervention, and at 3-month follow-up.

Self-Rating Scale of Social Skills for Elementary School Children. The Social Skills Scale for Elementary School Children (SSS-E) [26], a 15-item self-rating questionnaire using a 4-point Likert scale, was used for self-evaluation of social skills by the children. The SSS-E focuses on two main aspects of social behavior: the extent to which the respondent has acquired the actions necessary to maintain smooth human relationships and the extent to which he/she has not acquired actions hindering human relationships. Higher scores on the SSS-E indicate greater skills. The SSS-E was created for typically developing elementary school children; the instruments' validity and reliability were verified by Shimada [26].

Social Skills Self-Rating Scale for Adults. The Social Skills Self-Rating Scale for Adults (SS-A) [27], a 35-item questionnaire using a 4-point Likert scale to assess social skills, was used to evaluate the social skills of the parents by self-evaluation. Higher scores on the SS-A indicate greater skills. The SS-A was created for university students, and Aikawa et al. [27] examined its validity and reliability.

Vineland Adaptive Behavior Scales, Second Edition. The Japanese version of the Vineland Adaptive Behavior Scales, Second Edition (VABS-II) [28] was used for the information provider's evaluation of the social skills of children. It involves a semi-structured interview with parents, and scores are calculated on a 3-point Likert scale. The regional standard score of VABS-II has a mean of 100, a standard deviation of 15 and is normally distributed. The adaptive behavior subscale (VABS-A) evaluates three areas: interpersonal relations, play/leisure time, and coping skills. The higher the score, the more desirable the behavior. The maladaptive behavior subscale (VABS-MA) examines internalized and externalized maladjusted behavior. The higher the score, the less desirable the behavior.

Role-Play Test for Children and Parents. The Role-Play Test for Children and Parents (RPT-CP), developed by the authors based on a role-play test for individuals with schizophrenia [29], was used for practitioners' evaluations of social skills. The test evaluates participants' social skills through interaction with the examiner. The RPT-CP comprises five scenarios, including one practice item and four skills—listening to others, making requests, expressing positive feelings, and expressing unpleasant feelings—for each child and their parents. The evaluation consists of 13 items in the areas of situational recognition (e.g., place, partner, facial expression, purpose of the scene), coping skills (e.g., proposing coping method, correcting coping method), subjective evaluation (e.g., self-efficacy, anxiety), and transmission skills (e.g., gaze, facial expression, voice change, social validity, achievement of purpose). The RPT-CP is acted out between an examiner and the child/parent and videotaped for subsequent scoring. The RPT-CP typically takes 15–20 minutes for each participant. The examiner was the first author, but in order to avoid information bias, we asked another occupational therapist and two clinical psychologists to be evaluators. The evaluators were selected based on their experience as SST leaders. They watched the video to evaluate situation recognition and coping skills using a 3-point Likert scale, and subjective evaluation and transmission skills on a 5-point Likert scale. A total score for 11 items was calculated, excluding the subjective evaluation from the analysis because the purpose of the evaluation was to obtain objective data regarding skills. When the inter-rater reliability of the RPT-CP was assessed, the intraclass correlation coefficient was .858, confirming high inter-rater reliability.

Parenting Stress Index-Japanese Version. The Japanese version of the Parenting Stress Index (PSI) [30] was used to assess parental stress. It is a 78-item questionnaire using a 5-point Likert scale that assesses two domains of parental stress: child domain (PSI-C), which evaluates the adaptability of the child and how much he/she annoys the parents, and the parent domain (PSI-P), which measures the competence of the parents and their attachment to the child. A total score can also be calculated by adding the two domain scores, and the higher the score, the higher the stress.

Statistical Analysis

The total scores on the RPT-CP, SSS-E, VABS-A, VABS-MA, and SS-A, and the total score and subscale scores of the PSI before and after the intervention and at

Table 3 Outcome Measures at Pre/Post Treatment and 3-Month Follow-Up

Measure	Pre-treatment *M* (*SD*)	Post-treatment *M* (*SD*)	Follow-up *M* (*SD*)	Pre to post *p*-value	Post to follow-up *p*-value
SSS-E	36.4 (5.8)	37.5 (5.3)	36.9 (6.9)	.343	.932
SS-A	86.4 (14.1)	87.8 (15.0)	93.2 (12.5)	.244	.004
VABS-II					
VABS-A	75.3 (10.4)	72.9 (9.3)	72.3 (9.4)	.011	.550
VABS-MA	20.1 (2.99)	20.3 (3.0)	19.5 (3.1)	.596	.204
RPT-CP					
Children	94.6 (20.5)	105.5 (14.6)	110.7 (18.2)	.088	.209
Parents	122.8 (8.4)	130.1 (10.7)	135.4 (8.6)	.005	.020
PSI total	234.2 (33.4)	235.3 (32.9)	225.6 (37.1)	.776	.019
PSI-C	113.2 (14.6)	111.4 (12.3)	106.2 (14.4)	.463	.052
PSI-P	121.1 (26.3)	123.9 (26.3)	119.4 (26.0)	.394	.058

Note. M, mean; SD, standard deviation; RPT-CP, Role-Play Test for Children and Parents; RPT-C, Role-Play Test for Children; RPT-P, Role-Play Test for Parents; SSS-E, Social Skills Scale for Elementary School Children; VABS-A, Vineland Adaptive Behavior Scales, Second Edition, Japanese version, Adaptive Behavior Subscale; VABS-MA, Vineland Adaptive Behavior Scales, Second Edition, Japanese version, Maladaptive Behavior Subscale; SS-A, Social Skills Self-Rating Scale for Adults; PSI, Parenting Stress Index; PSI-C, Parenting Stress Index, Child Domain; PSI-P, Parenting Stress Index, Parent Domain.

follow-up were calculated. Because of the small sample size and use of ordinal scales, the Wilcoxon test was chosen to compare scores before and after the intervention, and scores after the intervention and at follow-up. Statistical significance was set at two-tailed $p < .05$. Statistical analyses were performed using SPSS version 25 for Microsoft Windows. Mizumoto's method was used was to calculate the effect size [31].

Results

Children's Social Skills

Table 3 shows the results of the evaluation performed in this study. The SSS-E score, which was a self-evaluation, showed no significant differences after the intervention or at follow-up. The information provider evaluations, the VABS-II and VABS-A scores decreased significantly after the intervention ($z = -2.58$, $p = .011$), and the effect size was moderate ($r = -.65$); however, there was no significant difference in the VABS-MA scores. At follow-up, neither the VABS-A nor VABS-MA scores changed. Regarding the RPT-CP, which was the practitioner's evaluation, the target skills scores after the intervention showed a tendency to rise ($z = 1.71$, $p = .088$), but they did not change at follow-up.

Parents' Social Skills

The SS-A score, which was a self-evaluation, showed no significant changes after the intervention, but increased significantly at follow-up ($z = 2.91$, $p = .004$), and the effect size was moderate ($r = .71$). The RPT-CP scores indicated that the parents' target skills increased significantly after the intervention ($z = 2.83$, $p = .005$), and the effect size was moderate ($r = .71$). Moreover, at follow-up, the target skills scores increased significantly ($z = 2.33$, $p = .020$), and the effect size was moderate ($r = .58$).

Parental Childcare Stress

After the intervention, there were no significant differences in total PSI, PSI-C, or PSI-P scores. At follow-up, the total PSI scores decreased significantly ($z = -2.34$, $p = .019$), and the effect was moderate ($r = -.57$), but there were no significant differences in the PSI-C and PSI-P scores.

Discussion

In this study, we explored the effectiveness of a new parent-child SST program to determine if there was an improvement in parental and child social skills and a reduction in parenting stress, and whether the effects were maintained. As a result, in the case of children, the social skills showed a tendency to improve after the intervention, as indicated by the RPT-CP scores, but scores decreased on the VABS-A and did not change on the SSS-E. At follow-up, no changes were seen in the SSS-E, VABS-A, VABS-MA, and RPT-CP scores. For parents, social skills after the intervention improved as measured by the RPT-CP but did not change according to the SS-A scores. At follow-up, both RPT-CP and SS-A scores improved, indicating that parents' social skills further improved. Parental stress did not decrease after the intervention, but a significant reduction was seen at follow-up.

Interestingly, parents' self-evaluation did not show improvement in general social skills immediately after intervention but did at follow-up, even though the

RPT-CP score indicated immediate improvement. This suggests that there was a time lag between the practitioners' evaluation and self-awareness. The experience of receiving praise from the staff and other parents during the program could have shifted the parents' focus of attention from wanting to enhance children's behavioral changes to wanting to improve their own social skills. The parents did not immediately recognize their improvement but were able to continue using the target skills in their daily life until they were able to realize the effects. To reduce mothers' stress and anxiety about parenting, it is effective to consider childcare and acquire parenting skills [32]. The decreased PSI score indicated that the improvement in the parents' self-assessment of social skills led to enhanced parenting skills, which resulted in a reduction in parenting stress.

Regarding the social skills of the children, the practitioner's evaluation showed a significant tendency to improve after the intervention, but the information provider's evaluation worsened, and the self-evaluation showed no change. The reason may be that the evaluator's subjectivity may have influenced the scores: the parents' expectation or changes of perception from the program experience for the information provider evaluation and the desires of the child for the self-evaluation [25]. Additionally, in a study in which SST was provided to children with ASD and psychological education was given to their parents, there was no change in children as indicated by the information provider evaluation using the Child Behavior Checklist [18]. However, improvement in the target skills according to the practitioner's evaluation is required. Thus, it may be necessary to revise the program to examine whether this goal is met. Many of the previous studies on SST for neurodevelopmental disorders involved training programs with more than 10 sessions [33–35]. Improvement in social skills may be difficult to achieve in such a short period. Currently, in Japan, programs aiming to support parents must be provided over a short period of time because of difficulty in maintaining parents' motivation and attendance to all the sessions [36]. As mentioned earlier, given that the social skills of parents improved after this short-term intervention, if parents use social skills in the home and become a good model, the social skills of their children may improve. Furthermore, a modification in the presentation of homework and its step-to-step stages may lead to the improvement of target skills. In the future, we would like to verify the effects by setting a long-term follow-up, such as 6 months and 1 year.

The participants in this study responded to open recruitment, and it can be predicted that the parents were highly motivated, for example, wanting their children to acquire social skills, or perhaps parents themselves seeking to improve their skills. Therefore, the observed effects of the parent-child SST program may have been limited to the parents, namely the improvement in parents' social skills and reduction in parenting stress. It is not clear whether the children were highly motivated even in open recruitment.

In this study, a scale had to be developed to evaluate the role-play of children with neurodevelopmental disorders and their parents. The RPT-CP is an important scale that can be used to evaluate whether the skills targeted in SST have been acquired [25]. This fact indicates that not only social skills training but also social skills evaluation measures in this area are lacking. It may not be possible to accurately evaluate all the target skills using practitioners' evaluation of behavior. Social skills include social cognition (receiving skills) to recognize oneself and the present situation; social problem solving and decision-making (processing skills) to consider options for achieving personal goals in specific situations; and expressive skills (sending skills) exchanged in actual situations [15]. The RPT-CP involves these three information-processing processes, and we would like to develop it for standardization in the future.

This study had several limitations. First, the sample size was small, and there was no control group in this study. In the future, the effects of the program should be verified using a controlled research design. Second, the criteria for selecting children in this study was only having neurodevelopmental disorders and their FSIQ. During this program, some children were joking and unable to concentrate. Furthermore, the target children had various diagnoses of neurodevelopmental disorders. We would like to consider adaptation criteria for this program in future studies, such as limiting target children to those having ASD.

Conclusions

The features of the parent-child SST program implemented in this study were that parents and children learned the same skills using SST, playtime for the generalization was set up in accordance with the target skills, and homework was performed at home. This study showed that parents' social skills improved after the intervention and at follow-up, and parenting stress decreased at follow-up. Since this program can be implemented over a short period in six sessions, it is considered easy to implement in clinical settings. However, in order to improve children's social skills, it may be necessary to modify the program in ways such as how to present homework. By implementing this program, it is expected that the skills learned will be used in the home and that communication between parents and children will increase.

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Conflict of Interest

The authors disclose no conflict of interest.

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ORIGINAL ARTICLE

Effectiveness of Metacognitive Training for Long-Term Hospitalized Patients with Schizophrenia: A Pilot Study with a Crossover Design

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Abstract: Objective: This study aimed to explore the efficacy of metacognitive training (MCT) with long-term hospitalized patients with schizophrenia.

Methods: Patients admitted to a hospital's long-term care ward were randomly allocated to Groups A or B, and a crossover trial was performed. As intervention, 16 weekly MCT sessions were performed for 4 months as part of standard occupational therapy, and the participants' cognitive functioning, psychiatric symptoms, overall functioning, and cognitive bias were assessed at baseline, 4 months later, and 8 months later.

Results: Twenty-two patients participated. Those who were discharged midway through the course, and those who withdrew their consent were excluded, and 17 individuals (Group A: $n = 9$; Group B, $n = 8$) completed their assessments 8 months later. No significant differences were seen in inter-group comparisons of the scores of various scales at the baseline. Four months and eight months later, a comparison between before and after MCT showed improvement tendencies for both groups in the participants' cognitive function and psychiatric symptoms. A comparison of scores before and after the MCT intervention period, from all participants, showed significant improvement tendencies in their verbal memory and attention.

Conclusion: MCT can be used for long-term hospitalization in patients with chronic-stage schizophrenia, and this study showed its potential to improve neurocognitive function. Going forward, there is a need to increase the sample size and examine the efficacy of MCT in more detail.

Keywords: schizophrenia, long-term hospitalization, cognitive rehabilitation, metacognitive training

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Introduction

In recent years, cognitive impairment has been considered the core impediment of schizophrenia [1, 2], and cognitive rehabilitation aimed at improving this is attracting attention. Schizophrenia's cognitive impairments include (a) disorders of neurocognitive function, such as attention, memory, working memory, verbal fluency, executive function, and processing speed; and (b) cognitive biases such as tending to seek causes in external factors, rushing to conclusions, and passing judgment with only minimal information and becoming strongly convinced of it. Patients with schizophrenia are liable to hold erroneous beliefs due to these cognitive impairments that are deemed to affect their social functioning, such as daily living, interpersonal relations, and employment [3, 4].

Moritz and Woodward [5] developed metacognitive training (MCT) to correct cognitive bias in schizophrenia. MCT regards metacognition as "thinking about thinking" or "cognition about cognition," and positions it as the ability to monitor one's own cognitive bias and control it [5–8]. MCT is a psychoeducational program conducted individually or in groups, using the basic theory of cognitive behavioral therapy as the background, with learning tasks presented, using a PowerPoint file. Participants complete their learning tasks and

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engage in group discussions while enjoying them, and aim to generalize the lessons gained in the sessions to their daily lives and expand their problem-solving repertoires [5]. It includes 8 modules prepared in 2 cycles, which are implemented over 16 weeks or 4 months.

A series of studies conducted by Moritz et al. confirmed that MCT is effective in mitigating the positive symptoms of schizophrenia patients [5–8]. The Japanese language edition of MCT was developed in 2012 by Ishigaki [9], and is currently at the stage of having the effects verified in Japan. Until now, improvements in the stress handling of those with schizophrenia and mitigation of positive symptoms have been reported as its training effects [10, 11]. Ishikawa et al. stated that the Japanese edition of MCT helped improve schizophrenia patients' positive symptoms (especially delusion) as well as overall functioning and cognitive bias [12]. Improvement of elemental neurocognitive functions, such as attention and memory, is believed to be related to the improvement of positive symptoms and cognitive bias. However, no reports have thus far been published about MCT's effectiveness in improving neurocognitive function in schizophrenia; its efficacy against long-term hospitalized schizophrenia patients [13] has not been investigated, either. Therefore, this study aimed to explore the possibility of using MCT with long-term hospitalized patients with schizophrenia in Japan as well as its efficacy in improving their neurocognitive function.

Methods

Participants

Participating in this study were patients who were diagnosed with schizophrenia by a psychiatrist, based on the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) [14], were admitted to a psychiatric hospital's long-term care ward, and were undergoing occupational therapy. As part of the enrollment criteria for participation, individuals had to be between the ages of 20 and 65 years. The following individuals were excluded: those with intellectual disability and a history of substance abuse and/or dependence, dementia, epilepsy, head injury, and cerebrovascular diseases. Those with unstable disease condition, e.g. those with refusal and/or significant loss of motivation, and those whom either a psychiatrist or an occupational therapist had determined as unfit for the study were also excluded. We explained the purpose of the study to all the participants, both in writing and orally, and obtained their consent to participate. This study was conducted after receiving the approval of Shinshu University's Medical Ethics Committee (Approval No. 3517).

Study design

A crossover trial was performed, with the participants being allocated to two groups (A and B) via stratified randomization that took their sex and age into consideration. In the first half of the follow-up period, Group A had MCT added to their occupational therapy (OT) sessions, while Group B received the usual OT only. In the latter half of the follow-up period, MCT was added to Group B's OT sessions, while Group A received the usual OT only. Because the carryover effects of MCTs were anticipated from the outset, no washout period was established in this crossover design. The start of the follow-up was based on the baseline assessment of outcome indicators. Assessment 2 was implemented in both groups four months after Group A had completed their MCT, and Assessment 3 was implemented in both groups eight months after Group B had completed their MCT.

Interventions

MCT was conducted in a group setting. A 60-minute weekly session was conducted 16 times over a period of four months. MCT modules included tasks that handled "causal attribution (simplistic attribution)," "jumping to conclusions," "correction of beliefs," "taking perspectives of others (the theory of mind)," memory (erroneous overconfidence)," and "self-esteem." In each session, two occupational therapists assumed the role of a leader and a co-leader, and used a projector to present PowerPoint teaching materials, encouraged verbal interactions among the participants in accordance with the MCT implementation manual [9], and ensured that the participants could tackle the tasks while enjoying them. By way of information, in the usual OT, either an individual or a group program lasting 1 to 2 hours per session was offered 4–5 times a week according to the participants' individual wishes and goals. The program included light physical exercises, arts and crafts, psychoeducation, and other subjects.

Measures

At baseline, an occupational therapist used the participants' medical records to gather data including basic information: age, sex, number of years of education, age of onset, disease duration, length of hospital stay, and the dose of antipsychotic drug(s) being taken ("medication"). At the baseline, four measures were used: the Brief Assessment of Cognition in Schizophrenia (BACS), the Positive and Negative Syndrome Scale (PANSS), the Global Assessment of Functioning (GAF), and the Beck Cognitive Insight Scale (BCIS). The BACS is a cognitive function evaluation scale developed by Keefe et al. [15]. It comprises six sub-tests that measure verbal memory, working memory, motor speed, verbal fluency, attention and processing speed, and executive function. The results were evaluated using a standard score (z-score) that used 0 as the typically functioning participants' population mean. The larger the z-score, the higher is the person's cognitive function. As a yardstick for severity, −0. 5 ≤ −1.0 was judged as mild disorder, −1. 0 ≤ −1.5 was judged as a moderate disorder, and −1. ≤ 5 was judged to be a severe disorder. In this study, the Japanese language edition standardized by Kaneda et al. [16] was used and evaluated by occupational therapists.

The PANSS, created by Kay et al. [17], is a scale for assessing the mental state during schizophrenia. A total of 30 items comprising 7 positive symptom items, 7 negative symptom items, and 16 general psychopathology items were evaluated, ranging from 30 to 210 (1 = *the mildest* and 7 = *most severe*). The PANSS was assessed by occupational therapists and psychiatrists.

The GAF is a scale featured in DSM-IV-TR [18], and evaluates a participant's mental health and disease condition based on the degree of severity and functional level (the role played in society and occupation), using a score ranging from 1 to 100. The higher the score, the healthier one's functional level is judged to be. The GAF was evaluated by occupational therapists. The BCIS, created by Beck et al. [19], is a self-report evaluation scale that measures cognitive bias. The respondents were asked to rate how much they agreed with each of the 15 items by using a 4-point scale, (0 = *do not agree at all* and 3 = *agree completely*). Self-Reflectiveness (SR) was compiled from nine items (range: 0–27), and Self-Certainty (SC), from six items (range: 0–18). The higher the SR score, the higher-level insight a person has toward their thoughts, and the higher the SC score, the stronger a person is convinced of their own thinking. A composite index is calculated by subtracting the SC score from the SR score (range: −18~27), and the higher the score, the more appropriate a person's cognitive tendencies are judged to be. In this study, the Japanese language edition of the BCIS produced by Uchida et al. [20] was used, and was evaluated by occupational therapists.

Statistical analyses

An inter-group comparison was made among the demographic characteristics and evaluation scale scores at baseline as well as the scores of scales at Assessments 2 and 3. These scores of Groups A and B were also compared before and after MCT. Because the Shapiro-Wilk test showed no normality of population, a nonparametric method was adopted. The Mann-Whitney U test was used to compare Groups A and B, the Friedman test was used for making before and after MCT comparisons in each group, the Scheffe method was used for multiple comparisons, and the Wilcoxon signed-rank test was used to compare the scores before and after MCT. Effect size® was also calculated to confirm the size of the differences that were not affected by sample size. Bell Curve for Excel Ver.3.21 was used for statistical analysis, and the significance level was less than 5%.

Results

Of the 43 patients hospitalized inside the long-term care ward, 22 took part in this study. Eleven individuals were randomly allocated to Groups A and B. During the follow-up period, one individual in Group A was discharged from the hospital, and another individual withdrew their consent, while two individuals in Group B were discharged, and another individual withdrew their consent. In the end, nine individuals in Group A (male-to-female ratio = 6 : 3), and eight in Group B (male-to-female = 4 : 4) were analyzed (Figure 1).

Table 1 compares the two groups' demographic data and the results of assessments at baseline. No significant differences were seen in a comparison between Groups A and B in terms of the demographic data and the scale scores of the baseline, and Assessments 2 and 3.

Table 2 shows a comparison of Group A's assessment scores before and after MCT. Compared to baseline scores, Assessments 2 and 3 (Friedman test), a significant increase in scores was seen in the BACS' verbal memory ($p < .05$, $r = .75$), attention ($p < .05$, $r = .81$), executive function ($p < .05$, $r = .75$), and composite scores ($p < .01$, $r = .81$). In the post-hoc test, a significant increase was seen between Assessments 2 and 3 in the score for executive function ($p < .05$, $r = .84$). In a comparison of the PANSS scores via repeated measurement, a significant decrease in score was seen in positive symptoms ($p < .01$, $r = .84$), negative symptoms ($p < .05$, $r = .89$), general psychopathology ($p < .05$, $r = .75$), and the PANSS total scores ($p < .01$, $r = .89$), and, in the post-hoc test, a significant difference was seen between baseline and Assessment 2 in positive symptoms ($p < .05$, $r = .84$), negative symptoms ($p < .05$, $r = .67$), general psychopathology ($p < .05$, $r = .77$), and the PANSS total scores ($p < .01$, $r = .89$). No significant differences were seen between medication and the scores for the GAF and BCIS.

Table 3 shows Group B's comparison of assessment scores between before and after MCT. In a comparison among baseline, Assessments 2 and 3, a significant increase in scores was seen in the BACS verbal memory ($p < .01$, $r = .84$) and attention ($p < .05$, $r = .84$), and, in the post-hoc test, a significant increase was seen between Assessments 2 and 3 in both verbal memory (*p*

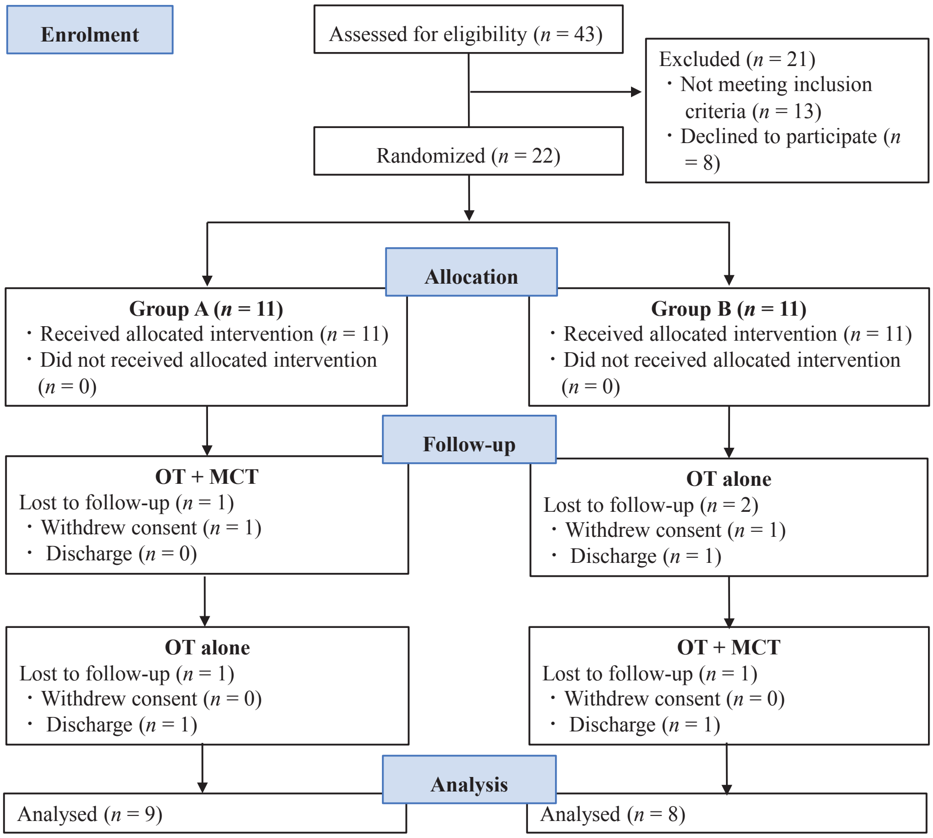

Fig. 1. A CONSORT flow diagram with crossover design for a randomized controlled trial

$< .05$, $r = .89$) and attention ($p < .05$, $r = .74$). Moreover in a comparison of the PANSS scores via repeated measurement, a significant decrease in scores was seen in negative symptoms ($p < .05$, $r = .57$), and, in a multiple comparison, a significant decrease in scores was seen between baseline and Assessment 1 in negative symptoms ($p < .05$, $r = .78$), general psychopathology ($p < .05$, $r = .84$), and total score ($p < .05$, $r = .89$). No significant differences were seen among dosage, the GAF, and BCIS.

The scores of various scales were compared before and after MCT implementation for all participants (Table 4). A significant increase in scores was seen in the BACS verbal memory ($p < .01$, $r = .73$), attention ($p < .01$, $r = .64$), and composite scores ($p < .05$, $r = .63$), but no significant differences were seen in the GAF, PANSS, BCIS, or medication.

Discussion

The participants were patients with schizophrenia whose disease duration exceeded 30 years, and who had been hospitalized for a long time in a psychiatric department's long-term care ward. At baseline, the BACS composite score was below −2.0 for both groups, showing severe cognitive impairment. Moreover, from their GAF, PANSS, and BCIS scores, the participants were assumed to have low-level psychosocial functioning, relatively severe psychiatric symptoms, and low SR. The large dosage of antipsychotic drugs was believed to reflect the participants' unstable mental and physical function. During the follow-up period, of the 19 participants a total of 17 individuals, or 89.47%, managed to complete the OT program that included MCT. This relatively high completion rate indicates the potential of using MCT in patients with chronic-stage schizophrenia who are being admitted to a psychiatric hospital's long-term care ward. There is a possibility that the advantages of MCT, allowing the participants to tackle the tasks while enjoying them, may have contributed to maintaining the participants' motivation.

Past studies have reported improvement of positive symptoms and cognitive bias with the use of MCT [5–8, 10–12], but no reports have thus far focused on the improvement of neurocognitive function. Our study's repeated measurements performed at baseline, Assessments 2 and 3, showed improvement tendencies for verbal memory, attention, executive function, and composite score in Group A, and improvements for verbal memory and attention in Group B (Tables 2 and 3). The

Table 1 Demographic characteristics and baseline assessments results by treatment group (A; B)

Variable	Group A (n = 9)		Group B (n = 8)		Statistic (U)	*p*	*r*
	Mean	(*SD*)	*Mean*	(*SD*)			
Age (years)	54.00	(7.60)	54.50	(8.63)	33	0.77	0.07
Sex							
• Male, n (%)	6	(66.67)	4	(50.00)	$\chi^2 = 0.48$	0.49	0.17
• Female, n (%)	3	(33.33)	4	(50.00)			
Age at onset (years)	22.22	(4.71)	21.13	(4.23)	30.5	0.59	0.13
Disease duration (years)	31.78	(6.16)	33.38	(10.43)	29.5	0.53	0.15
Education (years)	12.17	(1.97)	12.63	(1.80)	32.5	0.72	0.09
Length of hospital stays (months)	71.67	(89.79)	103.75	(106.87)	30	0.56	0.14
Medication (mg/day)	1117.24	(686.94)	1033.25	(419.74)	36	1.00	0.00
The BACS							
• Verbal memory	−2.29	(1.13)	−1.74	(0.69)	25	0.29	0.11
• Working memory	−2.47	(1.47)	−2.55	(0.87)	32.5	0.74	0.07
• Motor speed	−2.55	(1.60)	−3.15	(0.83)	24	0.25	0.15
• Verbal fluency	−1.18	(1.40)	−1.69	(1.00)	27	0.39	0.41
• Attention	−3.68	(1.49)	−3.90	(1.01)	36	1.00	0.14
• Executive function	−2.11	(2.42)	−1.44	(1.35)	31.5	0.66	0.01
• Composite score	−2.38	(1.15)	−2.41	(0.37)	32	0.70	0.05
The GAF	18.89	(4.84)	21.63	(5.17)	26.5	0.36	0.41
The PANSS							
• Positive	28.00	(5.98)	23.50	(6.26)	21.5	0.16	0.20
• Negative	27.33	(9.82)	28.75	(7.19)	33.5	0.81	0.16
• General psychopathology	53.33	(10.56)	54.75	(11.71)	35.5	0.96	0.08
• PANSS total	108.67	(22.87)	107.00	(22.91)	30	0.56	0.02
The BCIS							
• Self-reflectiveness	11.00	(3.43)	12.38	(4.18)	29	0.50	0.16
• Self-certainty	6.11	(2.47)	6.25	(4.15)	35	0.92	0.20
• Composite index	4.89	(5.22)	6.13	(4.54)	35	0.92	0.18

Note. Mann-Whitney U test. *SD*, standard deviation. *r*, Effect size
BACS, Brief Assessment of Cognition in Schizophrenia; GAF, Global Assessment of Functioning; PANSS, Positive and Negative Syndrome Scale; BCIS, Beck Cognitive Insight Scale; Medication, Antipsychotic medication (chlorpromazine equivalence).

Table 2 Comparison of the BACS, GAF, PANSS, and BCIS Scores of Group A

Variable	Baseline		Assessment 2		Assessment 3		*P*			*r*		
	Mean	(*SD*)	*Mean*	(*SD*)	*Mean*	(*SD*)	*p0*	*p1*	*p2*	*r0*	*r1*	*r2*
The BACS												
• Verbal memory	−2.29	(1.13)	−1.55	(0.93)	−1.31	(1.17)	*			**.75**	**.65**	.22
• Working memory	−2.47	(1.47)	−2.18	(1.31)	−2.06	(1.27)				.47	.38	.11
• Motor speed	−2.55	(1.60)	−2.83	(1.33)	−2.64	(1.19)				.10	.30	**.57**
• Verbal fluency	−1.18	(1.40)	−0.70	(1.27)	−0.70	(1.25)				.40	.42	.22
• Attention	−3.68	(1.49)	−2.64±	(1.75)	−2.59	(1.59)	*			**.81**	**.65**	.30
• Executive function	−2.11	(2.42)	−1.96	(2.77)	−1.4	(1.82)	*		*	**.75**	.14	**.84**
• Composite score	−2.38	(1.15)	−1.98	(1.15)	−1.78	(0.93)	**			**.81**	**.61**	**.57**
The GAF	18.89	(4.84)	20.78	(3.94)	22.44	(4.06)				**.77**	**.54**	.46
The PANSS												
• Positive	28.00	(5.98)	23.33	(5.64)	22.78	(5.61)	**	*		**.84**	**.84**	.23
• Negative	27.33	(9.82)	22.89	(5.65)	22.89	(8.27)	*	*		**.89**	**.67**	.06
• General psychopathology	53.33	(10.56)	47.00	(11.59)	46.56	(12.39)	*	*		**.75**	**.77**	.14
• The PANSS total	108.67	(22.87)	93.22	(20.33)	92.22	(22.89)	**	**		**.89**	**.89**	.14
The BCIS												
• Self-reflectiveness	11.00	(3.43)	11.33	(3.40)	12.22	(4.26)				.16	.02	.23
• Self-certainty	6.11	(2.47)	6.00	(2.21)	5.44	(2.22)				.16	.04	.28
• Composite index	4.89	(5.22)	5.33	(5.16)	6.78	(5.59)				.21	.08	.42
Medication (mg/day)	1117.2	(686.9)	985.9	(629.5)	1039.1	(623.1)				.39	.53	.53

Note. n = 9. Friedman test. *SD*, standard deviation. *r*, Effect size
* $p < 0.05$, ** $p < 0.01$. *p0* is a comparison of the three assessments by the Friedman test. *p1* shows a comparison between baseline and assessment 2, and *p2* shows a comparison between assessments 2 and 3 (Scheffe). *r0* represents the effect size for the comparison of the three assessments, *r1* represents the comparison between the baseline and the second assessment, and *r2* represents the effect size for the comparison between the second and third assessments.
BACS, Brief Assessment of Cognition in Schizophrenia; GAF, Global Assessment of Functioning; PANSS, The positive and negative syndrome scale; BCIS, Beck Cognitive Insight Scale; Medication, Antipsychotic medication (chlorpromazine equivalence).

Table 3 Comparison of the BACS, GAF, PANSS, and BCIS Scores of Group B

Variable	Baseline		Assessment 2		Assessment 3		*P*			*r*		
	Mean	(*SD*)	*Mean*	(*SD*)	*Mean*	(*SD*)	*p0*	*p1*	*p2*	*r0*	*r1*	*r2*
The BACS												
• Verbal memory	−1.74	(0.69)	−1.65	(1.01)	−0.94	(1.13)	**		*	**.84**	.24	**.89**
• Working memory	−2.55	(0.87)	−2.47	(0.76)	−2.19	(1.27)				.04	.31	.05
• Motor speed	−3.15	(0.83)	−2.62	(1.14)	−2.30	(0.92)				**.78**	.48	.24
• Verbal fluency	−1.69	(1.00)	−1.99	(1.33)	−2.03	(1.35)				.42	.36	.42
• Attention	−3.90	(1.01)	−3.72	(1.15)	−2.71	(1.00)	*		*	**.84**	.24	**.74**
• Executive function	−1.44	(1.35)	−1.42	(1.23)	−1.52	(2.37)				.05	.00	.05
• Composite score	−2.41	(0.37)	−2.31	(0.39)	−1.95	(0.78)				**.64**	.35	**.50**
The GAF	21.63	(5.17)	22.38	(3.50)	21.63	(2.69)				.03	.15	.05
The PANSS												
• Positive	23.50	(6.26)	21.88	(6.37)	22.38	(4.72)				.06	.27	.11
• Negative	28.75	(7.19)	23.75	(4.84)	24.25	(5.12)	*	*		.57	**.78**	.15
• General psychopathology	54.75	(11.71)	47.25	(7.66)	48.88	(6.81)		*		.42	**.84**	.30
• The PANSS total	107.00	(22.91)	92.88	(15.28)	95.50	(12.59)		*		.45	**.89**	.08
The BCIS												
• Self-reflectiveness	12.38	(4.18)	12.25	(4.41)	12.50	(3.77)				.05	.03	.00
• Self-certainty	6.25	(4.15)	4.5	(2.78)	3.88	(2.89)				.37	**.67**	.05
• Composite index	6.13	(4.54)	7.75	(4.84)	8.63	(3.97)				.15	.47	.27
Medication (mg/day)	1033.3	(419.7)	968.8	(521.5)	1014.9	(521.1)				.05	.43	.05

Note. $n = 8$. Friedman test. *SD*, standard deviation. *r*, Effect size
* $p < 0.05$, ** $p < 0.01$. *p0* is a comparison of the three assessments using the Friedman test. *p1* shows a comparison between baseline and assessment 2, and *p2* shows a comparison between assessments 2 and 3 (Scheffe). *r0* represents the effect size for the comparison of the three assessments, *r1* represents the comparison between the baseline and the second assessment, and *r2* represents the effect size for the comparison between the second and third assessments.
BACS, Brief Assessment of Cognition in Schizophrenia; GAF, Global Assessment of Functioning; PANSS, Positive and Negative Syndrome Scale; BCIS, Beck Cognitive Insight Scale; Medication, Antipsychotic medication (chlorpromazine equivalence).

Table 4 Changes in the BACS, GAF, PANSS, and BCIS Scores before and after the MCT period

Variable	Before ($n = 17$)		After ($n = 17$)		Statistic (*W*)	*P*	*r*
	Mean	(*SD*)	*Mean*	(*SD*)			
The BACS							
• Verbal memory	−1.99	(1.12)	−1.26	(1.07)	13	0.003**	0.73
• Working memory	−2.47	(1.19)	−2.19	(1.29)	59	0.41	0.20
• Motor speed	−2.58	(1.41)	−2.58	(1.18)	68	1.00	0.00
• Verbal fluency	−1.56	(1.42)	−1.33	(1.47)	62	0.76	0.08
• Attention	−3.7	(1.34)	−2.67	(1.45)	21	0.009**	0.64
• Executive function	−1.78	(1.98)	−1.75	(2.60)	66	0.62	0.12
• Composite score	−2.35	(0.88)	−1.96	(1.00)	22	0.01**	0.63
The GAF	20.53	(4.60)	21.18	(3.43)	30.5	0.30	0.26
The PANSS							
• Positive	25.12	(6.88)	22.88	(5.25)	27	0.11	0.39
• Negative	25.65	(8.08)	23.53	(5.45)	33	0.13	0.37
• General psychopathology	50.47	(9.79)	47.88	(9.68)	48	0.13	0.33
• The PANSS total	101.24	(21.19)	94.29	(17.17)	35.5	0.05	0.47
The BCIS							
• Self-reflectiveness	11.59	(3.97)	11.88	(3.63)	66.5	0.94	0.02
• Self-certainty	5.35	(2.74)	5.00	(2.77)	50.5	0.90	0.03
• Composite index	6.24	(5.24)	6.88	(4.92)	57.5	0.59	0.13
Medication (mg/day)	1047.4	(619.1)	999.5	(581.2)	62	0.76	0.08

Note. Wilcoxon signed-rank test. *SD*, standard deviation. *r*, Effect size
* $p < 0.05$, ** $p < 0.01$
In Group A, the score change from baseline to Assessment 2 was compared, and in Group B, the score change from Assessment 2 to Assessment 3 was compared.
BACS, Brief Assessment of Cognition in Schizophrenia; GAF, Global Assessment of Functioning; PANSS, Positive and Negative Syndrome Scale; BCIS, Beck Cognitive Insight Scale; Medication, Antipsychotic medication (chlorpromazine equivalence).

effect size, which represents the amount of changes in verbal memory, attention, and composite score, was large between baseline and Assessment 1 for Group A (*r1* = .65, *r1* = .65, *r1* = .61), while it had a tendency to be large between Assessments 2 and 3 for Group B (Table 3; *r2* = .89, *r2* = .74, *r2* = .50). These results show that, with the intervention of MCT, items such as verbal memory and attention, in particular, were liable to become activated, and a comparison made between before and after the MCT intervention period (Table 4) also suggested MCT's effects in improving verbal memory and attention.

In the MCT learning program, tasks are presented repeatedly on PowerPoint slides. Participants are assumed to turn their attention to the tasks that are being shown, explore the detailed information, memorize information, and, by constructing a story or listening to other participants' opinions, see the activation and application of their cognitive functions. Improvement of verbal memory and attention may have been affected by the activation of cognitive functions such as these. Moreover, in Group A, even in Assessment 3, which took place four months after the end of MCT, the participants' cognitive function was maintained or showed tendencies toward improvement, suggesting the possibility that the improvement of neurocognitive function by MCT may be maintained by the continuation of OT. Further consideration of OT interventions will be needed to promote working memory, motor speed, verbal fluency, and executive function.

As shown in Tables 2 and 3, changes in the PANSS scores tended to be large between the baseline and Assessment 1 for both Groups A and B. No significant differences were seen in a comparison between before and after the MCT intervention (Table 4). Participants in Group B showed a reduction in the PANSS scores before intervention with MCT, so there is a possibility that factors other than MCT may have worked to improve their psychiatric symptoms. Previous studies have reported that MCT is effective in improving delusion and other positive symptoms [21]. In this study, as shown in Table 4, although tendencies toward improvement for verbal memory and attention were seen after intervention with MCT, no significant changes were seen in psychiatric symptom scores. Further investigation is therefore needed to examine the relationship between the improvement of psychiatric symptoms and neurocognitive function.

Cognitive bias governs a person's judgment and decision-making, and affects their social functioning [19, 20]. Lam et al. [22] performed MCT in patients with schizophrenia at a frequency of two times a week and reported that, compared to the control group, the MCT intervention group saw a significant improvement in the BCIS SR scale and comprehensive evaluation scores. Ochoa et al. [23] implemented either MCT or psychoeducation with patients having recent-onset psychosis and reported that the BCIS performance results were superior in the group with which MCT had been implemented. In our study, the composite index of the BCIS showed an increasing tendency for both groups, suggesting the mitigation of cognitive bias. However, no statistically significant differences were seen in the changes in the scores. The participants of this study were patients with schizophrenia who were hospitalized in a long-term care ward and suffered severe neurocognitive disorder and moderate psychiatric symptoms. A reduction in reactivity, frequently seen in schizophrenia patients who follow a chronic course, may be related to the lack of improvements in cognitive bias.

Study limitations and future research

A limitation of this study is its small sample size. Another limitation is that interventions and assessments were not blinded. A third limitation is the possibility that other psychiatric services, which included daily living inside a ward during the follow-up period, were not controlled, so confounding factors may have influenced the results. There is also a need to recognize that the tendency for verbal memory and attention to improve, seen by the intervention of MCT, is not the single-handed effect of MCT, but was obtained by the concurrent use of OT. It is therefore necessary to position this study as a preliminary research. Future studies should increase the sample size, control the method of interventions to the extent possible, and investigate, in detail, MCT's efficacy on neurocognitive functioning, psychiatric symptoms, and cognitive bias, including the influence of age, sex, length of hospital stay, disease duration, and other factors.

Conclusion

This study showed that MCT can be used with long-term hospitalized patients with schizophrenia. The use of MCT indicated a tendency for schizophrenia patients' neurocognitive function (especially verbal memory and attention) to improve, and the improvement effects continued even after four months. No significant improvements were seen in the PANSS, GAF, and BCIS scores before and after MCT interventions. No improvements in cognitive bias attributable to MCT were seen. Going forward, there is a need to increase the sample size and, at the same time, control the confounding factors, and investigate in detail the efficacy of MCT in neurocognitive function, psychiatric symptoms, and cognitive bias.

Conflict of Interest

The authors declare no conflicts of interest.

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Relationship between Emotional Peer Support Networks and Subjective Recovery of People with Mental Illness Living in the Community

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Abstract: Purpose: This study determined the relationship between having an emotional peer support network (i.e. people experiencing similar mental health difficulties) and aspects of subjective recovery in people with mental illness.
Methods: In total, 37 participants with mental illness living in the community were divided into high/low emotional peer support groups using the Emotional Support Network Scale. Subjective recovery was evaluated using the Recovery Assessment Scale (RAS). Total and individual factor scores of subjective recovery between the two groups were compared with an unpaired t-test, and effect size were calculated.
Results: Participants were categorized into high (n = 18) and low (n = 19) emotional support (ES) network groups. For demographic and clinical characteristics and the total score of RAS, the groups had no significant differences. However, high ES was significantly higher in “no domination by symptoms” and “willingness to ask for help”, showed medium effect size.
Discussion: People with high levels of emotional peer support felt less affected by symptoms and were more willing to ask for help, which affected their recovery. This result reflects elements of peer support, like using experiential knowledge and recovery role models. In occupational therapy, emotional support among clients through group therapy and environmental adjustment is critical for recovery.

Keywords: mental illness, social support, peer support, emotional support network, subjective recovery

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Introduction

Recovery involves developing new meaning and purpose in life as one overcomes catastrophic effects of mental illness [1]. This is supported when the resulting treatment is person-centered, strengths-based, and community-focused, and enhances natural support [2]. “Optimism,” “recognition of emotional support network,” and “hobbies and enjoyment” are factors that significantly promote subjective recovery [3]. Occupational therapists should be conscious of such in psychiatric rehabilitation. Especially, the emotional support network composed of close persons like family, friends, and health care professionals, which is important in reducing stress [4]. Because people with mental illness living in the community are affected by symptoms, disorders, public stigma, and self-stigma [5], emotional support is important in reducing negative psychological responses and participating in society.

Recently, peer support has garnered attention as a component of community mental health welfare. The Ministry of Health, Labour and Welfare has indicated its importance for people with mental illness [6]. People experiencing similar mental health difficulties (i.e. “peers”) obtain security and self-affirmation when sharing their emotions [6]. Thus, emotional peer support may be included in the recovery of people with mental illness.

In occupational therapy, group programs encourage clients’ emotional support. In addition, occupational therapists must collaborate with and empower people with mental illness, and utilize peer support. However,

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the aspects of recovery affected by emotional peer support networks have been unidentified. Thus, this study explored the relationship between an emotional peer support network and aspects of subjective recovery in people with mental illness. The basic assumption is that participants with high levels of emotional peer support from their networks have better outcomes in aspects of subjective recovery.

Methods

This was a cross-sectional study using a self-reported questionnaire conducted from September 2018 to February 2019, approved by the institutional review board at Sapporo Medical University (approval number 30-2-8). Participants gave written informed consent.

Participants

Participants were from two employment support facilities and one mental health workshop in Hokkaido, Japan. All were diagnosed with a mental illness by trained psychiatrists according to the ICD-10. The inclusion criteria were: (i) aged over 20 years; (ii) living in the community; and (iii) no history of head injury, mental retardation, or serious medical disease like loss of consciousness. Participants who had difficulty understanding ethical considerations and/or questionnaire items were excluded.

Measurements

1) Demographic and clinical data

Demographic variables were age, sex, residence status, and employment status. Clinical variables comprised mental illness duration and diagnosis.

2) Emotional support network

Emotional support was measured using the Emotional Support Network Scale (ESNS) [4], which has 10 items like "someone who is always able to guess how I am feeling," and assesses perception of emotional support from specified others, designated here as "people experiencing similar mental health difficulties." Participants rated each item using a yes/no scale (No = 0, Yes = 1). Higher scores indicated a higher emotional support network.

3) Subjective recovery

The Japanese version of the Recovery Assessment Scale (RAS) measured subjective recovery [7]. It has five factors: (1) goal/success orientation and hope; (2) reliance on others; (3) personal confidence; (4) no domination by symptoms; (5) willingness to ask for help. It includes items, like "I have a desire to succeed," with 5-point Likert response options from 1 (strongly disagree) to 5 (strongly agree). Higher total scores indicate more advanced states of recovery.

Data analysis

Descriptive statistics were calculated for demographic and clinical characteristics, and the two scales. The ESNS score was divided into high level (High ES) and low level (Low ES); the former for eight points or higher, and the latter for seven points or less , based on criteria used in prior research [4]. The variable distribution normality was verified using the Shapiro-Wilk test. All variables except for ESNS score conformed to a theoretical normal distribution. We used t-tests to compare the averages of continuous variables and chi-square tests to compare the proportions of categorical variables between the groups. Effect sizes were calculated using Cohen's d [8]. The effect size thresholds are small = 0.20, medium = 0.50, and large = 0.80. Furthermore, the Mann-Whitney U test was used on each quantitative factor from the ESNS. IBM SPSS Statistics for windows, version 25.0 J (IBM Corp., Armonk, N.Y., USA) was used for statistical analyses, with significance level at 5% for all tests.

Results

Participants

Participants were categorized into High ES (n = 18) and Low ES (n = 19). Medians of the ESNS scale were 9.50 (Interquartile Range = 9.00–10.00) for the former and 5.00 (Interquartile Range = 1.00–6.00) for the former. Their demographic and clinical characteristics are shown in Table 1. The groups had no significant differences on the variables.

Relationship between emotional peer support network and subjective recovery

Table 2 presents the RAS scores differences between the groups. For the total RAS score, there was no significant difference (t = 1.984, p = 0.055, Cohen's d = 0.661). Analyzing individual factors, High ES was significantly higher in "no domination by symptoms" (t = 2.075, p = 0.045, Cohen's d = 0.687) and "willingness to ask for help" (t = 2.175, p = 0.036, Cohen's d = 0.726), showed medium effect size. However, in "goal/success orientation and hope" (t = 1.750, p = 0.089, Cohen's d = 0.585), "reliance on others" (t = 0.274, p = 0.786, Cohen's d = 0.091), and "personal confidence" (t = 1.638, p = 0.110, Cohen's d = 0.545), no significant differences existed.

Discussion

High ES gave stronger ratings of "no domination by symptoms" and "willingness to ask for help" in subjec-

Table 1 Demograhics and clinical characteristics of participants

		Emotional support network		Group differences	*P*-value
		High ES (*n* = 18)	Low ES (*n* = 19)		
ESNS, Median (IR)		9.50 (9.00–10.00)	5.00 (1.00–6.00)	U = 0.000	< 0.001
Age, Mean ± SD		40.39 ± 7.24	41.11 ± 8.05	t = 0.281	0.781
Sex, n (%)	Male	9 (50%)	7 (37%)	$\chi^2 = 1.424$	0.491
	Female	9 (50%)	11 (58%)		
	Other	0 (0%)	1 (5%)		
Resident status, n (%)	Single	7 (39%)	8 (42%)	$\chi^2 = 0.432$	0.934
	Living with family	9 (50%)	8 (42%)		
	Group home	1 (6%)	2 (11%)		
	Others	1 (6%)	1 (5%)		
Employment status, n (%)	Full-time job	5 (28%)	4 (21%)	$\chi^2 = 1.374$	0.503
	Part-time job	6 (33%)	4 (21%)		
	Non-working	7 (39%)	11 (58%)		
Duration of illness in years, Mean ± SD		13.00 ± 6.93	12.77 ± 9.57	t = 0.083	0.934
Diagnosis, n (%)	Schizophrenia	8 (44%)	5 (26%)	$\chi^2 = 2.441$	0.486
	Mood disorders	7 (39%)	11 (58%)		
	Disorders of psychological development	1 (6%)	2 (11%)		
	Other	2 (11%)	1 (5%)		

ES, Emotional Support; ESNS, Emotional Support Network Scale; IR, Interquartile Range; SD, Standard Deviation

Note: The results of the demographic and clinical characteristics data in High ES and Low ES groups were shown. The variables were matched between the groups.

Table 2 The difference between the groups of RAS scores

		Emotional support network		Group differences	*P*-value	Effect size (Cohen's d)
		High ES (*n* = 18)	Low ES (*n* = 19)			
		Mean ± SD	Mean ± SD			
RAS	Total	90.67 ± 14.27	80.95 ± 15.09	t = 1.984	0.055	0.661
	Goal/success orientation and hope	35.50 ± 6.60	31.84 ± 5.91	t = 1.750	0.089	0.585
	Reliance on others	15.11 ± 2.75	14.84 ± 3.13	t = 0.274	0.786	0.091
	Personal confidence	17.61 ± 4.04	15.37 ± 4.17	t = 1.638	0.110	0.545
	No domination by symptoms	7.89 ± 1.79	6.32 ± 2.67	t = 2.075	0.045	0.687
	Willingness to ask for help	14.56 ± 2.54	12.58 ± 2.89	t = 2.175	0.036	0.726

SD, Standard Deviation; RAS, Recovery Assessment Scale

Note: The results of the difference between the groups of RAS total and five factors scores were shown. There were significant differences in "No domination by symptoms" and "Willingness to ask for help" of RAS factors between the groups.

tive recovery, suggesting that participants who perceived high levels of emotional peer support felt less affected by symptoms and were more help-seeking. According to a previous study, psychiatric symptoms were not associated with network size and satisfaction of social support [9]. Open peer support providers who shared their experiences built trust with clients and served as recovery role models [10]. They gave experience-based advice and conveyed information better [11]. Such characteristics of peer support may be related to these results.

This study has limitations. First, due to cross-sectional design, causality cannot be determined. Thus, the opposite relationship (i.e. greater recovery leads to higher emotional support) may exist. Second, small sample size and focus on Japan limit generalizability. Third, because of the self-reported questionnaire, instruments used might not measure actual emotional support and recovery. In the future, we will investigate causal relationship and use objective measures.

Summary and Conclusions

We determined the relationship between emotional peer support networks and subjective recovery in people with mental illness, specifically in relation to no domination by symptoms and willingness to seek help. In occupational therapy, it is critical for clients' recovery to naturally foster their emotional support. To illustrate, group programs allowing clients to share emotional support is effective. However, since the pace of interpersonal relationship formation differs from one person to another, the client's individuality must be respected so as not to impose the therapist's agenda on clients but to tailor treatment to individual needs.

Conflict of interest

No conflicts of interest.

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ORIGINAL ARTICLE

Examining the Linguistic Equivalency and Cross-Cultural Adaptation of the Sensory Processing and Self-Regulation Checklist- Tagalog Version

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Abstract: Children's ability to adequately process sensory information from their environments contribute to the development of self-regulation. The increasing prevalence of sensory processing difficulties in both clinical and normative childhood population underscores the need for assessment. However, in the Philippine context, there is no cross-culturally validated tool that measures sensory processing and self-regulation among children. Both language equivalency and cultural-relevance should be addressed when translating health-related outcomes. In this study, the accuracy of linguistic equivalency and cultural relevance of the Tagalog version of the Sensory Processing and Self-Regulation Checklist (SPSRC) was validated. Using a multi-step process of forward translation, equivalence of translation testing, backward translation, face, and content validation, and cross-cultural adaptation inquiry, the SPSRC-Tagalog was examined. Adaptation of colloquial English terms was incorporated, and several items whose examples were deemed not culturally relevant were modified to reflect the language and culture it is intended for. The findings in this study support the linguistic equivalency and cultural-relevance of the SPSRC-Tagalog as a single measure of sensory processing and self-regulation abilities of Tagalog-speaking Filipino children that can be used by Filipino occupational therapists. Future studies should further examine its psychometric properties in the target population.

Keywords: linguistic equivalence, cross-cultural adaptation, Tagalog version of the Sensory Processing and Self-Regulation Checklist, translation

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Introduction

Sensory processing refers to the ability to detect and organize sensory information from the environment and integrate them in order for appropriate responses to be generated [1, 2]. The prevalence of sensory processing difficulties among children has been seen in both clinical and general populations. For example, children with neurodevelopmental disabilities, sensory processing difficulties were seen in as much as 80% [3]; while records have been documented to be between 5–28% among typically developing children [4, 5]. Sensory processing difficulties affect children's ability to participate in occupations [1, 2], and the development of self-regulator abilities necessary for higher order functional skills [6]. This underscores the importance measuring sensory processing and self-regulation among children. However, in the Philippine context, there is no known cross-culturally relevant and validated tool that may do so.

The adaptation of health-related measurement tools developed in Western countries has been a common worldwide clinical practice [7]. A similar trend can also be observed among developing countries, such as the Philippines [8, 9]. The pressure to adopt an evidence-based practice, the use of psychometrically tested outcome measures, lack of financial and temporal resourc-

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es, and growing interest in cross-cultural comparisons among normative and clinical groups have motivated this paradigm shift [7, 10].

The most basic process of cross-cultural adaptation of health-related measurement tools involves translation from the original text to the intended language of use [11–13]. However, this mere translation may pose to be more problematic than helpful. The existence of culture-dependent concepts may lead to misinterpretation when items on a tool are translated into the target language [8, 10]. Literal translations may disregard language form and content. Thus, when a translation is hastily performed, the original meaning behind the items may change, alongside its intended constructs and its psychometric properties [7, 10–13].

Translation of health-related measurement tools entails the careful translation of their meaning into the target language. Language equivalency is a suggested criterion that should be mindfully integrated into the translation procedures. Several translation procedures can be seen in the literature, but the most common methods involve forward and backward translation. In forward translation, a bilingual expert translates the original instrument from the original language to the target language. In the backward translation procedure, an independent bilingual expert translates the instrument back to its original form. Experts are then recruited to compare the backward translated instrument with the original one to detect inconsistencies [14–16]. More recently, the use of an expert panel to determine language equivalency has been suggested [16]. This may take several forms. One approach recruits an expert panel that evaluates the forward translated instrument and looks at whether the translated items contain the same meaning within the target language [11, 17].

While these approaches are useful, they might be limited to the form and content of the language, and not on the cultural relevance of the items. The physical objects or materials, and the level of familiarity, meaning, and value an individual places on them are not explicitly addressed [18, 19]. Language and culture, while different constructs, should be considered jointly when adapting health-related measurement tools [11, 13]. Determining the cultural appropriateness and relevance of the items on the translated instrument should be an implicit procedure towards the adaptation of an instrument.

Cross-cultural validation may be performed during the process of translation. For example, Beaton and collegues [11] suggests that translators should be oriented to both language and culture of the target language in order for equivalency of the translation and adaptation. During cross-cultural translations, equivalence of the concept, items, semantics, context, measurement, and function should be considered [12]. This can be achieved by a consensus panel of experts who are knowledgeable of the assessment construct, language, and culture [11]. In determining cross-cultural adequacy, authors may consider the use of quantitative (i.e. survey instruments) and qualitative (i.e., focus group discussions) methods [7, 10–17].

In this study, we examine the linguistic equivalency and cross-cultural adaptation of the Sensory Processing and Self-Regulation Checklist-Tagalog version (SPSRC-Tagalog) after going a multi-process of translation and language equivalency. In the Philippines, there is no known outcome measure similar to the constructs of the SPSRC-Tagalog. We further employed initial attempts to validate the translated tool using face and content validation tests. Establishing the linguistic equivalency and cross-cultural adaptation of the SPSRC-Tagalog will be useful for Filipino occupational therapists in understanding sensory processing difficulties among Filipino children.

Methods

Before conducting this research, ethical approval was sought from the University of Santo Tomas- College of Rehabilitation Sciences- Ethics Review Committee. This study reports the preliminary findings on the SPSRC-Tagalog, which is limited to examining its linguistic equivalency and cross-cultural adaptation.

The Sensory Processing and Self-Regulation Checklist (SPSRC)

The Sensory Processing and Self-Regulation Checklist was developed as a singular tool that can simultaneously measure self-regulation and sensory processing skills among children ages 3–8 [18, 20]. It was developed through a rigorous process that involved child development experts that resulted in the current 132-item checklist. The SPSRC has undergone psychometric property testing, and results indicate satisfactory reliability (internal consistency, intrarater reliability) and validity (factor analysis, convergent validity, discriminant validity) [18, 20]. It is divided into two parts: Self-regulation ability (Part 1) and Sensory processing ability (Part 2). Part 1 is subdivided into three scales (physiological, social/cognitive/emotional, facing changes or challenges), while Part 2 has six sensory-related subscales (auditory, visual, tactile, gustatory/olfactory, vestibular, proprioceptive). Parents are instructed to rate their child's typical performance on the items within the past three months using a 5-point Likert scale (never = 5, seldom = 4, sometimes = 3, most of the time = 2, always = 1; reversed scoring for some), where a lower score indicating performance that is less favorable. The original version is in Chinese [18, 20], but a translated English version is likewise available [21]. The SPSRC-English is a translation of the original version by the authors that underwent a rigorous process of forward translation, backward translation, and review by an expert panel.

Procedures

This research underwent several phases to report on the cross-cultural and linguistic equivalency of the SPSRC-Tagalog version, guided by the recommendations of the World Health Organization [17] and its original author (Lai, personal communication, February 2018).

Forward Translation

The Philippines is mostly a bilingual (English and Filipino) nation, with Tagalog being one of the most widely spoken languages. The Tagalog translation of the SPSRC was carried out using the recent English version [21]. Two Filipino occupational therapists (OT) performed the forward translation. Both were licensed OTs with > 5 years of experience in the field of pediatrics, familiar with sensory processing and self-regulation, and knowledgeable of the English language, but whose mother tongue is Tagalog. The translation was performed independently. A consensus meeting between the forward translators and the research team was conducted to review the initially translated tool. During this meeting, each item on the riginal tool was presented, while the individual forward translators presented their translations. The translations for each item were discussed in order to reach consensus. Diverging translation were deliberated, with the research team's primary investigator mediating the discourse. At the end of the meeting, converging and diverging translations, as well as questionable items endorsed by the translators, were resolved and revised to produce the initial draft of the Tagalog version.

Equivalence of Translation

The equivalence of translation into the Tagalog version was reviewed out by eight panel members, which included 7 OTs and 1 speech-language pathologist. All expert panel members were licensed (or in the case of the speech-language pathologist, carries the certification to practice) Filipino professionals with > 3 years of current and continued pediatric practice, familiar with sensory processing and self-regulation, and knowledgeable of the English language, but whose mother tongue is Tagalog. These participants were asked to comment on the equivalence of translation of the SPSRC from English to Tagalog using the Equivalence of Translation Tool by Flaherty [22]. Each item was rated using a 3-point scale (a score of 3 means that the item had precisely the same meaning in both versions, a score of 2 means that the item had almost the same meaning in both versions and a score of 1 means that there are different meanings in each language) and commented on by the experts. Items which scored 1 or 2 by any member of the expert panel were reviewed by the research team considering the specific comments and suggestions and were reworded for the purposes of enehancement of clarity of the Tagalog version.

Backward Translation

The Tagalog version was then translated back to English by two independent Filipino OTs (different from the OTs who performed the Tagalog translation but sharing similar characteristics) who were naïve of the original version. The translation was conducted independently of each other but was subsequently integrated. Items deemed questionable were revised following the suggestions made by the backward translators and by the study team. In order to avoid biased information language ambiguitites, the research team concorded with author of the original SPSRC in order to address determine whether the translated items retained their original constructs. A consensus was reached between the study team the original author on the Tagalog version of the SPSRC.

Face, Content and Cross-cultural Adaptation Validation

The SPSRC-Tagalog version was evaluated on its face, content, and cross-cultural adaptation validity by fifteen Tagalog-speaking Filipino expert panel members, which consisted of three OTs, three physical therapists, three speech-language pathologists, and three parents. All professionals were licensed therapists with > 3 years of current and continued pediatric practice. Face, content and cross-cultural adaptation validation can be accomplished using quantitative and qualitative methods [7, 10–17]. In this study, face, content and cross-cultural adaptation validity were measured using the questionnaire by Yaghmaei [23], and comments from the experts. The questionnaire allows for measuring and analyzing the extent of a measurement tool's ability to measure what it intends to measure. General face and content validity were determined by asking yes or no questions. Criteria items with > 80% were retained, while those with lower ratings were considered for revisions. Each scale on the questionnaire was evaluated on its relevance, clarity, simplicity, and ambiguity, using a 4-point Likert scale (the higher the rating, the better the validity score). Items with a mean score of > 3.00 were noted and revised based on the comments of the experts,

Table 1 Summary of Culturally-Adapted Terms in SPSRC-Tagalog

Part	Section	Item No	SPSRC-English	SPSRC-Tagalog
2	A	6	Radio broadcast at MTR	Anunsyo sa tren
	B	2, 6	Torch light	Flashlight
	C	3, 9	Rough mat or grass mat	Carpet o banig
		5, 12, 18	Ice or hot-water pad	Yelo o mainit na bimpo
		15	Hand cream	Lotion
	D	2	Markers	Pentel pen
		3	Lemon juice	Calamansi juice
	E	12	Roundabout	Merry-go-round (tsubibo)
	F	14	Play-doh	Clay

and subsequently integrated into the final draft of the SPSRC-Tagalog.

Results

Language Equivalence

We recorded and tallied the individual responses of the participants on each of the items on the SPSRC-Tagalog and their rating on its cross-cultural adaptation appropriateness. All items on Part 1 (Self-regulation ability) scored a grade of 3 on the Equivalence of Translation Tool [22] and did not receive any dissenting comments, which suggests its endorsement as cross-culturally appropriate for the Tagalog-speaking Filipino population. Across all items, there were no comments on the use of colloquially-adapted terms (using English words in due to lack of existing equivalent word or the word loses its meaning when translated into the Filipino language). The experts also endorsed the adapted Tagalog translation, which used non-direct translation. However, we noted eleven items (nine examples) that scored a 1 on language equivalence (means that there are different meanings in each language) and their respective comments across participants in Part 2 (Sensory-processing ability), specifically on the objects used as an example. We found that the process of consesnsus between the translators and the study team, the invaluable comments from the expert panel, and discussions with the tool's original authors are useful practices that allowed us to translate them into the target language and culture [11–13]. It was not that the translation was flawed, but rather the experts commented on its cultural relevance. In this research, we refer to these as non-culturally relevant objects. The participants provided similar suggestions on how these objects used in the items may be more culturally relevant. We modified the nine examples and integrated them into the SPSRC-Tagalog version. In order to retain the original construct and meaning of these items, discussions between the study team and the original authors proved useful and meaningful [13].

For example, Part 2 Section C Items 3, 9 used "rough mat or grass mat" in its colloquial English form (English form retained in the Tagalog version). The suggestion made by the participants was to omit the adapted colloquial term and replace it with "carpet o banig," a more culturally-relevant and familiar object that can be understood by the target audience. Another comment raised by the participants pertain to the objects depicted in Part Section C Item 18 "ice or hot-water pad." The suggestion was to replace it with "yelo o mainit na bimpo." In this example, we see "ice" directly translated into its Tagalog equivalent, "yelo." However, the "hot-water pad," an item that is somewhat familiar in the Filipino culture (closest equivalence is "hot packs"), is not most accessible or widely-used. Instead, the suggestion of using "mainit na bimpo" was made, which, when translated, refers to hot moist towels, traditionally used by parents on their children. These, among other examples, were suggested by the participants, and a summary of these can be seen in Table 1.

Face Validity

All participants deemed the SPSRC-Tagalog as a questionnaire that can be easily read and understood (Table 2). A consensus agreed that it is easy to understand (92.86%) and administer (92.86%). However, more than half of the participants (57.14%) noted the presence of grammatical errors.

Content Validity

Generally, all participants rated the SPSRC-Tagalog as a tool that covers major critical areas in sensory processing and self-regulation that are related to each other with appropriate rating scales (Table 3). However, some participants (14.29%) questions whether items under

Table 2 Summary of SPSRC-Tagalog Face Validation

Criteria	Rating
Text can easily be read	100%
Instructions are easy to understand	92.68%
Free from grammatical error	57.14%
Layout is properly arranged	85.71%
Can easily be administered	92.68%
Can easily be answered	100%
Can easily be administered within a reasonable amount of time	85.71%

Table 3 Summary of SPSRC-Tagalog General Content Validation

Criteria	Rating
Covers the necessary major areas needed to be measured	100%
Major areas covered by the tool relate to each other	100%
Items under each are adequately represent the area it falls under in	85.71%
Items under each major area are related to each other	100%
Rating scale used in the tool appropriate to the items it is supposed to measure	100%

Table 4 Summary of SPSRC-Tagalog Section Validation

Sections	Relevance	Clarity	Simplicity	Ambiguity
Part 1. Self-regulation abilities				
1. Physiological functioning	3.95 ± 0.14	3.91 ± 0.10	4.00 ± 0.00	3.95 ± 0.10
2. Social/Cognitive/Emotion Development	3.98 ± 0.05	3.86 ± 0.21	3.94 ± 0.11	3.92 ± 0.11
3. Facing Transition or Challenges	3.99 ± 0.03	3.90 ± 0.12	3.94 ± 0.16	3.98 ± 0.06
Part 2. Sensory processing abilities				
1. Auditory	4.00 ± 0.00	3.85 ± 0.20	3.93 ± 0.03	3.87 ± 0.27
2. Visual	3.98 ± 0.06	3.93 ± 0.14	3.99 ± 0.02	3.99 ± 0.03
3. Tactile	3.99 ± 0.02	3.91 ± 0.14	3.99 ± 0.22	3.99 ± 0.02
4. Gustatory/olfactory	4.00 ± 0.00	3.92 ± 0.15	3.92 ± 0.15	3.95 ± 0.15
5. Vestibular	4.00 ± 0.00	3.94 ± 0.08	3.99 ± 0.02	3.98 ± 0.04
6. Proprioceptive	4.00 ± 0.00	4.00 ± 0.00	4.00 ± 0.00	4.00 ± 0.00

each area adequately represent the area it falls under in.

We rated each scale on the SPSRC-Tagalog on its relevance, clarity, simplicity, and ambiguity (Table 4). For the relevance criteria, items on four out of the nine scales (auditory, gustatory/olfactory, vestibular, proprioceptive) were rated as very relevant (4.00 ± 0.00), with the rest ranging from a mean score of 3.95 to 3.99. Only the items on the proprioceptive scale were perfectly rated very clear (4.00 ± 0.00), while the rest ranged from 3.85 to 3.94. Items on two scales (physiological functioning, proprioceptive processing) were perfectly deemed very simple in its presentation (4.00 ± 0.00), and the rest ranged from 3.92 to 3.99. The meaning of the items is most clear (ambiguity) for the proprioceptive scale (4.00 ± 0.00) compared to the rest, which spanned between 3.87 to 3.99).

Discussion

The SPSRC-Tagalog has undergone a multi-process of translation and linguistic equivalency examination. The Tagalog version of the SPSRC depicted in this study has proven to be an excellent equivalent to the original English version, and is seen to be appropriate for psychometric testing among Tagalog-speaking Filipinos.

In the translation of the SPSRC from English and Tagalog, several English terms were retained and received no objections from the expert panel. The habit of using English integrated into the Tagalog language is a cultural phenomenon observed in the Philippines, a generally considered bilingual nation [24]. This form of communication, seen in both written and oral forms, places standard English words or phrases with the standard Tagalog. A kind of switching occurs between English and Tagalog within and between sentences. Several reasons may exist to explain such practice. Still, in this case, it surmised that the acceptance of the use of English colloquial words or phrases within a Tagalog version of the questionnaire might likely be for precision. Communicative proficiency is preferred over literal translations, which may compromise construct-specific lexical terms from the original source language [25, 26]. This practice is not exclusive to the SPSRC-Tagalog and can be seen in other Tagalog version of health-related outcome measures, especially among the intended constructs within [27, 28]. The Tagalog-English code-switching seen in this study reflects the bilingual nature of the target population the questionnaire is designed for. Further investigation is needed if SPRC is to be translated into other international or local languages.

More than language equivalency, this paper places importance on the cultural-relevance of items in a questionnaire. In the process of examining the equivalency of translation of SPSRC into Tagalog, our experts focused on recommending changing the objects of examples in some of the items. For the respondent to provide the best response to a questionnaire item, the construct of the question should be appropriate and relevant to them, in terms of culture and language [29]. Careful consideration of both physical and nonphysical characteristics of the sensory stimulus depicted in the questionnaire is essential to gather the appropriate response [18, 19]. Future researchers who intend to translate the SPSRC in other languages should look beyond the language translation, and likewise incorporate the relevance of the items within the culture it is designed to be used for.

The preliminary findings on the linguistic equivalance and cross-cultural adapatation of the SPSRC-Tagalog reported herein are part of a larger study that will examine the psychometric properties of the said tool. Nevertheless, in this research, we demonstrate the quality of the process of translating and determining the language equivalency of the SPSRC-Tagalog. However, there are some limitations in methodology. Whereas we used methods and strategies described in previous literature, the psychometric properties of the SPSRC-Tagalog remain to be answered, an objective beyond the scope of this study. There is a neeed for SPSRC-Tagalog to establish its measurement properties, which includes reliability (i.e., test-retest, internal consistency) and validity (i.e., criterion validity, construct validity) [30]. In the process of translating assessment tools from one language to another, researchers often run the risk of altering the intended meaning of the test items and consequently affecting the validity of the assessment tool. Nevertheless, it is recommended that the SPSRC-Tagalog be subjected to an extensive sample field testing to evaluate its reliability and validity. This includes an a priori examination of its ecological validity. For this, the bilingual approach suggested [19]. Both the English and Tagalog versions of the SPSRC should be tested on bilingual end users of the questionnaire (i.e. parents and caregivers of children), and their responses compared to determine the translation and language equivalency of the SPSRC-Tagalog in a real-world setting.

Conclusion

To conclude, these findings in this study support the linguistic equivalency and cultural-relevance of the SPSRC-Tagalog as a single measure of sensory processing and self-regulation abilities of Tagalog-speaking Filipino children. The methods described in this study may serve as a guide in translating the SPSRC in other local languages. Succeeding studies should evaluate its psychometric properties. Using the SPSRC-Tagalog may aid in a better understanding of sensory processing for clinical and research purposes among occupational therapists.

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CASE REPORT

An Intervention to Overcome Eating Difficulties in a Patient with Autism Spectrum Disorder -A Case Study

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Abstract: Introduction: Patients with autism spectrum disorder (ASD) may present with problems related to eating behaviors, including unbalanced diet, attention disruption, and poor tool manipulation. These problems are attributed to the widespread sensory processing abnormalities associated with ASD. Therefore, it is important to consider interventions and support for eating behaviors in patients with ASD that address these sensory processing problems. However, to date, no studies have investigated interventions to aid eating behaviors in this population. Here, we describe an action-based intervention to promote food ingestion in a young adult with ASD.

Methods: An A-B method with a single-system research design was implemented, with three main outcome measures: goal attainment scaling (GAS), time required to eat, and functional independence measure (FIM). Following baseline measures, the intervention was based on changes in eating actions and consisted of two phases. In Phase I, the eating environment was adjusted. Phase II supported the manipulation of eating tools in addition to environmental adjustments.

Results: The eating action changed from needing complete assistance with eating to her own manipulation of eating tools and the ability to ingest food orally. The time needed for eating was reduced, while the GAS and FIM scores both improved.

Conclusion: The organization of the environment promoted eating, while the manipulation of eating tools promoted the flow of actions. When a person with ASD has eating difficulties, it is suggested that manipulating the eating tools may be useful to promote oral ingestion in addition to environmental adjustments.

Keywords: autism spectrum disorder (ASD), eating action, eating environment, action-perception

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Introduction

Problems related to eating behaviors in patients with Autism Spectrum Disorder (ASD) have been reported, including unbalanced diets, attention disruptions, and poor tool manipulation [1]. These problems are attributed to the widespread sensory processing abnormalities associated with ASD [2]. Problems with sensory processing continue into adulthood and inconvenience in activities of daily living (ADL) [3]. In adulthood, sensory processing problems contribute to hyperreactivity and have been linked to the core symptoms of ASD [4, 5]. Therefore, it is important to consider support for eating behaviors in patients with ASD presenting with sensory processing problems. However, there is no report on specific support for adults with ASD. The purpose of this study was to outline a specific intervention to aid ADL; focusing on eating difficulties from an action-perception viewpoint [6].

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Table 1 Goal Attainment Scaling

		Goal area	
	Score	Eating action: Intervention of her mother	Eating action: Intervention of her therapist
Much less than expected	−2	She can eat less than 50% of jelly food by assisting her mother in oral ingestion	She can eat a little jelly by assisting her therapist in oral ingestion
Somewhat less than expected	−1	She can eat more than 50% of jelly food by assisting her mother in oral ingestion	She can eat less than 50% of jelly food by assisting her therapist in oral ingestion
Programme goal	0	She can eat less than 50% of rice porridge by assisting her mother in manupulate the eating utensils and tableware	She can eat more than 50% of jelly food by assisting her therapist in oral ingestion
Somewhat better than expected	+1	She can eat more than 50% of rice porridge by assisting her mother in manupulate the eating utensils and tableware	She can eat less than 50% of rice porridge by assisting her therapist in manupulate the eating utensils and tableware
Much better than expected	+2	She can eat herself less than 50% of rice porridge or noodles without assistance	She can eat more than 50% of rice porridge by assisting her mother in manupulate the eating utensils and tableware She can eat herself less than 50% of rice porridge or noodles without assistance

GAS is a tool for respecting the values of patient and their family, incorporating therapist's judgment, and conducting patient-centered interventions. Her personal goal was stable oral ingestion.
GAS: Goal Attainment Scaling

Subject

The patient was a 23-year-old woman admitted to the hospital for fever of unknown origin. She had been was diagnosed with a pervasive developmental disorder (now diagnosed as ASD) at the age of nine. After hospitalization, the fever resolved, but oral ingestions continued to be difficult. She had a strong resistance to exercising and was anxious. The Japanese Sensory Inventory-mini (JSI-m) explores the possibility of sensory dysregulation. Her inventory result was red; hence, a diagnosis of hyperesthesia was presumed. Sensory processing problems in childhood may persist into adulthood [3]. Therefore, behaviors that were scored during childhood on the JSI-m were used as clues to understand adult tendencies. The patient communicated by nodding only and all ADL required the assistance of her parents.

Eating action

The eating environment was on a bed in a private room. Around the time of eating, the body turned rigid, and the patient became nervous due to visual and auditory stimuli from outside the room. A spoon was used as the eating utensil. However, the patient was hesitant to reach food and could not scoop the food. As a result, the consumption of the meal was fully assisted by her mother.

Method

Procedure

An A-B method with a single-system research design comprising three target outcomes was conducted to assess the effects of the intervention. The baseline was 3 weeks without occupational therapy (OT). Thereafter, the intervention was performed for 5 weeks. Signed informed consent for this study was obtained from her mother.

1) GAS (Goal Attainment Scaling)

GAS was adopted to carry out patient-centered interventions, with the patient's therapist and family's help in setting the goals [7]. The individual goal was stable oral ingestion (Table 1). We quantified changes in GAS scores before and after baseline and OT interventions.

2) Eating; required time

The time required to eat, which can also be considered eating "efficiency," was measured daily for up to 60 minutes.

3) FIM (Functional Independence Measure)

ADL performance was scored by FIM and measured at admission and before and after the OT intervention.

Therapy process

The intervention based on action-perception was divided into two phases.

Fig. 1. Intervention scene by handling utensils and tableware.
a) Inserting the spoon into the food while keeping contact with the inner surface of the bowl. b) Scooping food while keeping contact with the inner surface of the bowl. The spoon is held in a horizontal position. c) The spoon is moved from the bowl to the lips with constant contact.

Table 2 Effect of the Intervention on the Main Outcome Measures

		Baseline: 1st to 3rd week		Intervention: 4th to 8th week
	Duration of hospitalization	Admission 1st week	Starting occupational therapy 4th week	discharge 8th week
GAS	Goal 1	-1	-1	+2
	Goal 2	-1	-1	+2
	Calculated goal attainment scores	38	38	75
Eating	Required time (minutes)	60±0	60±0	23.2±1.7
FIM	Total score	19	19	61
	Motor score	13	13	41
	Cognitive score	6	6	20

GAS: Goal Attainment Scaling, FIM: Functional Independence Measure

Phase I: 1st week

The dining table was separated from the bed, and the area was closed with curtains and doors. Only the utensils and tableware were placed on the table.

Her therapist scooped up food with a spoon and guided her head to encourage a relationship in which her mouth and food approached each other. The spoon was then guided to a stable contact with her lower lip, and the food was removed by her upper lip.

Phase II: 2nd to 5th weeks

From the 2nd week, the meal was changed to rice porridge and soft food, and utensils and tableware were handled by the patient (Fig. 1). Her therapist guided her hand to assist in using the spoon and bowl. When scooping food, her therapist started by bringing the spoon into contact with the inner surface of the bowl to stabilize it. Then, her therapist's guidance was shifted from a gathering manipulation to a scooping manipulation based on the sense of food resistance. Spooning food into the mouth continued while maintaining the spoon in contact with her lower lip from the inside of the bowl.

Results

The patient was hospitalized for eight weeks. Table 2 shows the changes in target outcomes in each period. GAS scores improved following the intervention. In the final stage of the interventions, the patient was able to consume all food with assistance in the use of eating utensils. She was also able to self-feed for about 50% of her eating, and the required time to eat was reduced. FIM was also improved after the intervention, and her mother reported that the patient's eating action was maintained after discharge.

Discussion

Prior to the intervention, the patient was unable to orient herself to the layout of the dietary environment, which was full of visual stimuli, and was overreacting to auditory stimuli from surrounding noise and involvement of others. ASD is characterized by an overreaction to sensory stimuli [4, 5], and hypersensitivity to sensory processing tends to distract them from eating. The distraction might lead to problems with eating behaviors [8]. For this reason, the patient had persistent tension during mealtimes and could not progress to eating actions. Persons with ASD tend to make decisions based on rules [9]. Therefore, her therapist offered the patient an action-based viewpoint, based on the perception of tactile sensation from the adjusted eating environment, to the manipulation of eating tools, and the sensory experience of food in the mouth. To promote eating, adjusting the eating environment and encourage behavioral changes offer promising results [6]. Therefore, it is conceivable that the interdependent experience of perception and action partly explains the improvement in ADL in general.

Conclusion

When adult patients with ASD have difficulty eating, it is suggested that in addition to environmental adjustments, the manipulation of eating tools based on the perception of tactile sensation may be useful to stimulate oral ingestion. However, the findings of this case report must be tested in a larger group to establish the real effectiveness.

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■ORIGINAL ARTICLE

Effect of Daily Living Activities on the Need for Long-Term Care in Older Adults

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Abstract: Background: Japan has become a super-aged society, resulting in an increased number of insurance certifications for long-term care needs. This study aimed to identify the effects of daily living activities on changes in certification among older persons with support needs classified by cognitive function.
Methods: The sample, sourced from the 2014 and 2016 Japanese long-term care insurance certification surveys, consisted of 6,219 individuals with support needs. Logistic regression analysis was performed to identify activities of daily living (ADL) associated with certification changes. Separate logistic regressions were performed to predict certification changes based on participants' cognitive functioning.
Results: Regarding levels of cognitive functioning, ADL associated with certification change among the highest functioning individuals were bathing, nail trimming, mobility, managing money, and decision-making ability. At the next level of functioning, the activities included bathing, toilet hygiene (urinary), taking prescribed medications, managing money, decision-making ability, and preparing meals. At the lowest level of functioning, only managing money was associated with a certification change.
Conclusion: ADL affecting certification change varies with the level of cognitive functioning. Thus, managing money was considered to be the most important activity as it influences change in certification in all cognitive categories. When occupational therapists create interventions for older persons with support needs, they should use IADL abilities such as managing money, which requires complex cognitive functions, from an early stage. This may lead to the reduction of the need for care in older persons with support needs.

Keywords: cognitive function, daily living activities, long-term care insurance, long-term care needs level, support needs level

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1. Introduction

Japan became a super-aged society in 2016, when the percentage of its older population exceeded 27% [1]. The population began to decline after peaking in 2008. This, in turn, has caused a drop in the working-age population and an increase in the aging population [2]. As a result, with the increase in the number of persons with long-term care needs certification under Japan's long-term care insurance (LTCI) system [3], the LTCI premium has more than doubled since its inception, and various initiatives emphasizing preventive long-term care have been launched [4].

In preventive long-term care, efforts have been focused on the phase prior to the support needs-certification stage; however, developing and applying effective interventions in earlier studies were difficult because of small sample sizes [5]. Accordingly, developing and executing care management plans to promote the in-

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dependence of individuals who have been certified as having support needs may deter the decline of their physical health and postpone their need for long-term care needs certification. In addition, care managers and occupational therapists working in the community should understand what activities of daily living (ADL) should be focused on, to deter a decline in certification of care needs. This is because if occupational therapists can appropriately predict ADL items that lead to care needs certification and intervene accordingly, individuals with support needs could live happily without care needs certification.

According to the Status of Basic Life Survey conducted in 2016 [6], although joint disease, frailty due to old age, and fracture/fall were common reasons for support needs certification, the most frequent reason for care needs was dementia, suggesting the importance of preventing cognitive impairment in persons with support needs. The importance of such an approach was highlighted in a previous longitudinal study, which reported an association between long-term care needs certification and dementia [7]. Recent studies have focused on the association between dementia and ADL [8, 9]. It has been reported that cognitive impairment causes limitations in instrumental ADL (IADL), gradually lowering basic ADL (BADL) functioning (e.g., in the early stage of cognitive decline, individuals often need support with managing money and taking prescribed medications).

Previous reports on factors of long-term care needs certification have included ADL, in addition to physical, mental, and social factors [10, 11]. Although Germany and South Korea, like Japan, have introduced LTCI [12, 13], studies on factors of long-term care needs certification are limited [14, 15], and no studies have examined long-term care needs certification based on ADL in older persons with support needs. Determining which ADL contribute to transition in certification (from support needs to long-term care needs) will help provide effective occupational therapy interventions for older adults with support needs. Since dementia is an important factor in the increase in the number of older adults with care needs [6, 7], we propose a care plan to support the cognitive function of older adults with dementia after analyzing their degree of independence in daily living.

Based on the analysis of certification data, this study first aimed to elucidate whether gender, age, and degree of independence in daily living among older adults with disabilities or dementia affect their certification change (from support needs to long-term care needs) after two years. The reason why the dependent variable was “certification change from support needs to long-term care needs” is that the recovery rate of persons with care needs is considerably lower than that of persons with support needs [16].

Further, to provide suggestions for developing measures to prevent individuals from transitioning to long-term care needs, we performed an analysis based on cognitive function for ADL items that affect certification change. The reason for assessing cognitive condition was that ADL capacity depends on the degree of cognitive condition, and as mentioned above, dementia is the most frequent reason for individuals being categorized as requiring long-term care [6]. Thus, it was hypothesized that given the difficulty to identify early cognitive dysfunction in older persons with support needs, it may be possible to determine it based on IADL.

2. Materials and Subjects

Participants in this study were individuals living in a Japanese city (which we refer to as City A) who completed the 2014 and 2016 LTCI certification surveys. The certification questionnaire was developed by the Japanese Ministry of Health, Labour and Welfare; it surveyed respondents on 74 items: 62 items related to physical, life, cognitive function, psychological and behavioral disorders, and social life, and 12 items related to special medical care.

The LTCI certification process consisted of two stages. First, individuals were placed into one of seven needs categories based on their responses to the certification survey. The first two levels were referred to as support-needs levels 1–2, which consisted of preventive services for individuals with less intensive needs. The remaining five levels were referred to as care-needs levels 1–5, which consisted of services for individuals categorized by disability severity. Second, a committee of physicians and other professionals determined the eligibility of each applicant. The survey data for this study were collected by a medical worker (certified researcher) from City A and met LTCI eligibility. The survey data were collected by trained professionals at the users’ homes and were stored in City A’s database in accordance with an agreement established between City A and the co-researcher’s institution.

A total of 23,818 individuals living in City A completed the certification surveys at two time points: 2014 and 2016. Of the 7,621 older adults who were categorized in the support needs group in 2014, 6,219 (2,555 and 3,664 with support-needs levels 1 and 2, respectively) also completed the certification survey in 2016 and made up the sample for this study. The remaining 1,402 respondents were not included because they did not need long-term care certification, had relocated, or died. The individuals certified for long-term care needs in 2016 comprised the changed group and those who remained certified for support needs made up the unchanged group (Table 1).

3. Method

We categorized and organized the basic attributes of the 2014 participants into two groups: those who required care needs in 2016 and those who remained in need of support (Table 1). Next, we classified and organized the basic attributes of all participants according to the degree of independence in the daily living of older adults with dementia (Table 2). We then sorted and organized the 2014 participants' activities of daily living scores by the degree of independence in daily living of older adults with dementia (Table 3). After organizing the data, we moved on to the statistical analysis. A series of stepwise logistic regression analyses were performed to identify the factors associated with certification change, and the variables were selected using the backward method. The dependent variable was whether an individual experienced a change in certification from support needs to long-term care needs. In our first analysis using data from the 2014 certification survey, the independent variables were gender, age, degree of independence in daily living among older adults with disabilities, and degree of independence in daily living among those with dementia.

In the second analysis, we identified ADL affecting the likelihood of certification change. Based on previous studies [8–9, 17], items were selected from the certification survey in 2014 to serve as independent variables. The analysis was adjusted for age, gender, and degree of independence in daily living. Multicollinearity was assessed using the variance inflation factor coefficient and correlation analyses. We examined the ADL factors affecting certification change by performing a separate logistic regression for each level of cognitive functioning. Based on the parameters of the Japanese Ministry of Health, Labour and Welfare, the degree of independence in the daily living of older adults with dementia in 2014 was classified into three levels—Independence, I, and II—ranging from more to less independent. Due to the small number of individuals assigned to category III, we excluded it from the analysis. While taking cognitive function into account, independence was further classified into eight levels: Independence, I, IIa, IIb, IIIa, IIIb, IV, and M. Level I is defined as "the patient has some dementia, but can live independently at home and in society"; level II as "although the patient has some symptoms or behaviors disturbing daily living, they can live independently with the attention and support of others (IIa: symptoms or behaviors are present outside the home, IIb: symptoms or behaviors are present at

Table 1 Participants' Baseline Characteristics in 2014 by Group (N = 6,219)

Items	Unchanged group	Changed group
N	4,062	2,157
Gender		
Male	908	627
Female	3,154	1,530
Age, years (mean ± SD)	80.61 ± 6.32	82.57 ± 6.48
Support needs		
Level 1	1,821	734
Level 2	2,241	1,423
Care needs		
Level 1	0	0
Level 2	0	0
Level 3	0	0
Level 4	0	0
Level 5	0	0
Degree of independence in daily living of older adults with disabilities[a]		
Independence	2	2
J1	74	27
J2	1,945	802
A1	1,128	601
A2	861	677
B1	49	44
B2	3	4
C1	0	0
C2	0	0
Degree of independence in daily living of older adults with dementia[b]		
Independence	2,502	734
I	1,369	1,019
IIa	124	213
IIb	63	184
IIIa	4	6
IIIb	0	1
IV	0	0
M	0	0

Note. [a] J1 = [the patient can go out by using public transportation], J2 = [the patient can go out in the neighborhood], A1 = [the patient goes out with assistance and is mostly out of bed during the day], A2 = [the patient goes out infrequently and alternates between sleeping and being out of bed during the day], B1 = [the patient can transfer to the wheelchair, as well as eat and excrete away from the bed], B2 = [the patient transfers to the wheelchair with assistance], C1 = [the patient can roll over], C2 = [the patient cannot roll over], [b] I = [the patient has some dementia but can live independently at home and in society], IIa = [although the patient has some symptoms or behaviors disturbing daily living, they can live independently with the attention and support of others; symptoms or behaviors are present outside the home], IIb = [although the patient has some symptoms or behaviors disturbing daily living, they can live independently with the attention and support of others; symptoms or behaviors are present at home], IIIa = [the patient has symptoms or behaviors that disturb daily living and they require care; symptoms or behaviors mainly occur in the daytime], IIIb = [the patient has symptoms or behaviors that disturb daily living and they require care; symptoms or behaviors mainly occur at night], IV = [the patient frequently has symptoms or behaviors that disturb daily living and they always require care], M = [the patient has severe mental, behavioral, and psychological symptoms of dementia or severe physical disease, therefore, they require specialized care].

Table 2 Summary of Attributes of Older Adults with Dementia by Degree of Independence

Items	(Degree of independence in daily living of older adults with dementia)			
	Independence	I	II	III
N	3,236	2,388	584	11
Gender (N)				
Male	766	577	187	5
Female	2,470	1,811	397	6
Age, years M (SD)	80.53 (6.46)	82.23 (6.14)	81.68 (7.00)	79.27 (7.23)
Degree of care (N)				
Support 1	1,440	883	228	4
Support 2	1,796	1,505	356	7
Degree of independence in daily living of older adults with disabilities (N)				
Independence	3	1	0	0
J1	54	35	12	0
J2	1,513	1,029	201	4
A1	922	634	173	0
A2	689	654	189	6
B1	52	32	8	1
B2	3	3	1	0
C1	0	0	0	0
C2	0	0	0	0

Note. N = [number of people], M (SD) = [mean ± standard deviation]

Table 3 Number of Older Adults with Dementia by Degree of Independence and Scores on Activities of Daily Living in 2014

Item	Score Range	Degree of Independence															
		Independence				I				II				III			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Bathing	4	2,467	703	29	37	1,745	579	19	45	414	152	4	14	7	4	0	0
Nail trimming	3	1,973	914	349		1,362	738	288		355	146	83		6	4	1	
Functional mobility	4	3,195	36	5	0	2,363	19	6	0	579	5	0	0	11	0	0	0
Mobility	4	3,039	188	9	0	2,155	227	6	0	527	54	2	1	10	1	0	0
Ability to swallow food	3	2,938	298	0		2,005	383	0		477	107	0		8	3	0	
Self-feeding	4	3,206	26	4	0	2,371	14	3	0	580	4	0	0	10	1	0	0
Toilet hygiene (urinary)	4	3,184	1	49	2	2,320	8	58	2	546	7	30	1	8	1	2	0
Toilet hygiene (fecal)	4	3,211	0	23	2	2,352	4	31	1	563	3	15	3	11	0	0	0
Brushing teeth/rinsing mouth	3	3,192	44	0		2,353	34	1		556	28	0		9	2	0	
Face cleaning	3	3,171	64	1		2,341	46	1		565	19	0		11	0	0	
Combing/styling hair	3	3,191	18	27		2,359	16	13		573	7	4		9	1	1	
Getting dressed (upper body)	4	3,042	11	183	0	2,239	9	140	0	546	12	26	0	9	2	0	0
Getting dressed (lower body)	4	3,064	11	160	1	2,270	9	107	2	547	14	23	0	9	2	0	0
Frequency of going outdoors	3	2,488	559	189		1,818	441	129		417	105	62		6	4	1	
Taking prescribed medications	3	2,866	370	0		1,554	833	1		144	437	3		5	6	0	
Managing money	3	2,658	436	142		1,641	607	140		218	260	106		3	5	3	
Decision-making ability	4	3,003	233	0	0	1,346	1,041	1	0	109	467	8	0	2	7	2	0
Inability to mingle with others	3	3,231	2	3		2,370	2	16		581	0	3		10	0	1	
Shopping for daily necessities	4	1,288	9	748	1,191	813	17	475	1,083	123	18	75	368	1	0	1	9
Preparing meals	4	1,978	2	23	1,233	1,303	6	9	1,070	237	8	5	334	3	0	0	8

Note. Daily life function consists of the following 20 items: “Bathing,” “Functional mobility,” “Mobility,” “Self-feeding,” “Toilet hygiene (urinary),” “Toilet hygiene (fecal),” “Getting dressed (upper body),” “Getting dressed (lower body),” “Decision-making ability,” “Shopping for daily necessities,” and “Preparing meals” are scored from 1 to 4. “Nail trimming,” “Ability to swallow food,” “Brushing teeth/rinsing mouth,” “Face cleaning,” “Combing/styling hair,” “Frequency of going outdoors,” “Taking prescribed medications,” “Managing money,” and “Inability to mingle with others” are scored from 1 to 3. Higher scores indicate lower daily life functioning and an increased need for assistance.

Table 4 Results of the Multivariate Stepwise Logistic Regression Analysis for Each Activity of Daily Living

Items	Independence				I				II			
	OR	95% CI	*p*	R^2	OR	95% CI	*P*	R^2	OR	95% CI	*p*	R^2
Bathing	1.271	1.082–1.493	< 0.01	0.054	1.321	1.140–1.530	< 0.001	0.052				0.013
Nail trimming	1.229	1.080–1.399	< 0.01									
Mobility	2.342	1.746–3.141	< 0.001									
Toilet hygiene (urinary)					1.457	1.107–1.917	< 0.01					
Toilet hygiene (fecal)												
Taking prescribed medications					1.320	1.099–1.586	< 0.01					
Managing money	1.537	1.192–1.982	< 0.001		1.400	1.196–1.640	< 0.001		1.481	1.153–1.902	< 0.01	
Decision-making ability	1.817	1.354–2.437	< 0.001		1.347	1.133–1.602	< 0.001					
Shopping for daily necessities												
Preparing meals					1.088	1.024–1.156	< 0.01					

Note. OR = odds ratio, CI = confidence interval.
Stepwise logistic regression analysis.

home)"; level III as "the patient has symptoms or behaviors that disturb daily living, and they require care (IIIa: symptoms or behaviors mainly occur during daytime, IIIb: symptoms or behaviors mainly occur at night)"; level IV as "the patient frequently has symptoms or behaviors that disturb daily living, and they always require care"; and level M as "the patient has severe mental, behavioral, and psychological symptoms of dementia, or severe physical disease, and requires specialized care."

For older adults with disabilities, the Japanese Ministry of Health, Labour and Welfare classifies individuals' degree of independence in daily living as follows: independence, J1, J2, A1, A2, B1, B2, C1, and C2. Therefore, for our study, patients without disabilities were classified in the Independence category. Level J comprises patients with some disability but are nearly independent (J1: "the patient can go out by using public transportation" and J2: "the patient can go out in the neighborhood"). Level A comprises patients who can live mostly independently at home but need a caregiver to go out (A1: "the patient goes out with assistance and is mostly out of bed during the day" and A2: "the patient goes out infrequently and alternates between sleeping and being out of bed during the day"). Level B patients require some care in their home and spend most of the day in bed (B1: "the patient can transfer to the wheelchair and eat and excrete away from the bed" and B2: "the patient transfers to the wheelchair with assistance"). Level C patients are bedridden and require care for excretion, eating, and dressing (C1: "the patient can roll over," and C2: "the patient cannot roll over").

SPSS software version 24 for Windows (IBM Corp, Armonk, NY, USA) was used for the analyses, with a significance level of $p < 0.01$. The National Institute of Population and Social Security Research signed a memorandum of understanding with City A concerning the use of its data, which was approved by the appropriate ethics committee (IPSS-TRN#15001-2). Due to a change in affiliation for one of the authors, Saitama Prefectural University signed a new memorandum of understanding with City A. The procedures used to collect the data followed all ethical standards of the Declaration of Helsinki.

4. Results

Table 1 shows individual baseline characteristics and ADL scores for the unchanged and changed groups. Tables 2 and 3 show the attributes and ADL scores for each group of older adults with dementia, respectively, classified according to their degree of independence in daily living. For the entire sample, the attributes affecting change in certification after two years were gender (OR = 0.674, 95% CI = [0.593, 0.766], $p < 0.001$), age (OR = 1.047, 95% CI = [1.038, 1.057], $p < 0.001$), and degree of independence in daily living of older adults with disabilities (OR = 1.312, 95% CI = [1.233, 1.397] $p < 0.001$) or dementia (OR = 2.203, 95% CI = [2.043, 2.374], $p < 0.001$). Table 4 shows the results of the analysis of ADL affecting change in certification after two years within different levels of cognitive function. For the entire sample, certification change was associated with bathing, mobility, toilet hygiene (fecal), taking prescribed medications, managing money, decision-making ability, and shopping for daily necessities. For the independent group, a certification change was associated with bathing, nail trimming, mobility, managing money, and decision-making ability. In group I, significant factors affecting certification change were bathing, toilet hygiene (urinary), taking prescribed medications, managing money, decision-making ability, and preparing meals. In group II, a certification change was only associated with managing money.

5. Discussion

Our findings indicated that change in certification after two years was associated with gender, age, and degree of independence in daily living of older adults with disabilities and dementia. Certification change to long-term care needs after two years occurred more frequently among men, compared to women. Conversely, previous studies have reported a higher incidence of BADL disorders in women, compared to men [18, 19]. However, research on gender differences in ADL is rare in Japan [20]. In addition, the disparity between our results and those of previous studies may be explained by the fact that the participants of this study required assistance and care, while Japanese men have a higher mortality rate than Japanese women [21]. This study confirmed that men are more likely to experience a certification change from support needs to long-term care needs.

We also found that the degree of independence in daily living of older adults with disabilities or dementia was a significant factor in certification changes. Previous studies have reported that a decline in physical function affects the severity level of long-term care needs certification and frailty progression [22, 23]. Similarly, a decline in cognitive function has been shown to affect changes in long-term care needs [7]. This study confirms that certification change to long-term care needs is affected by the degree of independence in daily living of older adults with disabilities or dementia.

Our findings also suggest that increased support for ADL may reduce LTCI usage. Among older adults with the highest level of independence, impairments in mobility, bathing, nail trimming, managing money, and decision-making were significantly associated with certification change, suggesting that supporting ADL associated with physical function decline may reduce the level of long-term care needs. Managing money is not a fragmentary living behavior, and long-term management is needed. Decision-making involves serious decisions, such as choosing a treatment or care plan. On the other hand, non-serious decisions include where to go out and what to wear. Therefore, decision-making is fundamental for everyday life, which is why a decline in the individual's decision-making ability implies that they require assistance. Based on our results, we believe that even for independent individuals without dementia symptoms, increased support for IADL is key to reducing LTCI usage.

Furthermore, in group I (individuals with the second-highest level of independence), items that reflected declining capabilities were significantly associated with certification change to long-term care needs. Like the independent group, decision-making, managing money, and bathing, which are important items from the viewpoint of care prevention, were significantly associated with certification change. Additionally, taking prescribed medications, preparing meals, and toilet hygiene (urinary) were associated with the need for nursing care [24, 25]. Taking prescribed medications and preparing meals are IADL prone to decline along with cognitive function and require complex cognitive processing. Toilet hygiene (urinary) may be related to urinary control difficulty as cognitive function declines. An association between cognitive decline and urinary incontinence has been reported in studies of older adults living in the community [26, 27]. Further, biometric studies have reported that the frontal cerebral cortex might be associated with bladder control problems in older people [29, 30].

In group II (individuals with the third highest level of independence), only managing money was linked to certification change. As shown in Table 3, unlike "bathing" and "decision-making ability," about 20% of participants in the "managing money" category received a partial assistance grade. In other words, we can assume that money management is very difficult for people with declining cognitive function, which may have led to this result. Moreover, managing money was the only significant ADL factor identified across all levels of independence, suggesting that, from a preventive long-term care standpoint, assistance in managing money is important for individuals with support needs. Previous studies have shown that, when declines in BADL occur, IADL deteriorate due to the progression of cognitive impairment [8–9, 30, 31]. These findings are similar to those of ADL associated with certification changes identified in this study.

Cognitive decline affects both IADL and BADL [8–9, 30]. In this study, we identified ADL items that were significantly associated with a change from support needs to long-term care needs and analyzed the results based on the level of cognitive function. Recently, effective approaches to improve older adults' decision-making abilities [32], prescribed medication-taking behaviors [33, 34], and money management abilities [35, 36] have been developed. For individuals with long-term care needs certification, it might be useful to provide support for ADL involving complex cognitive processing in addition to those for improving physical functioning. Moreover, developing and implementing effective care management plans may support the independence of older adults with support needs by identifying ADL interventions from occupational therapists using data from certification surveys.

Occupational therapists can use the findings of this study to deter individuals' transition from support needs to care needs. First, an occupational therapist needs to evaluate the degree of independence in daily living among older adults with dementia and the ADL of individuals with support needs. Next, the presence or absence of high-risk items should be confirmed by comparing the individual's evaluation results with the results of this study (Table 4). If a risk item is identified, the subject should be given appropriate occupational therapy focusing on improvement of said factor as soon as possible. In the future, we need to clarify the effectiveness of this intervention strategy.

A limitation of this study was its reliance on certification survey data, as it did not provide background information of individuals, which may include factors, such as disease type, educational background, economic status, and family structure, that could affect the severity level of their long-term care needs. Further, we did not obtain data from clinical tools used by physicians to diagnose patients. Therefore, we could not infer causality based on our study design. The number of samples differed greatly between the cognitive function groups independent, I, and II. Given the results of the logistic regression analysis, the power of each test may have differed and affected the results. Although there were several levels of care needs (ranging from 1 to 5), the dependent variable in this study was "care needs"; therefore, some important ADL items might have been overlooked during analysis.

6. Summary and Conclusions

This study examined the effects of ADL on older adults' certification change from support needs to long-term care needs after two years. The findings showed that ADL affecting certification change varies depending on the level of cognitive functioning. Within levels of cognitive functioning, the ADL associated with certification change among the most independent individuals (level Independence) were bathing, nail trimming, mobility, managing money, and decision-making ability. At the next level of independence (level I) the activities included bathing, toilet hygiene (urinary), taking prescribed medications, managing money, decision-making ability, and preparing meals. At the lowest level of independence (group II), only managing money was associated with certification change. In particular, managing money was considered to be the most important item, as it influences the change in certification in all cognitive categories. When occupational therapists intervene older persons with support needs, they should grasp IADL abilities such as managing money, which requires complex cognitive functions, from an early stage, and this may lead to the reduction of the need for care in older persons with support

Conflict of Interest

The authors report no conflicts of interest.

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Author Contributions

Study concept and design: A.S., T.T., M.K.; data acquisition: M.K.; data analysis and interpretation: A.S., M.M., H.M.; manuscript writing: A.S., T.T., T.H., M.K.

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CASE REPORT

An Intervention to Overcome Locomotion Difficulties in a Patient with Oculomotor Nerve Palsy: A Case Study

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Abstract: Introduction: Diplopia due to restricted eye movements makes it difficult to locomote. There are no reported therapies that overcome the locomotion difficulties of patients with oculomotor nerve palsy after a stroke. We outline a therapy process conducted by an occupational therapist (OT) that combines ptosis therapy and the treatment of impaired eye movements with exploratory activities for locomotion that enabled the patient, a Japanese woman in her 70s, to improve her engagement in daily activities.

Methods: The OT therapy consisted of two phases. Phase I: Ptosis and eye movement interventions were performed. Phase II: Interventions supported locomotion that linked visual exploration and the somatosensory system, and the experienced locomotion was adapted to the environmental structure. The outcomes for the intervention effects were the degree of ptosis, eye movement and diplopia, gait functions, and a functional independence measure for activities of daily living.

Results: The patient's ptosis and eye movement disorder improved, and the difficulty of locomotion due to diplopia was overcome. She was thus able to become independent in all daily activities.

Conclusion: Therapy that combines interventions for ptosis and eye movement with exploratory activities supporting locomotion have overcome locomotion difficulties and improved the outcomes of patients with oculomotor nerve palsy. Current interventions may improve locomotion in post-stroke patients with oculomotor nerve palsy. Our findings led us to hypothesize that locomotion difficulties in patients with diplopia due to oculomotor nerve palsy can be overcome by combined therapy for ptosis and eye movements with support for exploratory action in locomotion.

Keywords: oculomotor nerve palsy, eye movement disorder, diplopia, locomotion, exploratory activities

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Introduction

About 60% of stroke patients experience visual impairment [1]. An unpleasant symptom of such impairment is diplopia [2], which is a cause of oculomotor nerve palsy. Its symptoms are associated with saccadic eye movement and gaze problems [2], and having diplopia makes locomotion in activities of daily living (ADLs) difficult. Eye-movement rehabilitation has been attempted [3, 4], but no optimal therapy is established.

Adaptive locomotion to the environment requires moving the gaze to explore the surrounding environment and associating self-movements [5]. Exploratory activities that link the surrounding environment with self-movement may thus facilitate locomotion, but this possibility is not verified. We describe an effective therapy comprised of combined therapies for ptosis and eye movements with exploratory activities for locomotion.

Subject

A Japanese woman in her 70s had experienced a brainstem infarction in the oculomotor nucleus area due to vertebral artery occlusion (Fig. 1). Cranial nerve findings showed ptosis of the left eye and movement disorders of the left eye's upward adduction, adduction, upward abduction, and downward abduction, indicating

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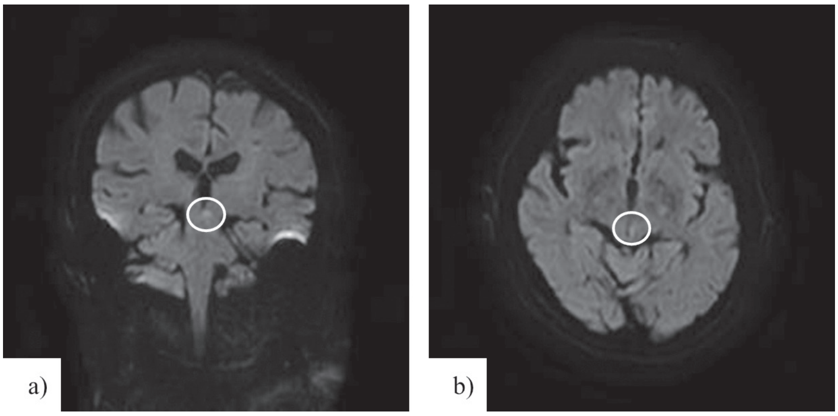

Fig. 1. Brain magnetic resonance imaging (MRI) on admission.
a) Coronal diffusion-weighted imaging (DWI) on admission shows a slightly hyperintense lesion on the midbrain's left side.
b) Axial DWI.

left oculomotor nerve palsy. Eye-opening and eye-movement patterns required enhanced effort by excessive compensatory activity of the head/neck and facial muscles. The patient's diplopia was severe based on her results on the Diplopia Questionnaire (www.pedig.net), which evaluates diplopia in ADLs on a 5-point scale. She had no physical paralysis, but her diplopia worsened with the changes in her binocular-vision gaze, and her mental and physical tension was constantly increasing. Her self-care ADLs could be performed with monocular vision (right eye), but the movements needed for toileting, bathing, and gait including locomotion were stagnant due to the diplopia's worsening, and she needed a caregiver's constant guiding.

Method

Therapy process

The interventions based on ptosis, eye movement, and exploratory activities for locomotion were divided into two phases and performed by an occupational therapist (OT): a 40-min therapy session each morning and a 60-min therapy session each afternoon, 5 days/week for 2 weeks. The two phases were performed consecutively in one therapy session. Phase I lasted 30 min, and Phase II lasted 10–30 min. The patient's informed consent for this report was obtained.

Phase I: Ptosis and eye movements therapy

The OT adjusted the patient's head/neck and facial muscle tone and facilitated selective movements with the aim of achieving independent eye-opening and eye movements. Using the vestibulo-ocular reflex is effective for facilitating eye movements for brainstem-derived eye movement disorders [3]. Therefore, the patient's atlanto-occipital joint was quickly rotated to facilitate the saccadic eye movement in binocular vision (Fig. 2a).

Next, the OT administered an activity for approaching a visual object with the aim of enabling the patient to intentionally control her gaze from saccadic eye movement to the visual object (Fig. 2b). This intervention prepared the environment so that the patient's gaze and body movements could be easily oriented by using the environmental structure, and the patient thus experienced locomotion linked with her gaze and her body movements.

Phase II: Locomotion therapy

The occluding edge was used to help achieve the patient's locomotion adapted to the environmental structure; the 'occluding edge' refers to the edge of the surface structure of the environment, and it is a stimulus that changes the environment's appearance with locomotion [6]. We speculated that the patient was unable to accept changes in visual stimuli during sensory reception because her diplopia increased her mental/physical tension. The OT thus oriented the patient's locomotion by having her look to the occluding edge to enable her to pass through a gap while keeping her body in contact with the gap in the environmental structure (Fig. 2c).

Results

Table 1 summarizes the changes following the interventions. The patient's ptosis and her levator muscle function improved, and there was almost no difference between the left and right eyes. The eye-movement disorder also improved, and the diplopia in ADLs was nearly eliminated. For this patient, even if diplopia occurs when she performs ADLs, the direction in which the diplopia occurs is now limited, and it has become possible to resolve the diplopia by self-adjustment.

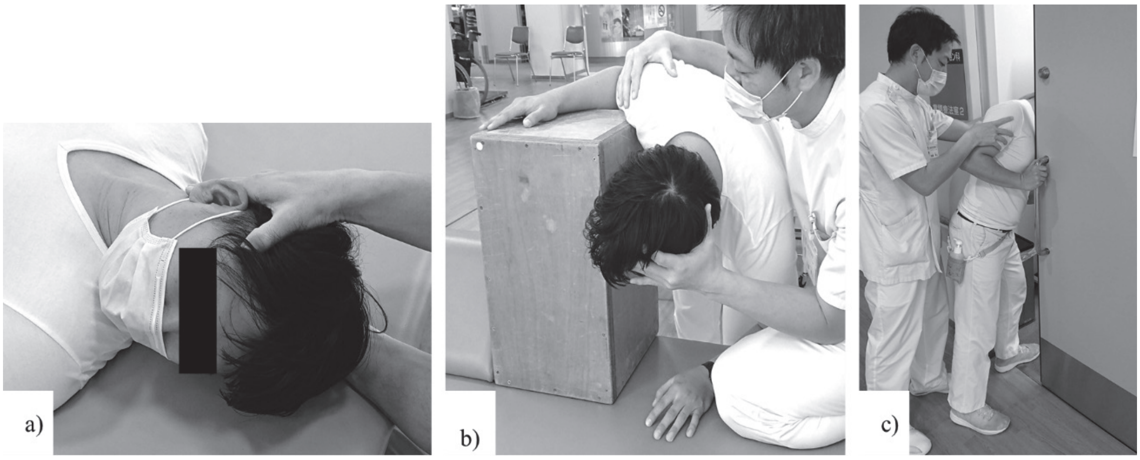
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Fig. 2. Reproduction of the therapy setting.
a) Manipulating the rotation of the atlanto-occipital joint induced the vestibulo-ocular reflex in binocular vision and facilitated saccadic eye movement. b) By adjusting the body to the environmental structure, we guided the approach activity to the visual object beyond it. c) The door is the smallest gap through which the patient's body passes. The patient is looking into the gap in the door. Locomotion was induced to link with the movement of the gaze while maintaining the patient's body contact with the environmental structures.

Table 1 Effect of the interventions on the main outcome measures

Illness days			Day 30	Day 45	Δ
Ptosis	Degree of ptosis (mm)	Rt	4	4	0
		Lt	-3	3	+6
	Levator muscle function (mm)	Rt	13	14	+1
		Lt	4	12	+8
Eye movement	Diplopia	Type	Horizontal and rotatory	Blurred state	
		Maximum deviation direction	Upward adduction	Upward abduction	
			Upward abduction	-	
			Downward abduction	-	
		Minimum deviation direction	Downward adduction	-	
Gait functions	10-meter walk test	Sec	12.27	7.1	-5.17
		Steps	23	17	-6
	TUG	Sec	14.93	8.81	-6.12
ADL	FIM	Total (/126)	107	126	+19
		Motor (/91)	69	91	+22
		Gait (/7)	4	7	+3
		Stairs (7)	1	7	+6

The evaluation of ptosis and diplopia used the method that is used in clinical diagnoses in Japan. Degree of ptosis: Ptosis is judged when the distance from the corneal reflex image to the levator palpebra is ≤ 2 mm. Levator muscle function: If the width of movement when the gaze is directed from downward to upward is ≤ 10 mm, the levator muscle function is classified as impaired. Δ: The pre-data subtracted from the post-data. ADL: activities of daily living, FIM: functional independence measure, TUG: Timed up and go test.

Regarding her gait function, her tension about locomotion decreased and she became able to perform ADLs independently. Since she became able to conduct self-care activities with binocular vision, she overcame all difficulties involving locomotion.

Discussion

The patient had a midbrain infarction, and the symptoms of inferior rectus muscle and unilateral ptosis suggested oculomotor fascicle damage. In that lesion, the nerve fibers distal to ischemia are vulnerable, causing predominant damage to the extraocular muscles [7]. Since our patient had severe diplopia symptoms, she practiced ptosis and eye-movement therapy in Phase I. Although there is no therapy for ptosis to date, our patient's results indicate that the adjustment of muscle tone and the facilitation of selective movements may have contributed to her recovery of levator muscle function. The eye-movement therapy used herein is based on the stimulation of the superior colliculus, which is involved in the execution of saccadic eye movement [1, 3]. This therapy assisted the movement of the gaze [8] and appears to have been appropriate.

To our knowledge, the Phase II exploratory activity described herein is the first therapy to provide a stimulus composed of vision and somatosensory information. Processes based on audiovisual stimuli are known to improve the accuracy of visual exploration [9]. The Phase II intervention's effectiveness was suggested to involve learning transitions in exploratory activity [10], and somatosensory stimuli may have oriented our patient's locomotion and facilitated visual exploration accuracy. However, spontaneous recovery from brain lesions can occur several months post-onset [1], and further research and a large patient series are required to validate the present interventions' effectiveness. Moreover, the intervention conditions are limited to ptosis and eye-movement disorder without motor paralysis of limbs.

Conclusion

The combined interventions for ptosis, eye movements, and exploratory activities for locomotion helped a post-stroke patient with oculomotor nerve palsy overcome locomotion difficulty.

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■ORIGINAL ARTICLE

Social Participation of People with Intellectual Disabilities in Rural Areas of the Philippines

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Abstract: The purpose of this study was to analyze the current status and challenges related to social participation faced by people with intellectual disabilities living in rural areas in the Philippines. Semi-structured interviews were conducted with 10 professionals, including nurses of public health center, social workers of nonprofit facility for persons with disabilities, and teachers of public and private special needs schools. The study was approved by the Graduate School of Human Sciences, Osaka University. The results indicated five categories and 21 subcategories. The five categories are: Current status of social participation of people with intellectual disabilities in rural areas; Interventions performed by rural professionals for people with intellectual disabilities; Improved activities of people with intellectual disabilities owing to study participants' interventions; Recognition of hindrances to promote social participation; Recognition of the ideal social participation for people with intellectual disabilities. Based on the current conditions, there were challenges in leisure activities and employment, especially for adults with intellectual disabilities. Our findings suggest it is important for Philippine occupational therapists and those working in international organizations to conduct occupation analysis for understanding the backgrounds, strengths, limitations, concerns, and goals for their leisure activities and employment. In addition, occupational therapists can contribute not only to providing individual support but also to the development of community supporters.

Keywords: Philippines, Rural, Intellectual Disability, Social Participation

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Introduction

In September 2015, the Sustainable Development Goals (SDGs) were adopted by the United Nations General Assembly. They were based on the concept of "no one will be left behind," meaning no one will be left vulnerable to society, including persons with disabilities. Previous research has already clearly delineated the issues faced by persons with disabilities, such as access to medical care, education, employment, and community development, as well as the importance of their social participation [1]. According to the World Report on Disability published in 2011 by the World Health Organization and the World Bank, the number of persons with disabilities accounts for 15% of the world population, of which about 80% live in developing countries [2]. Many persons with disabilities face poverty because of the barriers imposed upon their access to social participation in a wide variety of fields (e.g., education, health, and employment) [3]. Particularly, persons with disabilities living in rural areas of developing countries tend to be excluded from society [4], and experience great differences in various aspects of their lives compared to those living in urban areas. For example, people with disabilities living in rural areas have fewer opportunities for medical services including rehabilitation, education, and employment than people with disabilities living in urban areas. Moreover, it is not easy to use public transportation in rural areas [2–4].

Furthermore, only 0.1–0.4% of people with intellec-

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tual disabilities (PID) living in developing countries can receive appropriate public services [5]. PID living in developing countries do not receive appropriate support for social participation compared to those in developed countries [2, 6]. Due to these current conditions, many PID are not able to work, which often leads to poverty [2–4].

The Japanese government created a support project called the Japan International Cooperation Agency (JICA). For over 60 years, JICA has assisted people with disabilities living in developing countries by managing the work of medical welfare workers who attend to these populations. JICA has achieved this by dispatching volunteers to support occupational therapists and conducting financial cooperation projects. In the past, many of JICA's projects aimed at supporting PID in targeted urban areas [5, 6]. Recently, there has been an increase in the number of projects targeting rural areas [6]. For example, JICA has implemented barrier-free development in many countries such as Bolivia, India, Vietnam, and Senegal. However, persons with physical disabilities are the main targets of most of these rural projects, and there are few rural programs targeted at improving the social participation of PID [7].

In 2018, the first author investigated a welfare facility in rural areas of Bohol, the Philippines, to examine the progress—and current status—of the activities for Filipino adults with intellectual disabilities. However, the content was limited to activities within only one facility, and the relationship between professional interventions and social participation was not clarified. Further, the details of the interventions of specialists in multiple facilities in rural areas, especially in the medical, welfare, and education fields, were unclear [8].

To the best of our knowledge, there is no comprehensive study on the current status of support for PID living in rural areas of the Philippines. Therefore, this study aimed to interview workers engaged in providing medical, welfare, and educational support for PID living in rural areas of Bohol, the Philippines. Particularly, we aimed to examine the support that this vulnerable population is currently receiving, as well as their current levels of social participation. Moreover, we aimed to clarify the benefits of occupational therapists in rural areas of developing countries working with other specialists in the same settings. This type of cooperation could make occupational therapy intervention more useful by better understanding the interventions of other experts and the social participation of PID.

This study is significant because it seeks to contribute to the promotion of social participation of PID living in rural areas of developing countries; hence, we propose methods on this subject based on occupational therapists' expertise.

Methods

1. Research Participants

Participants were 10 professionals—nurses of public health center, social workers of nonprofit facility for persons with disabilities, teachers of public and private special needs schools, and teachers of private special needs schools in rural areas of Bohol. We utilized snowball sampling method by procuring an introduction from a director of a welfare facility having previous experience with our work. Given the purpose of this study, participants were required to know both disability characteristics and regional characteristics.

2. Data Collection

We visited each facility and conducted semi-structured interviews in English between August 1 and 9, 2019. We asked participants about their basic information—gender, age, facility, specialty, years of experience in supporting persons with disabilities, and years of experience in supporting PID. Then, we conducted the interviews based on four guiding topics: (1) Social participation of PID: "How do PID spend their time at home or in the community?" (2) Interventions aimed at PID: "What kind of interventions do you apply for PID?" (3) Difficulties in social participation: "What are the difficulties that PID experience when trying to participate in society?" (4) Specific methods aimed at enhancing the social participation of PID: "What kind of intervention are you considering to further their social participation?"

The interviews were conducted based on the outlined interview guide, but we also listened to participants' narratives outside of the interview questions and took all measures to respect their answers and descriptions regarding each of the four major topics. After each participant provided written consent, we recorded each interview through an IC chip recorder.

3. Data Analysis

We conducted qualitative analyses based on M-GTA (Modified Grounded Theory Approach) [9, 10], which was considered suitable, because its theoretical groundings relate to the social participation construct, are relevant for analyses in the intellectual disability context, and are excellent in explaining and predicting human behavior.

First, a verbatim transcript was created from raw interview data. Participants' narrative contents were simplified into single sentences that denoted the general idea of the content of a phrase, and were subsequently coded, while maintaining the meaning of the expressed phrase/word. We generated analytical concepts that

Table 1 Profile Characteristics of Participants

№	Gender	Age (years)	Affiliation	Professional	Period for PWDs (years)	Period for PIDs (years)	Interview Time (min)
1	Female	20s	Public Health Center	Nurse	8	3	47
2	Female	20s	Public Health Center	Nurse	9	5	52
3	Female	30s	Public Health Center	Nurse	17	11	37
4	Female	40s	Welfare Facility	Social Worker	20	12	88
5	Female	50s	Welfare Facility	Social Worker	25	20	45
6	Female	50s	Public Special School	Teacher	25	10	85
7	Female	40s	Public Special School	Teacher	23	15	55
8	Female	20s	Public Special School	Teacher	5	3	49
9	Male	30s	Private Special School	Teacher	15	10	39
10	Male	20s	Private Special School	Teacher	6	6	44
					15.3 ± 7.4	9.5 ± 5.3	54.1 ± 17.7

PWD: People with Disability
PID: People with Intellectual Disability

explained the proposed codes and conducted continuous comparative analysis by focusing on the context of the narratives, which were strongly related to the social participation of PID. Next, we formed categories based on the relationships between the generated codes. During these procedures relevant to generating analytical concepts, we discussed the proposed classifications until we found no possible theoretical objections regarding the proposed classifications.

Based on the categories and subcategories created by the aforementioned procedures, we structurally organized the current situation of the social participation of PID living in rural areas of Bohol and examined the problems regarding the topic. We highlight that one of the researchers had already engaged in international medical and health research (SY) and was well versed with the subject matter. Moreover, multiple researchers engaged in international medical and health research with different theoretical and methodological backgrounds (KH and MK) participated in this study. To ensure the study's credibility, all researchers jointly conducted triangulation procedures.

4. Ethical Considerations

This study followed the ethical standards of the Declaration of Helsinki exactly, and was performed with the approval of the ethics review committee of the Graduate School of Human Sciences, Osaka University. Prior to participation, we explained—both verbally and on paper—the study aims and procedures to the participants and obtained their written consent.

Results

1. Participants' Characteristics

Our sample comprised 2 male and 8 female participants (average age = 37.2 ± 10.2 years). Their average number of years of experience in supporting persons with disabilities was 15.3 ± 7.4 years, and average number of years of experience in supporting PID was 9.5 ± 5.3 years. There were 3 nurses, 2 social workers and 5 teachers. The average interview time for each research participant was 54.1 ± 17.7 minutes (Table 1).

2. Social Participation and Issues of PID Living in Rural Areas

In total, we extracted 464 codes related to the current state of social participation, support contents, and the issues of PID living in rural areas of Bohol, the Philippines. We categorized codes based on those that had similar meanings and expressions and made efforts to constantly return to the context of the specific codes in the participants' narratives, to ensure that each code was accurately categorized. In total, we obtained 5 categories and 21 subcategories (Table 2).

The subcategories that make up each category are described in Table 2. To facilitate differentiation between the categories, subcategories, and raw data in the text, we utilized the following symbols: 【 】= a category, [ ] = a sub-category, and " " = raw data.

In the category 【Current status of social participation of PID in rural areas】, the following example narratives from participants provide context to the results. One participant provided a statement related to the subcategory [People with mild intellectual disabilities have roles in the home and in the community]: "Adults with intellectual disabilities can help cook at home and play basketball with local residents." Another study participant provided a statement related to the subcategory [PID have few opportunities to interact with local residents]: "PID have little interaction with others because they cannot speak at the same language level as do their families and community residents, and they are not good at communicating." One study participant

Table 2 Social participation of people with intellectual disabilities through the recognition of rural professionals

Category (Code quantity)	Sub category (Code quantity)
Current status of social participation of people with intellectual disabilities in rural areas (141)	People with mild intellectual disabilities have roles in the home and in the community (21) People with intellectual disabilities have few opportunities to interact with local residents (33) People with intellectual disabilities have restrictions on home activities (35) People with intellectual disabilities have restrictions on community activities (39) People with intellectual disabilities tend to be treated unfairly by local residents (13)
Interventions performed by rural professionals for people with intellectual disabilities (81)	Professionals provide medical examinations and family guidance on how to treat infants (10) Professionals provide learning guidance and emotional education programs (34) Professionals provide few vocational training programs (14) Professionals provide opportunities for people with intellectual disability to interact with local residents (23)
Improved activities of people with intellectual disabilities owing to study participants' interventions (56)	People with intellectual disabilities have more activities to do at home (10) People with intellectual disabilities have become more actively engaged in institutional programs (14) People with intellectual disabilities have mutual peer assistance, and relationships have been built (22) People with intellectual disabilities have more opportunities to interact with local residents (10)
Recognition of hindrances to promote social participation (115)	People with intellectual disabilities cannot receive continuous medical services (9) People with intellectual disabilities cannot receive education and welfare services owing to accessibility issues (20) People with intellectual disabilities cannot work (58) Local residents sometimes do not comply with the legal system for intellectual disabilities (9) Local residents have prejudice and discrimination against people with intellectual disabilities (19)
Recognition of the ideal social participation for people with intellectual disabilities (71)	People with intellectual disabilities need to increase their leisure activities (20) People with intellectual disabilities can earn money (37) People with intellectual disabilities can make their own decisions (14)

provided a comment related to the subcategory [PID have restrictions on home activities]: "PID are unable to help with housework, and they do nothing at home." One study participant provided a comment related to the subcategory [PID have restrictions on community activities]: "PID cannot perform leisure activities outside their home." Lastly, a study participant provided a statement that related to the subcategory [PID tend to be treated unfairly by local residents]: "Children with disabilities may be bullied and women with intellectual disabilities may be raped."

Regarding the category【Interventions performed by rural professionals for PID】, one study participant provided a statement related to the subcategory [professionals provide medical examinations and family guidance on how to treat infants]: "We carry out simple medical examinations and family instructions several times." Another participant provided a statement related to the subcategory [professionals provide learning guidance and emotional education programs]: "I teach language, calculation, music, etc. at a special needs school." Moreover, one research participant provided a comment related to the subcategory [professionals provide vocational training programs]: "We provide PID the opportunity to experience cooking, crafting, agriculture, and selling goods at welfare facilities." Finally, a participant provided a statement regarding the subcategory [professionals provide opportunities for PID to interact with local residents]: "We encourage participants to participate in events such as local sports competitions through the organization."

The category【Improved activities of PID owing to study participants' interventions】also included many narratives. One research participant provided a comment related to the subcategory [PID have more activities to do at home]: "PID have started to care for their homes by cleaning their desks and cooking rice." Another participant said about the subcategory [PID have become more actively engaged in institutional programs]: "PID began to calculate the values of their products while selling goods and worked with agriculture." Furthermore, a participant provided a statement related to the subcategory [PID have mutual peer assistance, and relationships have been built]: "PID started to help each other with tasks they are not good at." Another participant provided a comment related to the subcategory [PID have more opportunities to interact with local residents]: "PID have been invited by residents to participate in religious festivals and volleyball competitions held in the district."

In the category【Recognition of hindrances to promote social participation】a participant provided a comment related to the subcategory [PID cannot receive continuous medical services]: "In private clinics, medical costs are high, so PID cannot access these services." Another provided a statement related to the subcategory [PID cannot receive education and welfare services owing to accessibility issues]: "Children with severe intellectual disabilities and adults with intellectual disabilities cannot frequently attend schools and facilities because they are located far away." Additionally, a participant provided a statement regarding the subcategory [PID cannot work]: "There are few places in the area that provide vocational training, such as workshops. Further, there are few professionals who provide employment support." Another participant said about the subcategory [Local residents sometimes do not comply with the legal system for intellectual disabilities]: "The law that regulates discounts for persons with disabilities to access entertainment facilities is not fully enforced in the area." Concluding this category, a participant commented about the subcategory [Local residents have prejudice and discrimination against PID]: "The prejudice and discrimination of local residents is strong, and the behaviors of PID are not understood."

Coming to the category 【Recognition of the ideal social participation for PID】, a participant provided a statement related to the subcategory [PID need to increase their leisure activities]: "PID should continue to have opportunities to interact with local residents at local events." Another participant remarked about the subcategory [PID can earn money]: "PID can do many rural jobs, such as agriculture and fishing, in a short period of time." Finally, a participant said about the subcategory [PID can make their own decisions]: "Even if family members and professional supporters provide assistance, PID can still make their own decisions."

Discussion

In this study, participants reported that some people with mild intellectual disabilities who lived in rural areas of Bohol, the Philippines were involved in local sports and employment. However, most had few opportunities to interact with other local residents, experienced limited activities, and were mistreated by some residents within the local community. Participants reported that community health centers, welfare facilities, and special needs schools provided PID simple medical services, educational and employment support, and encouragement to participate in community activities. Owing to such institutions, PID in this setting seem to be currently experiencing improvements regarding the number of opportunities available to perform different types of activities and to experience interpersonal exchanges. However, some barriers to the promotion of social participation among this population remain; for example, difficulty in providing continuous medical services, travelling/access problems (owing to the distance from their homes to the institutions and facilities in which the activities are performed), difficulty finding work opportunities, and local residents' lack of understanding about the behaviors and characteristics of PID.

The category 【Current situation of social participation of PID in rural areas】 comprised topics regarding the lack of opportunities for PID to experience interpersonal exchanges, the unfair treatment they receive from local residents, and restrictions on the activities available to them both inside and outside their homes.

Owing to their disability characteristics, PID experience a deficit in abstract thinking and judgment, as well as in planning and problem-solving skills [11]. Additionally, people without disabilities tend to have a harder time understanding PID than those with physical disabilities, and the former are more likely to experience discrimination and prejudice than the latter [12, 13]. Furthermore, the provision and accessibility of social resources are weaker in rural areas than in urban areas [2]. Convention on the Rights of Persons with Disabilities that the United Nations General Assembly was drafted in 2006, and the Philippines ratified in 2008 [14]. Our study participants recognized that there is a tendency for equal opportunities and participation to be impeded, especially among those with moderate to severe intellectual disabilities.

Additionally, the categories 【Interventions performed by rural professionals supporters for PID】 and 【Improved activities of PID owing to study participants' interventions】 comprised topics related to specialized professional interventions in the fields of medical care, welfare, and education by the study sample. The main interventions provided by the professionals related to simple examinations regarding patients' intellectual functions, and family guidance for infants who were in medical institutions—mostly public health facilities, where costs are low. Private medical institutions also provide services but are not preferred as they are expensive. Another concern is the inability to access these services regularly after school age. Moreover, educational institutions provided support for children with disabilities throughout school years; the contents comprised math, language (learning the alphabet), and music activities. Additionally, welfare facilities provided opportunities for this populational group to have access to different daily and community activities. After using the services provided by these facilities, our participants reported that the PID they interacted with started being able to assist in the cooking and cleaning chores at their homes and being able to actively carry out activities such as making crafts (wood and paper craft) and caring for pets (such as dogs and cats or livestock such as chickens and ducks) in the facility. Furthermore, those frequenting the facility also started to engage in activities to help each other with their intellectual disabilities, and to participate in sports competitions with local residents, all of which increased their opportunities to engage in interpersonal interactions. Nonetheless, although the Convention on the Rights of Persons with Disabilities requires participating countries to ensure that rehabilitation services are provided for this public [14], our results showed that the welfare institutions had only few rehabilitation specialists. Hence, PID living in rural areas of Bohol still need individual and group interventions that evaluate their intellectual functioning and social adaptation and consider their culture and environment.

Regarding the category【Recognition of hindrances to promote social participation】, our participants recognized that PID were not able to receive continuous medical services or access education and welfare services owing to transport accessibility issues, such as their inability to board the local buses and pay the fare, and the lack of available buses to reach the far-off facilities. Moreover, they faced difficulties in finding work. The interviewed supporters also felt that local residents had prejudice against PID, so the residents often did not comply with the legal system for PID.

Although there is an employment support program that is promoted by a public rehabilitation center in the Philippines, it is implemented mainly in urban areas [15]. Therefore, employment support initiatives for PID in the region are limited to some disability support groups and special support schools. In order to enhance the employment opportunities of PID living in rural areas of the Philippines, a project that specializes in employment support for this public should be implemented. Particularly, stakeholders should engage with not only one institution but also promote a strategic cooperation with professionals and a wider array of institutions and companies, both public and private.

Regarding the category【Recognition of the ideal social participation for PID】, participants recognized that persons with disabilities should ideally participate in leisure activities, be able to work, and earn their incomes. However, participants were not able to provide specific methods regarding the promotion of such ideal social participation and were not able to outline how to develop interventions that are tailored to the disability and environment characteristics that surround this populational group.

To promote the social participation of people with disabilities living in developing countries, World Health Organization recommends the concept of Community-Based Rehabilitation (CBR), which is used worldwide [16]. CBR comprises five components: Health, Education, Livelihood, Social, and Empowerment. It is aimed at developing the entire community and is not just an intervention for the recovery of functional disabilities. Additionally, in CBR, occupational therapists are also expected to participate for the purpose of social participation in supporting people with disabilities in developing countries [17]. The results of this research indicate that the development of employment and leisure activities in adulthood is essential for the ideal social participation of PID. Occupational Therapy Association of the Philippines has also stated the need for OT intervention for adults with intellectual disabilities in rural areas [18]. These findings suggest the need for OT in the study area. To promote their leisure activities, occupational therapists use occupational analysis to match an individual's abilities with the demands of the task [19]. In addition, occupational therapists use the concepts of COPM and ICF to assess their activities for providing effective support. Occupational therapist understands the experience background, strengths, weaknesses, worries, and goals of the person with disability and provides highly specialized interventions [17].

In CBR, occupational therapists are also expected to teach and train CBR workers and volunteers in basic assessment and interventions to help people with intellectual disabilities lead better daily lives [20]. The supporters and occupational therapists then check on the progress of the program and support the parents in their guidance and activities to diminish stigma in the community [19]. In other words, in a study area in which the number of occupational therapists is limited, it is important not only to provide individual support but to also train supporters to support the entire community. We hope that this study's findings provide guidance to occupational therapists from support groups in the Philippines and elsewhere, such as JICA and international NGOs.

Limitations

Although our study included novel qualitative results in the field of disability research, it still had methodological limitations. First, our sample size was small. Second, we performed our interviews in a very limited area of the Philippines. In the rural areas of the Philippines, the number of facilities and professionals that supported PID was very limited at the time of this study. Therefore, our study comprised only the Bohol province, making it difficult to generalize our results. Future studies should conduct interviews among PID and their families, other types of specialists, and other types of companies in order to plan more detail OT interventions. Moreover, we suggest future research endeavors collect data in other regions of the Philippines on the current situation and issues regarding the social participation of PID, which will contribute to a clearer understanding of the problems throughout the country on the topic and allow specific solutions and programs to be devised for each region.

Conclusion

Based on our qualitative results, many PID living in rural areas of the Philippines experience difficulties regarding social participation owing to their activity restrictions. Our study participants reported that the studied populational group lacked continuous medical services, lacked adequate access to education (owing to living in remote areas and having severe intellectual disabilities, because of which they needed to be accompanied to the distant locations to access the services), experienced difficulties in receiving employment assistance, and were not understood by local residents. We propose that international stakeholders try to collaborate with specialists in the fields of medicine, welfare, education, and occupational therapy to improve on the studied populational group's access to leisure activities and employment opportunities; such collaborations may ensure the promotion of an ideal social participation of PID living in the rural areas of the Philippines.

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