■ORIGINAL ARTICLE

Functional Significance of Sit-to-stand by Hip Abduction with External Rotation Angle

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Abstract: The principal aim of this study was to analyze the effects of differences in hip abduction and external rotation angles on sit-to-stand (STS) movements. Hip abduction and external rotation angles of 0 deg (closed legs parallel to each other) and 45 deg (open legs) of 27 healthy participants were compared. Analysis parameters were the center of pressure, the ground reaction force, and the activities of fourteen muscles using surface electromyography. The center of pressure parameter revealed that standing with open legs requires less anterior-posterior displacement during STS movement. The open leg movement showed that ground reaction force differed slightly for right and left sides. Muscle activity of the erector spinae and tibialis anterior decreased with the STS movement with open legs. In contrast, muscle activity of the adductor longus and the biceps femoris increased.

Key words: sit-to-stand movement, center of pressure, the ground reaction forces, electromyogram, hip angle

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Introduction

Japanese homes typically have a 20 cm step in the entrance hall (Research Institute of Human Engineering for Quality Life, 2002, Chapter 7), where people almost always put on and take off shoes. Most adults can put on and take off shoes in a standing position, but it is necessary for functionally limited elderly to sit down on the 20 cm step. Few elderly people can rise from a 20 cm high step without a footstool and handrails. Therefore, the daily life of such elderly is limited without access to a footstool and handrails. Clinically, the authors fixed the hips of the elderly at an angle of bilateral symmetry. Then the sit-to-stand (STS) movement was attempted from this position. Results show that, for hip abduction and external rotation angles of 0 deg (closed legs parallel to each other; closed legs) the elderly were unable to stand up, but they were able to do so with hip abduction and external rotation angles of 45 deg (open legs). We concluded, therefore, that abduction and external rotation angles of the hip had positive effects on STS movement from a low step.

Factors affecting STS movement include chair seat height (Arborelius, Wretenberg & Lindberg, 1992; Janssen, Bussmann & Stam, 2002; Kuo, Tully & Galea, 2010; Schenkman, Hughes, Samsa & Studenski, 1996; Yamada & Demura, 2004), use of armrests or arms (Alexander, Schultz & Warwick, 1991; Arborelius et al., 1992; Eriksrud & Bohannon, 2003; Etnyre & Thomas, 2007; Janssen et al., 2002; Leung & Chang, 2009; Schultz, Alexander & Ashton-Miller, 1992), use of handrails (O'Meara & Smith, 2005; O'Meara & Smith, 2006), foot positioning (Janssen et al., 2002; Khemlani, Carr & Crosbie, 1999; Lecours, Nadeau, Gravel & Teixera-Salmela, 2008; Vander Linden, Brunt & McCulloch, 1994), trunk positioning (Schenkman, Berger, Riley, Mann & Hodge, 1990), STS movement speed (Bieryla, Anderson & Madigan, 2009; Hanke, Pai & Rogers, 1995; Pai & Rogers, 1990; Vander Linden et al., 1994), age (Alexander et al., 1991; Lundin, Grabiner & Jahnigen, 1995; Schultz et al., 1992; Zijlstra, Bisseling, Schlumbohm & Baldus, 2010), and hip angles (Gotoh, Takada & Suehiro, 2002). Nevertheless, no report describes kinematic differences in hip abduction and ex-

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ternal rotation angles on the STS movement. This study was intended define basic kinematic differences between open and closed legs in the STS movement.

Methods

Participants

Participants were 27 healthy volunteers (20 males and 7 females) ranging in age from 20–41 years (mean 22.3; standard deviations: SD 4.5), in weight from 39–100 kg (mean 62.6; SD 2.8), and in height from 152–183 cm (mean 167.3; SD 1.5). All participants indicated that the open legs position was easier for standing up than that of closed legs. No participants had diseases or injuries which could impair STS movement.

All participants gave their informed consent to the experimental procedure, which was approved by the Ethics Committee of Yamagata Prefectural University of Health Sciences, Yamagata, Japan.

Instrumentation and data acquisition

Fig. 1a (1), b (1) shows the start position of the experiment. The stool height was 50% of the length from the floor to the caput fibulae for closed legs (17–25 cm). The distance between the right and left heels was the same as the distance between the two acromia. Each participant comfortably positioned the neck and trunk. The STS movement speed was self-selected. Participants were instructed to fold their arms across their chest to remove any upper limb influence. The end point of the experiment was a standing position with complete extension of knee and hip joints.

The analysis parameters were the center of pressure (COP), the ground reaction forces (GRF), and electromyograms (EMG) of fourteen muscles.

COP and the magnitude of the right and left GRF were recorded using a sampling frequency of 50 Hz with two force plates (Kineto Gravicorder G-7100; Anima Corp, Tokyo). Low pass was filtered with a cutoff frequency of 50 Hz. COP was calibrated after setting the two force plates. Participants were positioned with both legs and the buttocks on each force plate.

STS movement images were recorded from the front and lateral sides at 30 frames per second using two digital video cameras (NV-GS300; Panasonic Inc, Osaka).

EMGs of the erector spinae (ES), gluteus maximus (GMA), vastus lateralis (VL), adductor longus (AL), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius (GC) were recorded with one pair of disposable surface electrodes (L-600C; Nihon Kohden Corp, Tokyo), attached longitudinally 2 cm apart on the central part of the contracted muscle belly. EMGs were amplified, band pass filtered (10–500 Hz), sampled at 1,000 Hz, and fed into the computer (Teraview; Gigatex Ltd, Osaki). Then they were integrated (rectified and averaged) using a raw EMG (EMG integration program, Gigatex, Ltd., Osaki).

The movement pictures, the COP, GRF, and EMG data were recorded using Teraview.

Procedure

Participants performed sufficient practice trials in closed and open leg positions before the data collection. Data were collected from three trials under each condition. Participants were given adequate rest between trials to avoid fatigue.

Finally, according to methods of muscle testing (Hislop & Montgomery, 2002, Chapter 3, 5), we recorded EMGs of maximum voluntary contraction of the measured muscles.

Data analysis

1. Movement Phases

Using video data STS movements were divided into three phases according to previous studies (Millington, Myklebust & Shambes, 1992; Riley, Schenkman, Mann & Hodge, 1991; Schenkman et al., 1990). During phase 1 (flexion-momentum phase), the buttocks left the chair seat (Fig. 1, (2)) as the head began to move horizontally. Phase 2 began after the buttocks separated from the chair seat and continued until ankle maximum dorsiflexion of the ankle. Phase 3 was from the ankle maximum dorsiflexion position to the complete standing position.

2. Analysis of COP

Analysis of COP consisted of two points. First, we studied COP at the initiation of movement in the anterior-posterior COP (COP-Y) and the medial-lateral COP (COP-X) direction. Second, we measured the maximum movement displacement of COP-Y and COP-X in each phase.

3. Analysis of GRF

The analysis of GRF examined the differences between the absolute values of the right and left load at identical points every 20 ms. Furthermore, we calculated the mean difference in each phase.

4. Analysis of EMG

To facilitate intra-individual and inter-individual comparisons of EMG, a standardization procedure was performed. For standardization, the contraction level of the muscle was indicated by expressing the amplitude of the integrated EMG as a percentage of that produced by the maximum contraction (%max). The %max data were used as reference values in each phase. The analyzed data were the data in which EMG indicated no artifacts.

The analyzed COP, GRF, and EMG data compared the open legs with closed legs. Statistical processing used

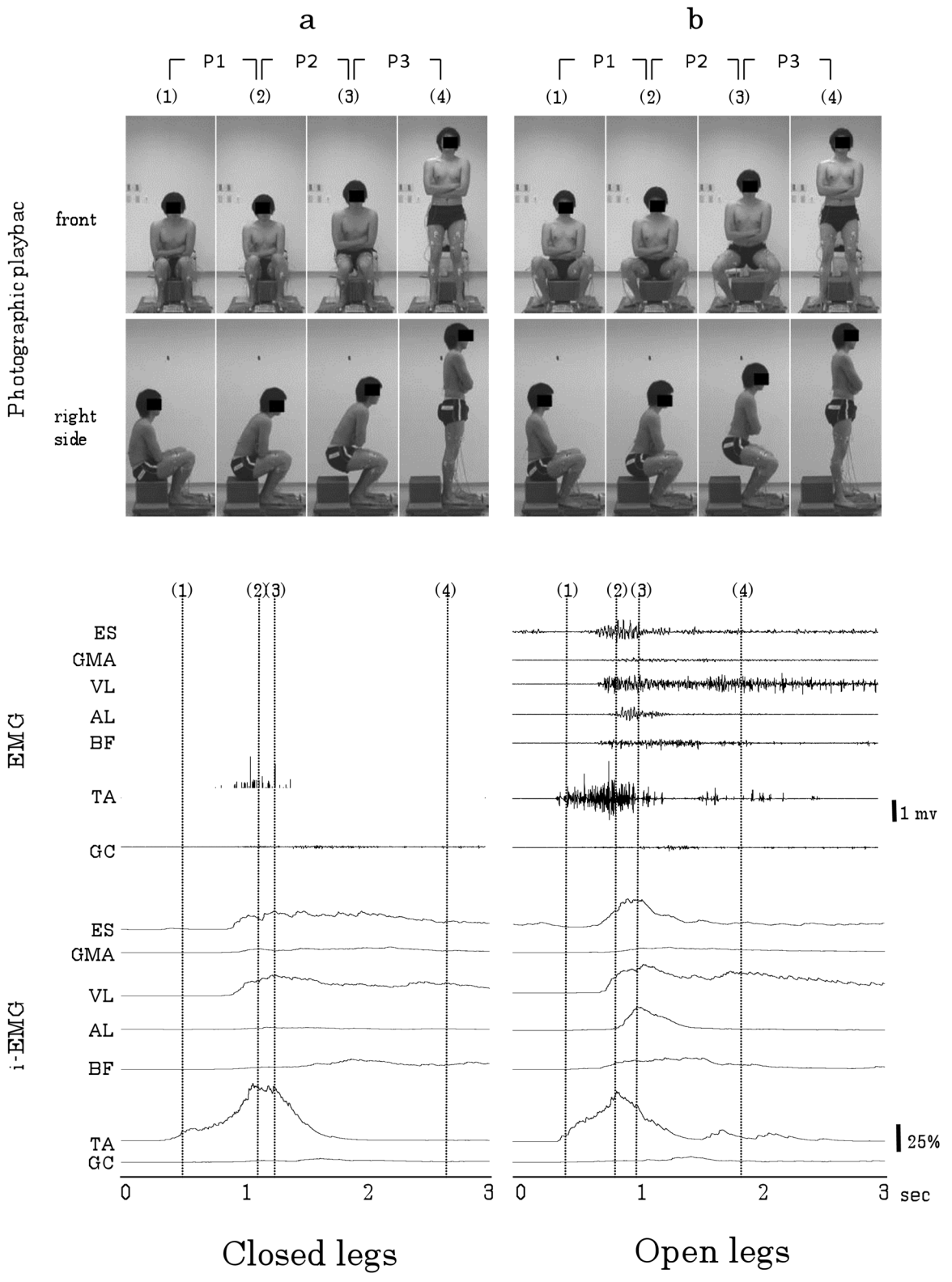

Fig. 1. Results of photographic playback, electromyogram (EMG), and integrated EMG (i-EMG). Vertical dotted lines indicate start (1), hip lift-off (2), maximal dosiflexion of the ankle joint (3), complete standing position (4). Calibration bar for EMGs and percentage of the amplitude produced by the maximum voluntary contraction (%max). EMG activities of erector spinae (ES), gluteus maximus (GMA), vastus lateralis (VL), adductor longus (AL), biceps femoris (BF), tibialis anterior (TA), gastrocnemius (GC) during the STS movement with closed legs (a) and open legs (b). Phase 1 (P1), Phase 2 (P2), Phase 3 (P3). Abbreviations in this as well as Figs. 2–4, and Table 1.

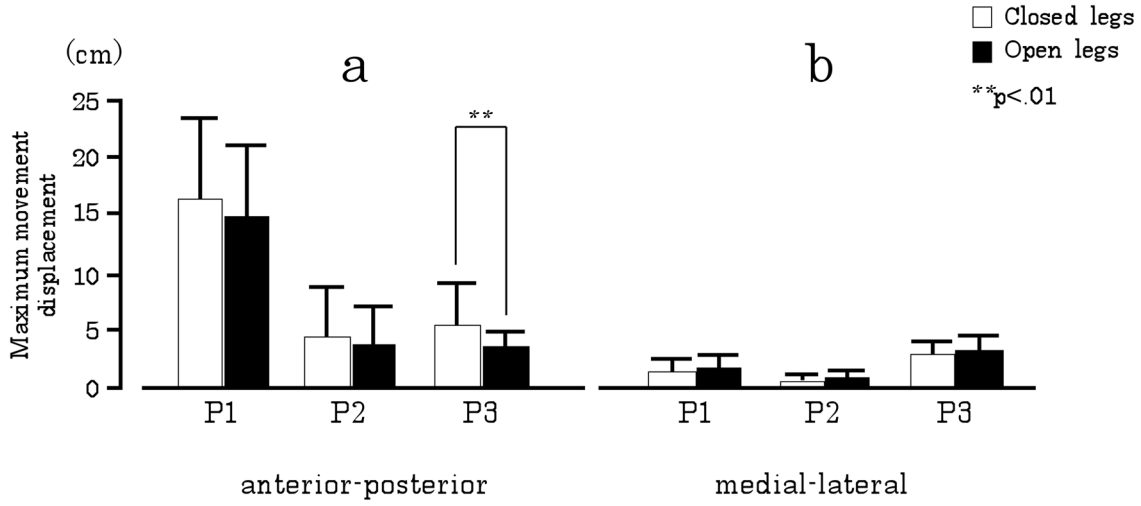

Fig. 2. The comparison of the maximum movement displacement during STS movement with anterior-posterior (a) and medial-lateral (b).

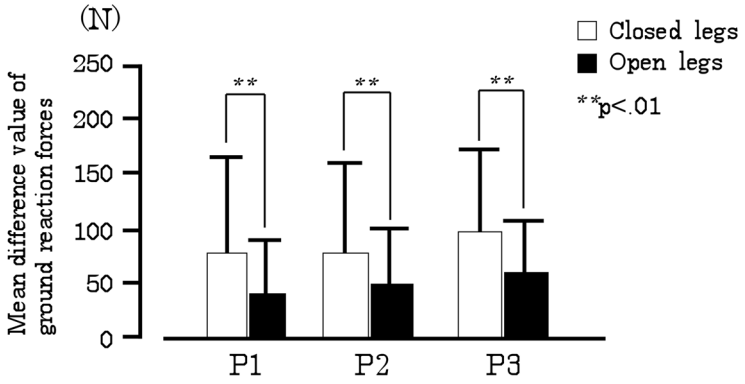

Fig. 3. The comparison of ground reaction forces.

student's t tests, and a significance level of 0.05 was selected.

Results

COP study

The means and SD of COP-Y position at the start of movement with closed and open legs were –14.48 ± 5.80 cm and –11.24 ± 5.64 cm, respectively. The COP-Y point at the start of movement with open legs was located significantly forward of the starting position ($p<.01$). COP-X position at the start of movement showed no statistically significant differences between closed and open legs.

The comparison of the maximum movement displacement of COP-Y in each phase is shown in Fig. 2a. In open legs, the maximum movement displacement of COP-Y was significantly less smaller than that of closed legs in phase 3 ($p<.01$). For comparison, the maximum movement displacement of COP-X in each phase is shown in Fig. 2b. The maximum movement displacement of COP-X showed no statistically significant differences between closed and open legs in each phase.

GRF study

The comparison of GRF in each phase is shown in Fig. 3. In all phases, the average differences in right and left GRF were significantly smaller for open legs than closed legs ($p<.01$).

EMG study

Comparisons of the right and left %max of each phase are shown in Table 1. Measurement of muscles found no significant difference between the right and left side. Comparison of right side %max of the STS movement in closed and open legs is shown in Fig. 1 and Fig. 4. TA showed significantly decreased muscle activity in phase 2, although AL activity increased significantly in

Table 1. The comparison of muscle activities in the left and right side limbs

	Closed legs									Open legs								
	Phase 1			Phase 2			Phase 3			Phase 1			Phase 2			Phase 3		
	left	right		left	right		left	right		left	right		left	right		left	right	
ES	19.0±9.8	17.4±8.6	*n.s*	29.3±13.0	25.9±11.7	*n.s*	15.4±7.7	15.6±8.1	*n.s*	17.6±8.4	16.6±8.1	*n.s*	26.4±12.7	26.4±13.0	*n.s*	13.1±8.4	13.6±8.9	*n.s*
GMA	3.9±3.6	5.2±7.1	*n.s*	12.8±10.4	14.9±17.1	*n.s*	10.4±7.0	11.6±7.1	*n.s*	4.4±3.7	5.0±4.9	*n.s*	11.0±7.4	11.8±10.5	*n.s*	9.5±6.3	10.8±7.1	*n.s*
VL	13.9±7.3	13.2±5.6	*n.s*	51.9±22.9	46.5±24.9	*n.s*	25.6±10.3	25.7±10.5	*n.s*	15.1±8.7	14.6±7.9	*n.s*	50.1±20.9	46.7±22.9	*n.s*	26.6±11.2	28.1±10.9	*n.s*
AL	9.8±8.2	9.9±10.0	*n.s*	16.1±13.2	15.0±14.9	*n.s*	6.9±4.2	7.9±6.4	*n.s*	10.1±11.3	10.0±9.2	*n.s*	21.3±15.5	22.6±21.2	*n.s*	7.4±5.0	8.6±7.6	*n.s*
BF	5.4±6.7	6.0±8.7	*n.s*	15.0±14.9	13.8±16.0	*n.s*	8.1±5.9	9.8±9.8	*n.s*	6.1±6.7	6.8±8.0	*n.s*	16.0±16.0	15.9±15.7	*n.s*	10.3±7.0	12.1±9.8	*n.s*
TA	31.2±13.9	31.6±15.6	*n.s*	41.6±22.5	40.2±21.8	*n.s*	6.5±4.7	6.5±5.0	*n.s*	30.7±16.4	31.1±15.6	*n.s*	32.9±23.1	32.1±22.5	*n.s*	6.4±5.3	6.0±4.4	*n.s*
GC	4.2±3.4	5.0±4.1	*n.s*	6.1±4.5	7.6±6.4	*n.s*	7.0±5.3	7.4±6.1	*n.s*	4.5±4.1	4.9±4.1	*n.s*	6.9±5.5	7.8±6.9	*n.s*	7.5±4.6	8.3±5.8	*n.s*

Percentage of the amplitude produced by the maximum contraction; %max. ES; GMA; VL; AL; BF; TA; GC.

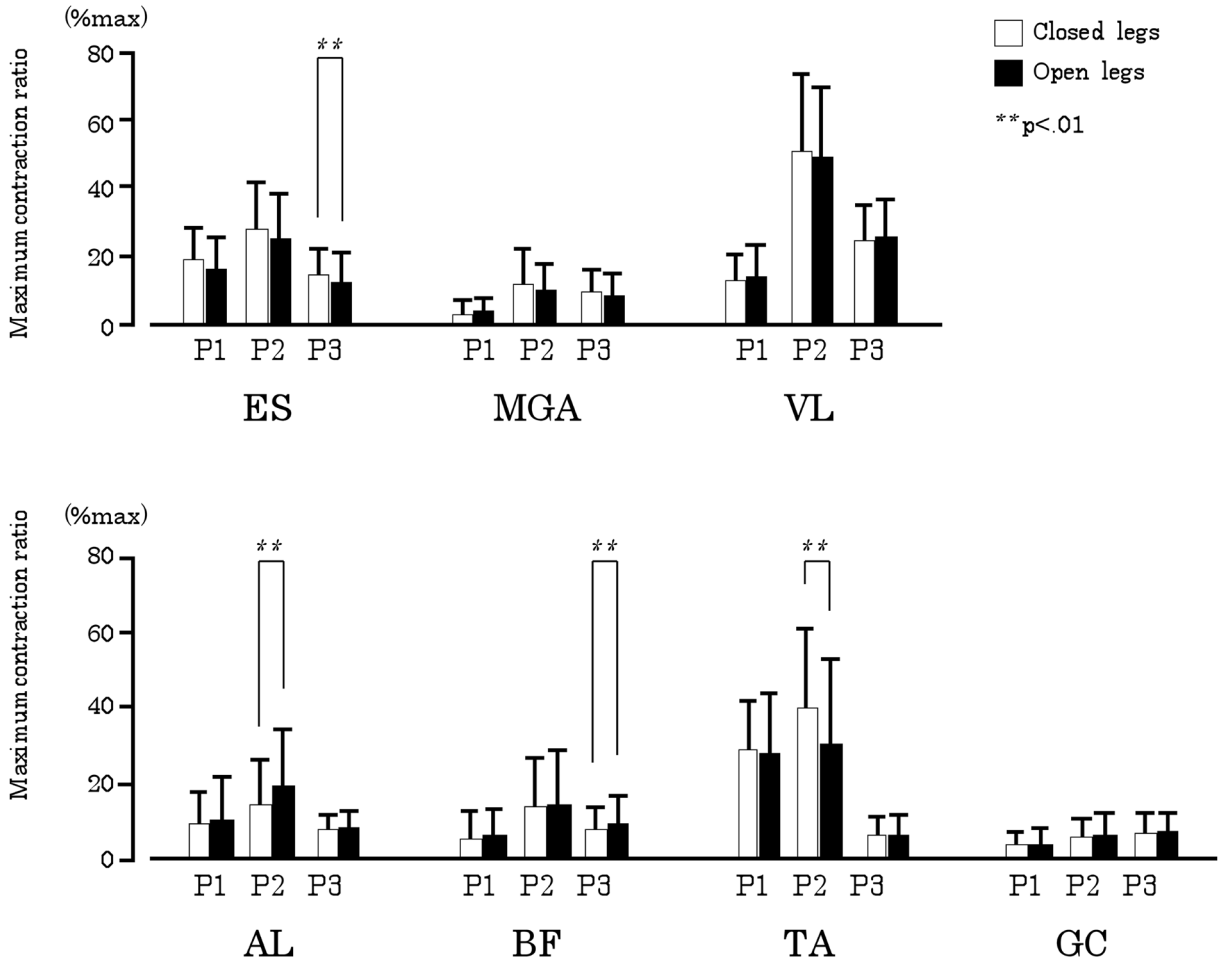

Fig. 4. The comparison of %max in each muscle.

open legs (p<.01). In phase 3, ES showed significantly decreased muscle activity, and BF significantly increased for open legs (p<.01).

Discussion

Kinematic analysis of variable hip joint angles in healthy people has documented that the STS movements from hip external rotation positions increased to partial lumbar extension and pelvis anteversion (Gotoh et al.,

2002). In comparing sitting postures in Fig. 1 (right side, (1), a, b), open legs seemed to show greater increase of partial lumbar extension and pelvis anteversion than closed legs sitting in phase 1. This suggests that the results of open legs resembled the above report. In this way, we speculate that COP-Y at the starting position with open legs was located significantly forward by pelvis anteversion. Moreover, another report stated that there was a center of force under the heels during the buttocks lift from the seat (Riley et al., 1991). In other words, COP of phase 1 is under the heels. This research shows that open legs with COP-Y at the time of initiation of STS movement were located in a forward position due to a short COP-Y displacement. It is speculated that this is one factor in making the STS movement easier.

Phase 2 was defined to be from after the buttocks lift off the chair seat to maximum dorsiflexion of the ankle (Schenkman et al., 1990). The center of mass is located in a maximum forward position at the time of ankle maximum dorsiflexion (Schenkman et al., 1990), and TA acted mainly in this ankle dorsiflexion (Gotoh et al., 2002). In addition, it was reported that STS movement from the hip external rotation angle decreased the anterior shift of the COP (Gotoh et al., 2002). Our results showed no significant differences in COP-Y between open and closed legs, but open legs decreased the anterior shift of the COP-Y in phase 2 (Fig. 2a, P2). Thus, our results indicate that there was slightly more ankle dorsiflexion with open legs than closed legs. Therefore, we suggest that TA showed significantly decreased muscle activity in open legs (Fig. 4). On the other hand, %max of AL was significantly different between open legs and closed legs in this phase (Fig. 4). It isn't clear if activities of AL increased with open legs in phase 2. The analysis of video data did not show hip joint adduction from the start (Fig. 1b (2)) to the end (Fig. 1b (3)) in phase 2. It seems that an increase of AL activities does not affect hip joint adduction. AL arises mainly from the medial border of the pectineus muscle and from under the pubic tubercle, spreading outside from underneath, and partly attaches about halfway along the femur medial lip (Fagerson, 1998, p. 18; Jenkins, 2002, p. 288). Thus, AL influences adduction and flexion of the hip joint (Fagerson, 1998, p. 18; Jenkins, 2002, p. 288). Furthermore, AL acts as the hip external rotator (Moore, 1997, p. 103; Pansky, 1996, p. 255). In the present study, AL seems to maintain the hip joint external rotation position. It is suggested that AL acts as an external hip rotator at the hip joint abduction and external rotation position. Furthermore, AL under open legs position should be effective for approximately 20 cm heights in phase 2 of the STS movement.

In the present study, during phase 3 from the maximum ankle dorsiflexion position to the complete standing position, open legs had less displacement of COP-Y than closed legs, because open legs has less anterior-posterior displacement in phase 3. It has been reported that ES acts to suppress body bending in STS movement (Millington et al., 1992). In other words, muscle activity of ES decreases at the time of slight bending of the body. In comparing postures at the start of phase 3, open legs seemed to show less body bending than closed legs (see Fig.1, right side, (3), a, b). Therefore, in open legs with slight bending of the body, ES decreased muscle activities in comparison with phase 3 of closed legs. BF and VL showed increments of synchronous activities at phase 3 from the latter half of phase 1 (Fig. 1). In addition, BF of open legs increased %max more than closed legs in phase 3. Anatomy textbooks describe BF as arising mainly from the ischial tuberosity of ischium (long head) and the lateral lip of femur (short head) and attaches to the head of the fibula. The long head of BF acts as an extensor, abductor and external rotator of hip joint, and a flexor of the knee joint. The short head of the BF acts as flexor of the knee joint. It was described that the knee joint is nearly fully extended, the long head of BF acts as an extensor of the hip joint (Kapandji, 2011, p. 44). In this study, the knee joint has to extend so that the BF acts as a hip extensor. The open legs knee extension angle was larger than closed legs at the end of phase 2 (see Fig. 1a(3), b(3)). It is suggested that activities of BF promote hip extension, and help antigravity movement of the body.

In kinematic studies, it has been reported that GRF of STS movement was asymmetric for both right and left limbs, and STS movements of healthy subjects could be completed with different distributions of the body weight on both feet, because healthy people have strong muscle power (Lundin et al., 1995). Our closed legs results were similar to the above report. However, GRF of open legs had right and left symmetry in all phases. It is speculated that the STS movement of open legs is effective for the standing up of the elderly who have decreased muscle power.

As mentioned above, the STS movement from the open legs position has anterior position of COP, short displacement distance of COP, and symmetrical GRF. Therefore there is less muscle activity of ES and TA with open legs in comparison with closed legs. Furthermore, AL must be active during phase 2, which must be very beneficial to fix the hip joint during the STS movement from open legs. The functional significance of the STS movement with open legs promotes hip and knee extension, and helps antigravity movement of the body.

Study limitations

This study analyzed the effects of differences in hip abduction and external rotation angles on the STS movements of young people. However, the relation of STS

movements between young people and the functionally limited elderly is unclear. In the future, we would like to investigate the STS movement by hip abduction and external rotation angles in the elderly.

Conclusion

This study analyzed the influence of differences in hip abduction and external rotation angles on STS movement. The STS movement from open legs showed less trunk flexion, and it indicated that GRF differed slightly for right and left. In addition, muscle activity of ES and TA decreased with open legs. In contrast, muscle activity of AL and BF increased.

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■ORIGINAL ARTICLE

The Present State of Fieldwork Education and the Problems of Psychiatric Occupational Therapy in South Korea

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Abstract: Occupational therapy (OT) provided by psychiatric institutions across South Korea is typically conducted by mental health professionals rather than occupational therapists (OTR). There are few psychiatric OTRs in Korea, and none have studied OT through an official program. To identify possible remedies for this situation, we analyzed questionnaire surveys and interviews from 14 OTRs and compared our data to the current literature. We found that OT in Korean psychiatry departments was fraught with legal, educational, and clinical problems. There were no established minimum standards for OT education, OT was typically conducted by other mental health professionals, OTRs found it difficult to gain confidence, and students had not been given the necessary psychiatric fieldwork experience. Examining these results, we found a need for the revision of existing laws and enactment of better laws regarding OT, rationalization of treatment costs, verification of clinical effects, and reform of psychiatric OT training programs.

Key words: Occupational therapy, Fieldwork education, Psychiatric rehabilitation in South Korea

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Introduction

The Mental Health Act of South Korea was amended in 2008 and executed from March 2009 onward. This act was the first law to define occupational therapy (OT) for hospitalized patients (Ministry of Health and Welfare, 2008) and the occupational therapist (OTR) as an agent of rehabilitation activities (Ministry of Health and Welfare, 2009). However, the therapy currently provided in psychiatry departments throughout Korea is implemented by social welfare workers, nurses, or other clinical psychologists; these are referred to as mental health agents, of which OTRs are not considered to be a part (Ministry of Health and Welfare, 2008; Ministry of Health and Welfare, 2010). The duties of mental health agents are, in general, focused on hospital cleaning, outdoor work, and occupational training for the rehabilitation of patients; this phenomenon has been noted to be problematic, such as group administration and exploitation of incomes in *Seikatu-ryoho* (Japanese) domains in Japan (Ministry of Health and Welfare, 2012a; Yoon-Jeong, E., & Hiroshi, Y., 2011; Hiroshi, Y., 2010). No formal system for OT for the mentally ill has been established in Korea, unlike in Japan and throughout the West. While the number of OTRs in Japan reached 57,196 (association members: 44,942) in March 2012 (The Secretariat of the Japanese Association of Occupational Therapists, 2012), and the country had 7,637 psychiatric OTRs according to 2010 statistics (The Secretariat of the Japanese Association of Occupational Therapists, 2011), the number of OTRs in Korea reached only 6,446 in 2011 (The Secretariat of the Korean Association of Occupational Therapists, 2013), with only 20 psychiatric OTRs (Joo-Eon, L., 2011). Korea has few psychiatric OTRs, and they have not been formally trained in OT or psychiatric OT in an official program. Thus, psychiatric OTRs end up performing activities similar to those performed by mental health agents and the professionalism of psychiatric OT remains underdeveloped (Table 1).

In this study, we analyzed the problems related to the current conditions of psychiatric clinical education in South Korea and existing laws and training regulations

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Table 1. Comparison of mental health agent and agent of rehabilitation activities

	Qualifications or requirements	Duties
Mental health agent	Social welfare workers, nurses, clinical psychologists	In general, focused on hospital cleaning, outdoor work, and occupational training for the rehabilitation of patients
Agent of rehabilitation activities	OTRs, social welfare workers, nurses, and so on	Psychiatric OTRs end up performing activities similar to those performed by mental health agents

Table 2. Details of the questionnaire

1. How many students do you receive a year?
2. Please explain what aspects of training you place emphasis on when supervising and educating your students.
3. Please give your opinion of the current situation of psychiatric clinical training in Korea and any problems you encountered during your time as a supervisor of fieldwork education.
4. Do you currently lecture at a college or university? If yes, please write the name(s) of places where you lecture, and briefly explain how you feel about giving lectures on psychiatry.

in order to fully understand the task of developing and expanding psychiatric OT.

Research Methods

To analyze the current state of the clinical education of psychiatric OT in Korea, questionnaires were sent via e-mail to 14 OTRs working in psychiatry departments throughout Korea. We collected additional data by conducting personal interviews with the six OTRs that consented to participate. Table 2 presents the details of the self-administered questionnaire.

Furthermore, after comparing and analyzing the current literature and data regarding clinical training rules, laws, and institutions, we were able to review the problems that hinder OT in Korea on the basis of the interviews held with psychiatric OTRs.

Results

Clinical training of psychiatric OT in Korea

The questionnaire was sent to 14 OTRs working in the psychiatric departments of 12 institutions in Korea in 2010. Results are based on data from 10 respondents from 10 institutions; the collection rate was 71% (83% per institution).

1) Questionnaire results

(1) Number of trainees per year

Results showed that five institutions (50%) had received trainees in the past year. The number of students annually received in each institution ranged from 6 to 40, with 89 students receiving training in psychiatry departments nationally. The remaining 50% of institutions did not administer OT training to their students.

(2) Emphasis on training guidance

Many subjects reported that they tended to place emphasis on teaching the most basic concepts to their trainees. Three subjects selected the following items: "explain the basic concepts of OT and the current status of the psychiatry department," "teach the necessity and role of OT in the psychiatry department," "pay attention to privacy and confidentiality issues," and "teach the basic terms, symptoms, and drugs related to various mental disorders." In contrast, two subjects selected the following items: "make sure trainees gain diverse experiences in the psychiatry department" and "pay attention to communication skills used with patients." In addition, two subjects mentioned students' lack of knowledge of the main concepts of psychiatry.

(3) Problems and opinions associated with psychiatric clinical training

"Students' lack of knowledge regarding psychiatric OT," "difficulty of carrying out clinical training with students who have not received a basic theoretical education," and "students' lack of understanding of psychiatric principles, as students are taught by faculty with little clinical experience" were selected by three subjects. This finding confirms that many OTRs were discontented with the low quality of the available training programs. Furthermore, subjects also mentioned problems related to human resources; three subjects selected "less time to teach students due to a busy clinical schedule," and two subjects selected, "lack of clinical training facilities" and "difficulties related to lack of adequate psychiatric OTRs." In addition, "outdated development of psychiatric OT," "absence of psychiatric OT supervisor," "communication problems," and "lack of places required for training, providing support, and exchanging information in relation to psychiatric OT" were each selected by two subjects.

(4) University lectures

Only one of the OTRs surveyed gave university lectures, having worked at two four-year colleges. This indicates that among the 25 four-year colleges nationwide, only two (8%) provided a psychiatric OT curriculum in

which students could learn from a psychiatric OTR with clinical experience. In addition, two of the surveyed OTRs had given lectures in the past, and one OTR occasionally gave special lectures.

(5) Views on the lectures

In their lectures, subjects generally acknowledged the lack of psychiatric OTRs in South Korea and the few employment opportunities available in psychiatric health. Other views included "the need to attract national attention to students' preferences for larger hospitals," "the tendency for students to show a greater interest in fields other than psychiatry," "the need for lectures provided by specialists with clinical experience," "the need for support from a professional association," "the need to establish formal OT concepts," and "the need for support, assistance, and interest in OT."

2) Interview results

In general, subjects were apprehensive about the future of psychiatric OT in Korea and requested the active support of the Korean Association of Occupational Therapists (KAOT) with regard to the legal and institutional problems that psychiatric OT must solve.

Subjects were largely dissatisfied with the fact that students without basic knowledge in clinical training had been sent to the psychiatry department, and they noted a strong need to recruit teachers with clinical experience. Because many students who attended psychiatric training sessions did not know even the most basic concepts related to mental disorders and general psychiatry, the first few weeks were generally spent on teaching basic theory. Furthermore, many subjects indicated that the absence of psychiatric OT supervisors led to hospitals presenting different OT content, making it difficult to have confidence in currently implemented therapy throughout the country.

Comparison with clinical training laws in various countries

Clinical training of more than 1,000 hours is expected to meet the minimum educational standards for OTRs according to the World Federation of Occupational Therapists (WFOT) (World Federation of Occupational Therapists, 2002), which have become the standards for OT training. Furthermore, students must have two months of a clinical training, and supervisors, at least one year of experience. Although the standards do not state the time or specifics of the arrangement for clinical training in psychiatry, they do mention the following: "Students experience a range of different fieldwork placements that require them to integrate knowledge, skills, and attitudes to practice with a range of people with different needs and in different circumstances" (World Federation of Occupational Therapists, 2002). The reason for avoiding any detailed requirements is that the standards in the 2002 revised version (World Federation of Occupational Therapists, 2002) were created to allow flexibility in curriculum content and to relax clinical training requirements. As the standards were written in consideration of national characteristics, rules differ according to country (Table 2).

The U.S. clinical training rules present precise regulations, qualifications, purposes, and roles for all of the following: Level I/Level fieldwork, OTR/Occupational Therapy Assistant (OTA), doctoral/master's degree levels, and student/fieldwork educators (FWE)/academic fieldwork coordinators (AFWC)/program faculty. While they do not present specific rules for clinical training in psychiatry, their specifications for Level II fieldwork state the following: "It is recommended that the student be exposed to a variety of clients across the life span and to a variety of settings." Furthermore, they also specify that Level II fieldwork must last at least 24 weeks, must be implemented in 1–4 institutions, and supervision must be provided by an OTR or OT with at least one year of experience (American Occupational Therapy Association, 2010; American Occupational Therapy Association, 2009).

Like the U.S., Canada does not present specific rules regarding psychiatric clinical training. However, it requires university fieldwork coordinators/professors to "coordinate offers and requests for placements and whenever possible match students and sites according to students' academic and fieldwork profiles and interests" (Committee on University Fieldwork Education, 2011). In addition, detailed regulations are stated in their academic accreditation indicators (Canadian Association of Occupational Therapists, 2010) (Table 3).

In contrast, Ireland presents the following detailed regulations in addition to the WFOT standards: a minimum of 250 hours of training in psychiatry and a minimum of 250 hours of training in body and sensory disorders (Association of Occupational Therapists of Ireland, 2013).

Japan adopted the rules of the Japanese Association of Occupational Therapists (JAOT) and the Ordinance of the Ministry of Health, Labour and Welfare. Although the designated rules of the Ministry recommend 810 hours of clinical training (two-thirds of which must be conducted in hospitals and medical centers), the JAOT designates the minimum as 1,000 hours in accordance with the minimum standards of the WFOT. Furthermore, both the Ordinance of the Ministry of Health, Labour and Welfare and the JAOT designate a clinical educator as a person who has accumulated at least three years of clinical experience after acquiring a license, and they indicate the need to carry out training regardless of disorder, stage, or age (Japanese Association of Occupational Therapists Education Division, 2003; Ministry of Education, Culture,

Table 3. Minimum standards for psychiatric OT fieldwork education in several countries

	WFOT	USA*	Canada	Ireland	Japan	Korea
Minimum fieldwork hours and duration	1,000 hours	24 weeks	1,000 hours	1,000 hours	JAOT: about 1,000 hours Government: 810 hours	None
Minimum fieldwork hours in psychiatric care	No particular amount (a range of different fieldwork placements)	No particular amount (students should be exposed to a variety of settings)	No particular amount (match students and sites according to students' interests)	250 hours	No particular amount	None
Fieldwork placements	A range of different fieldwork placements	1–4 institutions	All fieldwork occurs in approved sites	Same as WFOT	More than two-thirds is at hospitals or clinics	None
Supervisor (minimum fieldwork experience)	OTR or OT educator (1 year)	OTR (none) OTA (1 year)	OTR (1 year)	Same as WFOT	OTR (3 years)	None

Table 4. Occupational qualifications including OTRs

	Occupations and qualifications
Rehabilitation activity personnel	1) Social welfare workers, nurses, and OTRs. 2) Any person who has graduated from the Department of Psychology in a university which conforms to Article Two of the Higher Education Act. 3) Any person who has taken courses related to psychiatric rehabilitation activities at a college for three or more years and has graduated.
Job coaches	OTRs, social welfare workers, nurses, nurse assistants

Sports, Science and Technology of Japan, 2010; Ministry of Health, Labour and Welfare of Japan, 1999; Ministry of Education, Culture, Sports, Science and Technology of Japan, 1976). In Korea, OTR training standards have not been designated by either the KAOT or the government.

Furthermore, while Japanese WFOT standards have approved 132 out of 183 schools (72%) (The Secretariat of the Japanese Association of Occupational Therapists, 2013) as suitable for training, Korea has only approved 8 out of 55 schools (15%) (The Secretariat of the Korean Association of Occupational Therapists, 2013; The Secretariat of the World Federation of Occupational Therapy, 2013), including universities and junior colleges in 2013. Maximum number of incoming students accepted is 1,985 in 2013 (The Secretarit of the Korean Association of Occupational Therapists, 2013).

Rehabilitation in the field of psychiatry in Korea

Unlike other countries, Korea provides psychiatric rehabilitation under the "mental health agent system." This system was first introduced when the need for the rehabilitation and social integration of the mentally ill was raised by the enactment of the Mental Health Act in 1995. This converted the law from a policy focused on hospitalization and isolation to a policy focused on rehabilitation and social return.

As the development of specialists in various fields was required by this process, Korea introduced the mental health agent system in March 1997. Under this system, training institutions designated by the Ministry of Health and Welfare recruit trainees once a year to begin training programs during March and September. Programs are classified into Level 1 and Level 2 programs. The Level 2 program requires at least one year of training, whereas the Level 1 program requires at least three years. However, qualifications vary, as in some cases students are permitted to apply for the Level 1 program after gaining five years of clinical experience since acquiring the Level 2 certificate. After completing the training program, subjects can apply for a certificate from the Ministry of Health and Welfare and thereby become an official mental health agent.

The number of mental health agents reached 9,947 in December 2009, and nearly 1,000 students acquire the certificate every year (Ministry of Health and Welfare, 2010). However, this system is restricted to nurses, social welfare workers, and clinical psychologists; OTRs are affiliated with rehabilitation activity personnel and job coaches, as shown in Table 4 (Ministry of Health and Welfare, 2009; Ministry of Health and Welfare, 2010; Ministry of Health and Welfare, 2012b).

Thus, OT was first implemented in Korea by individuals in other occupations rather than by OTRs. Although OT can be implemented by either mental health agents or OTRs according to a psychiatrist's direction, in cases where the patient has legally requested and consented to treatment, OT is generally implemented by job coaches (OTRs, social welfare workers, nurses, and nurse assis-

Table 5. Sections of the Korean Mental Health Act relevant to OT

Article 46-2 (Occupational therapy in mental hospitals)
1. If it is judged that simple work such as making crafts may be helpful for the treatment of a hospitalized patient or the social reinstatement of a hospitalized patient, the chief of the psychiatric institution may instruct them to do such work when it presents no risk to their health.
2. The occupation in Section 1 will be enforced only with application or consent of the person and in accordance with the psychiatrist's instructions. In the case of mental recreation facilities, however, mental health professionals may direct the specific method of the occupation under the guidance of a psychiatrist.
3. If the occupation is instructed as per Sections 1 or 2, the chief of the psychiatric institution must record the details in the medical chart or occupational therapy record of the patient or inmate.
4. Specific matters of Section 1 such as occupation time, risk, and place will be decided by the Ministry of Health, Welfare and Family.
[Enactment of this article 2008.3.21] [Date of enforcement 2009.3.22]

Table 6. Sections of the Enforcement Regulations of the Mental Health Act relevant to OT

Article 23-2 (Occupational therapy for hospitalized patients)
1. If the occupation is conducted at a psychiatric institution as per Section 1 of Article 46-2, the total hours must not exceed 6 hours a day or 30 hours a week. If the occupation is conducted outside, instead of at the psychiatric institution, the total hours must not exceed 8 hours a day or 40 hours a week. Moreover, the occupation must be conducted in a place with facilities equipped appropriately for the occupation, for example, an occupational rehabilitation training room.
2. The occupation in Section 1 will be conducted with the consent or application of the patient and carried out under the instruction of a psychiatrist. However, the occupation must be conducted in a safe environment by hiring a mental health professional or occupational therapist, and tools that may harm mental patients or others, such as scissors or cutters, must be monitored and used safely.
3. If the occupation brings in money, as per Section 1, the amount will be calculated by subtracting the charges of the occupation, for example, the purchase of raw materials, and it must be paid directly to the bank account of the hospitalized patient.
[Enactment of this article 2009.3.20]

Table 7. Related matters of occupational therapy and social rehabilitation training in nursing facilities

1. The chief of the psychiatric institution may instruct hospitalized patients to do simple occupations, such as making envelops, cleaning, cooking, and washing of the hospital where patients can be admitted, in consideration of their health and the types/hours/dangers/places of that occupation, for the purpose of rehabilitation training.
2. The occupation in Section 1 must not exceed 6 hours a day or 30 hours a week. (If the occupation is conducted outside the nursing facilities, the total hours must not exceed 8 hours a day or 40 hours a week, and the occupation must be conducted in a place with facilities equipped appropriately for the occupation, e.g., an occupational rehabilitation training room.)
3. The occupation in Section 1 will be enforced with the consent or application of the patient and carried out under the instruction of a psychiatrist or mental health professionals under the guidance of a psychiatrist. However, occupation therapists, social workers, nurses, and assistant nurses will be used as vocational training instructors, and hospitalized patients must be protected by providing the occupation in a safe environment. Vocational training instructors must make a record of the occupational therapy specified in appended form 15, and must receive further confirmation from a psychiatrist.

Table 8. Medical expenses of health insurance relating to OT

Class No.	Code	Classification	Points
ㅇ-4	NN040	Occupational or recreation therapy [music, painting, calligraphy, sculpture, sports, etc.]	54.15
		Notes:	
		1. Stated points will be calculated regardless of the number of treatments carried out.	
		2. For outpatients, points will be calculated once a week, and for hospitalized patients, points will be calculated five times a week.	
		3. The price for raw material will not be calculated separately.	

tants) under the guidance of mental health agents who are directly supervised by a psychiatrist (Ministry of Health and Welfare, 2008; Ministry of Health and Welfare, 2009; Ministry of Health and Welfare, 2012a). Tables 5–7 present these details.

As OTRs are not currently affiliated with mental health agents, "Occupational or Recreation Therapy" is the only health insurance item that can be requested (Ministry of Health and Welfare, 2012b), and as 66 KRW is paid per point (unit cost of hospitals, nursing hospitals,

Table 9. Comparison of medical treatment fees related to psychiatric OT between Japan and Korea

Country	Class	Points	₩/¥	US$
Korea	Occupational or recreation therapy [music, painting, calligraphy, sculpture, sports, etc.] 6 hours a day, 30 hours a week	54.15	3,574	3.13
Japan	Psychiatric occupational therapy, 2 hours once a day	220	2,200	27.57
	Social skills training therapy at the hospital (within 6 months after admission), once a week	100	1,000	12.53
	Social skills training therapy at the hospital (over 6 months after admission), once a week	75	750	9.40
	Short-stay psychiatric care (small scale), 3 hours a day	275	2,750	34.46
	Short-stay psychiatric care (large scale), 3 hours a day	330	3,300	41.35
	Psychiatric day care (small scale), 6 hours a day	590	5,900	73.93
	Psychiatric day care (large scale), 6 hours a day	700	7,000	87.72
	Psychiatric night care, 4 hours a day, after 16:00	540	5,400	67.67
	Psychiatric day/night care, 10 hours a day	1040	10,400	130.33
	Psychiatric discharge guidance fee, once during hospitalization	320	3,200	40.10
	Psychiatric home visit nursing guidance fee (I), 3 times a week (within 3 months after discharge is 5 times a week)	575	5,700	71.43
	Psychiatric home visit guidance (before discharge) fee, 3 times during hospitalization	380	3,800	47.62
	Severe dementia day care fee, once per day	1040	10,400	130.33
	Addition of environmental improvement for life with medical treatment	40	400	5.01

* Exchange rate: reference date is 2012.03.09 (₩/US$: 1,140, ¥/US$: 79.77).

and general hospitals) (Ministry of Health and Welfare, 2012b), the cost amounts to about 3,574 KRW (Table 8). This is extremely low when compared with the number of health insurance items related to OT and their cost in Japan (Japanese Association of Occupational Therapists, 2010). Table 9 compares the status of OT in Korea with that of Japan.

Review

As the survey and interviews were conducted with only psychiatric OTRs, this study is limited in that the problems indicated in the research are based on the perspectives of OTRs only. However, the results indicate that the current state of clinical training for psychiatric OTs in Korea is complicated and problematic. The causes of these problems were observed to be related to the lack of clinical training institutions and training programs and legal, institutional, and regulations-related problems.

1) Clinical training institutions

Although the questionnaire was carried out in 2010, there have been no significant changes in the psychiatric OT training situation since that time. The number of psychiatric OTRs remains currently at about 20 (2012). Thus, when considering that the number of freshmen enrolled in universities and junior colleges was 1,870 in 2011, students who graduated with psychiatric clinical experience account for only 5% of the total number of students. The remaining 95% graduated without receiving any sort of experience or training in psychiatric practice. The reason for the scarcity of clinical training institutions in Korea is considered related to the low position relegated to OTRs in psychiatry and their overall lack of confidence. Consequently, OTRs do not want to accept students or reveal their skills and position to trainees.

This study first examined the position of OT and OTRs in psychiatry departments across Korea. As OTRs are affiliated with rehabilitation activity personnel or job coaches rather than mental health agents, they do not take a leading role in treating patients. Instead, they focus more on assisting with therapy or reporting on the overall safety of patients. Furthermore, the fact that it is more cost-effective to hire mental health agents also serves as an obstacle to increasing the number of clinical training institutions. In addition, 50% of the institutions surveyed did not receive trainees at all, even though they had employed OTRs in their psychiatry departments. This is probably because although there are many OTRs working, they might be anxious and doubtful about the therapy itself, as they themselves have never received in-depth training in psychiatric OT. In addition, many institutions do not receive trainees because they have begun operating only recently and thus cannot afford it.

2) Training programs

With regard to psychiatric OT training in universities, many subjects expressed strong discontentment with the fact that students must learn the basics during their training program due to a lack of knowledge in psychiatric OT caused by inadequate training, theory-based curriculums, and a lack of professors with sufficient clinical experience in psychiatric care. Thus, it is important for South Korea to increase the number of college professors teaching psychiatric OT and to improve the quality of their teaching. To do this, the KAOT must establish minimum training standards and take the time to foster teachers who can properly teach students the basics of psychiatric OT before graduation. Furthermore, the demand for OTRs is low, and it is difficult for OTRs to gain confidence in practice. They tend to have trouble obtaining appropriate medical fees in clinical situations, as they

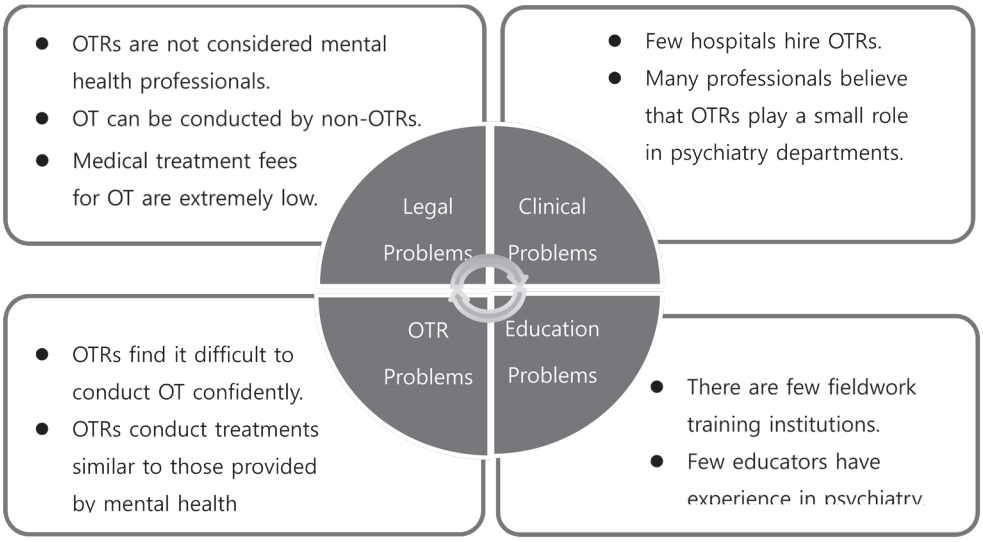

Fig. 1. Major problems in psychiatric OT in Korea

have a somewhat ambiguous position within the hospital. In order to improve this situation, it is important to help OTRs gain confidence in their abilities and the care they provide, enhance the overall quality of OT offered in hospitals, and emphasize the advantages of OTRs above other medical staff in administering OT. Furthermore, it is essential to recruit supervisors responsible for mentoring future psychiatric OTRs. The KAOT must plan and eventually implement a more appropriate training program for OTRs who specialize in psychiatry.

3) Legal/institutional/designated regulations

Both the health insurance system and the Mental Health Act of Korea have allowed non-OTRs to conduct OT, thus giving it a low treatment cost and an insignificant position in care facilities. Although there is a fundamental problem in the development and dissemination of psychiatric OT in Korea, the quality of psychiatric OTRs has also been viewed as a significant problem from a legal perspective. The therapy currently administered in psychiatry departments throughout Korea is conducted primarily by mental health agents. To acknowledge the merits of using OTRs to conduct psychiatric OT, researchers must emphasize how the characteristics and advantages differ from the conventional methods with regard to the therapy's structure, content, and effects.

Furthermore, another significant problem is the absence of formal standards for OT training in Korea. As different standards have been designated for different OT training programs in other countries, including differences in teaching qualifications, curriculum, and clinical training time, the quality of such programs varies significantly throughout Korea. Furthermore, because of the small number of hospitals that have implemented clinical training in their psychiatry departments, it is impossible for all students to receive practical psychiatric experience. It remains necessary to increase the overall quality of graduate students and OTRs by providing better psychiatric OT training, enacting official OT training standards by law, establishing minimum training requirements for the association, maintaining a consistent level of training across schools, and making it mandatory for all schools to provide basic psychiatric OT education.

Conclusion

As psychiatric OT in Korea is fraught with legal, educational, and clinical problems (Figure 1), it is difficult to present clear solutions. Although many areas must be improved, such as revising and enacting laws related to OT, rationalizing treatment costs, and verifying the clinical effects of OT, it is essential to reform psychiatric OTR training programs on a national level. Before the legal defects, problems of treatment costs, and inadequate clinical environments can be discussed, it is important to publicize the necessity for psychiatric OTRs through the practice of quality psychiatric OT; this would help establish OTR as an essential occupation in the field of psychiatry in the near future.

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■ORIGINAL ARTICLE

Behavioral and Physiological Observations During the Day: How Patients with Advanced Dementia Spend Time in a Care Facility

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Abstract: Objective: To clarify how patients with advanced dementia in a care facility spend time during the day through sequential observation of activities. **Methods:** Activities of 12 patients with dementia were observed using an original form for monitoring their behavior and applying electroencephalograms (EEGs) with electrooculograms (EOGs) to identify awake and sleep states. **Results:** The amount of time in an awake state was significantly longer than in the other states, although the awake/sleep rhythm fluctuated in all participants. The subjects were mainly occupied with "unpurposed period", in which they were inactive, although fully awake. **Conclusion:** Through reporting daily activities and awake/sleep states during the daytime in patients with dementia in a care facility, serial monitoring of behavior and the recording of biological activity revealed precise knowledge of the actual daily situation of patients with advanced dementia.

Key words: occupational balance, dementia, activity, lifestyle

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Introduction

A considerable number of people who suffer from dementia are living in care facilities in Japan, where 23.3 and 11.6% of residents were over 65 and 75 years old, respectively, in 2011 (Japanese Ministry of Health, Labour and Welfare, 2011a). Occupational therapy is important in such a situation, and occupational therapists are required to have sufficient knowledge of the elderly with dementia (Padilla, 2011).

Again, in Japan, the number of patients living in care facilities has markedly increased in recent years. While the number of registered elderly care facilities and patients in such facilities in 2000 was 10,992 and 648,559, respectively, they were 11,319 and 805,889 in 2009 (Japanese Ministry of Health, Labour and Welfare, 2011b). Therefore, how occupational therapists provide interventions for patients with dementia in care facilities as well as those in the community is an important issue. Although there are many problems to be solved in care facilities, interventions for so-called bed-ridden elderly patients have been the most closely considered over the last decade. The development of percutaneous endoscopic gastrostomy (PEG), instead of intravenous hyperalimentation in the 1990s (Shintani, Fumimura, Shiigai, Nakamura, Kataoka, Yokoi, & Ariyasu, 2001), has certainly changed the situation for these patients (Higaki, Yokota, & Ohishi, 2008; Yamaguchi, Hoshiyama, & Takano, 2011). Although the potential benefit of PEG to improve a patient's nutritional condition has been emphasized, the role of treatment in patients with advanced dementia has recently been debated (Garrow, Pride, Moran, Zapka, Amella, & Delegge, 2007; Gillick & Volandes, 2008; Sanders, Leeds, & Drew, 2008; Freeman, Ricevuto, & DeLegge, 2010; Yamaguchi et al., 2011). Occupational therapists in Japan have been struggling to find a better intervention for bed-ridden patients, and the number of such patients is still increasing (Suzuki et al., 2010). Therapists may easily imagine that patients with advanced dementia and poor oral intake exhibit little activity. However, there is a dearth of information regarding their actual activity in care facilities during

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Table 1. Profile of the participants

Participant	Sex	Age (years)	BI*(/100)	MMSE**(/30)
P-01	F	89	5	0
P-02	F	78	5	0
P-03	F	76	55	14
P-04	M	78	30	12
P-05	F	82	40	13
P-06	F	77	10	10
P-07	F	88	0	0
P-08	F	82	0	7
P-09	F	85	5	11
P-10	F	75	5	7
P-11	F	80	5	0
P-12	F	75	10	16
Mean (± SD)	M:F = 11:1	80.4 ± 4.9	14.2 ± 17.7	7.5 ± 6.1

* BI: Barthel Index. ** MMSE: Mini-Mental State Examination.

daily life.

The objectives of the present study were to investigate how the elderly with advanced dementia spend their time in a care facility, and to provide basic information for therapists in care facilities on activities during the day of patients with advanced dementia. Jacobs, Ancoli-Israel, Parker, & Kripke, (1989) previously investigated 24 hour sleep-awake patterns of the elderly in a nursing home by observing their wrist movement with an approximate evaluation (one value per hour). However, determining awake/sleep states in elderly patients with dementia through open observation is not practical, since those patients often make only a few movements even in awake states. For this purpose, continuous behavioral and biological observations of patients were conducted. We continuously recorded and quantified their activities and biological signals using electroencephalography (EEG) and electroculography (EOG), as well as behavioral observation during the day. The EEG signals with EOG recording have been one of the most reliable methods to document the awake/sleep status (Martin, Johnson, Viglione, Naitoh, Joseph, & Moses, 1972). We considered that precise knowledge of patients' biological activities would enable us to identify efficient interventions for them from cognitive functional aspects. This pilot study aims to clarify the activity of patients with advanced dementia to help them lead a more balanced life.

Materials and Methods

We collected personal profiles, and observed and recorded the behaviors of the participants every 2.5 min starting before breakfast (7:40) to before supper (18:00) on a single day (Wednesday). We also continuously recorded EEG and EOG during the observation period.

Participants

Twelve patients with dementia in a care facility participated in the present study. They were comprised of one male and eleven females, ranging in age from 75–89 years (mean 80.4; SD ± 4.9). The mean admission period of the patient ranged from 11.8 months to 73.4 months (mean 54.1; SD ± 21.0). All subjects suffered from advanced dementia, and were wheelchair bound. The average score of the 100-point Barthel Index (BI) (Shah, Vanclay, & Cooper, 1989) for all patients was 14.2 ± 17.7 (± SD). A summary of the participants is shown in Table 1.

No participants had a history of focal cortical symptoms, but evaluating precise higher brain functions such as agnosia and apraxia proved difficult due to their poor response at the onset of the study. Participants with specific causes of dementia, i.e., massive cerebral infarction/hemorrhage, encephalitis, toxic and metabolic encephalopathy, brain tumors, and other focal intracranial lesions, were excluded. Therefore, the participants suffered from slowly progressive dementia, including senile dementia of the Alzheimer type (SDAT) and dementia with Lewy bodies (DLB), although further diagnostic examination was not applied. None of the participants showed involuntary movements of the head, neck, or extremities, and ocular movement was not disturbed by physical examination at the bedside. They did not show major problems related to behavioral and psychological symptoms of dementia (BPSD) at the time of the study, which often cause difficulty in care, and hence increase the caregiver burden (Finkel, 2000).

The mean Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) score of the participants was 7.8 ± 5.9. Written informed consent to participate in the study was obtained from the families, and, if possible, from all participants prior to commencing the study. The study was approved by the Ethical Committee of Nagoya University, School of Health Sciences, based on the Helsinki declaration (World Medical Association,

Table 2. Scoring criteria for awake and sleep states

Awake/Sleep state	EEG findings	EOG	EMG
Full-awake (FA)	Beta or alpha activity	Blinking or saccadic eye movement	Bursts of EMG
Rest-awake (RA)	Alpha activity	Loss of blinking or saccadic eye movement	Spontaneous bursts of EMG
Drowsy (S1)	Suppression of alpha activity, sporadic vertex potentials	Loss of blinking or saccadic eye movement	Silent EMG
Light sleep (S2)	Spindles	Loss of blinking or saccadic eye movement	Silent EMG

Table 3. Monitoring sheet for behavioral observation

Place			Posture			Time	Activity	Notable observation
R	H	Others	L	S	Others			
						7:10		
						7:20		
						7:30		
						7:40		
						7:50		
						8:00		
						:		
						:		
						10:40		
						10:50		
						11:00		
						11:10		
						:		
						:		

R: room, H: hall, L: lying, S: sitting.

Table 4. All activities shown during observation for every participant

Category	Activities
ADL	Dressing (1)*, Eating (12), Medical treatment (6), Oral hygiene (11), Personal device care (1), Toilet hygiene (12), Transfer (12)
Purposeful	Conversation (7), Watching television (2), Afternoon tea (2), Walking around inside (1)
Un-purposed	(12)
Rest	Sleep (11)

( )* the number of patients who participated in the activity.

2008).

Participants were all inpatients in a mid-sized care facility, where approximately 100 elderly patients with and without dementia were provided with medical care and underwent rehabilitation with occupational and physical therapists.

Experiment design

1. Continuous recording of behavioral activities

We selected Wednesday as the day of the observation, since bathing and outside activities were not scheduled on that day. From 8 a.m. to 5 p.m., we carefully observed and described each participant's behavior every 2.5 min using an original monitoring sheet (Table 3) because some activities were completed in less than a few minutes. We recorded the location of the patients, the patients' postures, their activities, and anything worthy of note; e.g., talking with a caregiver, watching television, eating, and dressing (Table 4).

2. Continuous recording of biological activities

A wireless amplifier was employed so as not to disturb each participant's movements during the recording period. EEG signals were recorded from two scalp areas, Oz and C3, with referential electrodes of the linked mastoid process, using surface electrodes which were 7-mm silver-silver chloride disc electrodes. Those recording areas were selected to observe basic alpha activity and sleep-specific responses, the vertex potential, and sleep spindle. EOGs were recorded from the right eye by placing electrodes 2 cm below the infra-orbicular edge and 2 cm lateral to the lateral canthus of the right eye. Impedance between electrodes was kept at less than 10 kOhm. The EEG and EOG signals were recoded with an initial band-pass filter from 1.6 to 60 Hz and transferred through

a wireless amplifier (WEB-5000, NIHON-KOHDEN, Japan) with an analog to digital converter (ADC) (CSI-320312, Interface Co., Japan). The data were digitized at 1.0 KHz to store on a personal computer.

3. Data analysis

All observed activities were recorded and divided into four categories: activities of daily living (ADL), purposeful activities (work, productive activities, and leisure), un-purposed activities and sleep. We referred to the uniform terminology defined by the American Occupational Therapy Association for categorization (Rockville, 1979; American Occupational Therapy Association, 1994, 2004). The category of ADL included grooming, oral hygiene, bathing/showering, toilet hygiene, personal device care, dressing, feeding and eating, medication routine, and health maintenance. The category of purposeful activities included both "work and productive activities" and "play and leisure activities". The other period when patients did nothing was categorized as an unpurposed period. The period of time in each activity category was expressed as a percentage of the recording period, since the total recording period varied in each participant, as described in Results.

Biological signals were also evaluated every 2.5 min. Awake and sleep states were investigated based on EEG signals and were evaluated based on the scoring system of Rechtschaffen & Kales (1968), although the score was partially modified using the EOG data. Full-awake (FA), rest-awake (RA), drowsy (S1), and light sleep (S2) states were defined as shown in Table 2.

From EOG signals, the period of time spent blinking or showing step-wise rapid (saccadic) eye movement, corresponding with the full-awake state, was measured. Since blinking and saccadic eye movements could not be separated on EOGs, we measured the time period showing both eye movements.

We compared BI or MMSE and the amount of time in an awake state using Peason's correlation coefficient test. We also compared the time period of FA, RA, and sleep with Student's t-test. P-values less than 0.05 were considered significant.

The awake/sleep score was determined every 5 min: i.e., FA = 5; RA = 3; sleep (S1 or S2) = 1. The mean awake/sleep score every 20 min from 07.40–17.00 hours was calculated and described as a chart for each participant.

Results

All activities and biological signals were successfully obtained from all patients. The total recording period was 523 (8 hours and 43 min) ± 56 min (SD). Since the light-sleep state (S2) was determined by spontaneous sleep spindles, it was difficult to identify the exact onset and end of S2 during the recording period. Thus, S1 and S2 were put together and determined as a sleep state.

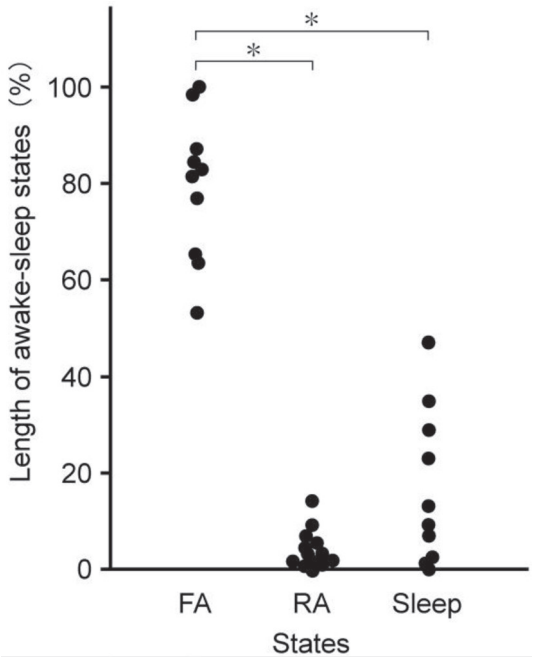

Fig. 1. Relative amount of awake/sleep states of patients during the daytime. Percentage of amount of time for full-awake (FA), rest-awake (RA), and sleep. The FA state was significantly longer than the other states ($p<0.05$).

We also calculated the amount of time for FA, RA, and sleep during the entire recording period (Fig. 1). The average percentage of the FA and sleep states was approximately 80% and 20%, respectively. The RA status period was minimal. The patients were fully awake for significantly longer than for sleeping or resting while awake during the day. There was no significant difference between the resting while awake and sleep states. The correlation between BI or MMSE and the time period of FA was not significant. Sequential changes in the awake/sleep score during the day for all participants are shown in Fig. 2. The awake/sleep rhythm fluctuated in all participants, and the awake state was mostly maintained around meal times.

All activities performed by every patient were dressing, eating, medical treatment, oral hygiene, personal device care, toilet hygiene, and transferring (ADL), afternoon tea, conversation, walking around the facility, and watching television (purposeful activities), and sleeping. The period in which patients spent their time inactively was divided into an unpurposed category (Table 4).

The percentage of the four categories performed by each patient is shown in Fig. 3. The percentage for the category of ADL was around 30% in the twelve patients. Purposeful activities were shown in 8 patients, and the

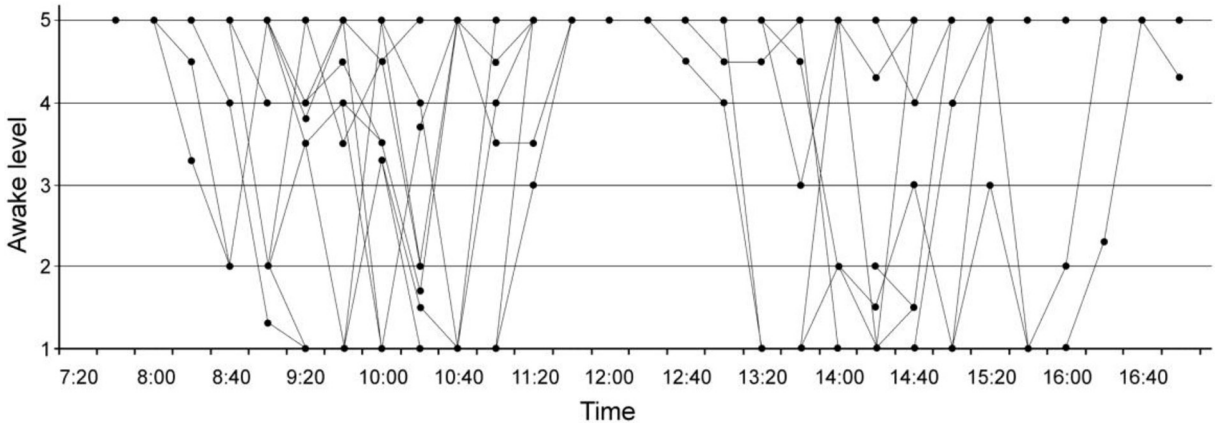

Fig. 2. Sequential changes of awake and sleep states for each participant. Each connected line indicates a participant. Awake and sleep states fluctuated during the daytime. The awaking state was maintained around meal times, and patients were not always in sleep states but awake during the day.

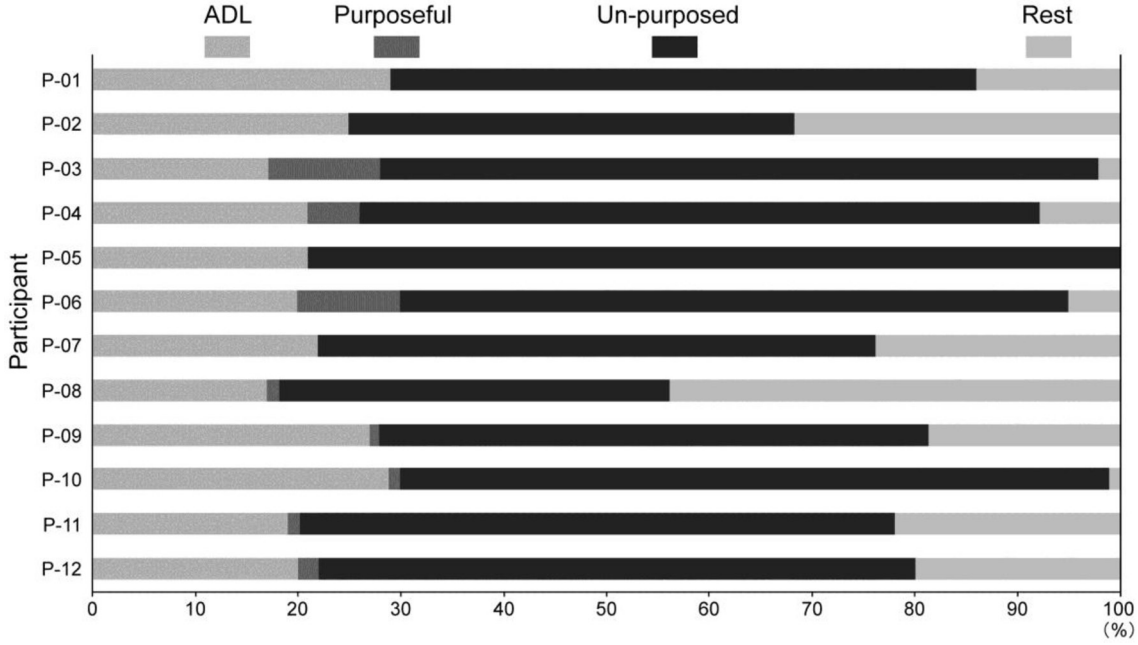

Fig. 3. Relative amount, expressed as a percentage, of activities during a day. The majority of time was observed as un-purposed. Participants' numbers corresponds to those in Table 1. Activities in each category were described in the text (2. 2. 3. Data analysis).

percentage was less than 12%. The percentage of time in the unpurposed period was the highest in 11 patients, ranging from approximately 40 to 70%. Sleep was noted in 11 patients. The percentage of unpurposed and sleep categories totaled more than 70% in all patients.

According to the results of EEG and EOG, the unpurposed periods consisted of 2 kinds of awake/sleep states: FA and RA. Four patients were fully awake during the unpurposed period, and the others were fully awake during more than 90% of the unpurposed period. Thus, all patients spent their time inactively during the un-purposed period, even though they were completely awake.

Discussion

In the present study, we investigated the daily performance and awake/sleep states of patients with dementia in a care facility during a single day. To our knowledge, such detailed observations have not been reported. The results are 1) a fully awake state remained, but the awake/sleep rhythm fluctuated except for meal times; 2) the patients were occupied by just a few activities except for ADL; and 3) the un-purposed period was the longest in almost all patients. All patients were fully awake during that period.

Clinicians may assume that elderly patients with advanced dementia lack activity and tend to sleep during the day. However, there is no data regarding how long and how often such patients sleep during the day. In fact, patients often stay awake during the day, although their awake/sleep states fluctuate. Jacobs et al. (1989) measured awake-sleep patterns in 19 elderly patients with and without dementia in a care facility, but they did not separately record the patterns for patients with advanced dementia. This is the first report, as far as we know, which investigated the awake/sleep states in elderly patients with advanced dementia by continuous recording of biological signals.

The relationship between activity and cognitive function in the elderly has been reported (van Gelder, Tijhuis, Kalmijn, Giampaoli, Nissinen, & Kromhout, 2004; Weuve, Kang, Manson, Breteler, Ware, & Grodstein, 2004; Klusmann, Evers, Schwarzer, Schlattmann, Reischies, Heuser, & Dimeo, 2010; Leung, Fung, Tam, Lui, Chiu, Chan, & Lam, 2011). Decreasing activity leads to a decline in cognitive function, and leisure or cognitive activities could reduce the risk of dementia (Verghese et al., 2003; Helzner, Scarmeas, Cosentino, Portet, & Stern, 2007; Hall, Lipton, Sliwinski, Katz, Derby, & Verghese, 2009). Although physical activities do not always show a link to cognitive impairment (Laurin, Verreault, Lindsay, MacPherson, & Rockwood, 2001), reduced physical activity could be a risk factor for Alzheimer's disease (Larson, 2008; Lautenschlager et al., 2008). Thus, maintaining an active daily life, especially linked with a positive emotional state, has been considered an important factor maintaining the quality of life (QOL) of elderly patients (Skevington, Lotfy, O'Connell, & WHOQOL Group, 2004), although evaluation of QOL of patients with advanced dementia is not easy (Schölzel-Dorenbos et al., 2007). Therefore, therapists must identify the most appropriate intervention for low-activity patients with advanced dementia to prevent functional decline and maintain their QOL.

The patients in the present study spent most of their time without purpose, although they were in a fully awake state. This is the most significant finding of the present study. Because they were not asleep but in an awake state providing them with cognitive interventions and activities, even physical environmental control could improve the awake/sleep cycle (Sloane et al., 2007; Flick, Garms-Homolová, & Röhnsch, 2010). Thus, adequate occupational intervention may reduce awake/sleep fluctuation in these patients. However, keeping the patients awake is not the sole solution. Previous research pointed out a similar issue in patients with advanced dementia, who spent the greater part of their day unoccupied (Perrin, 1997). They also stated that simply facilitating intervention might not be sufficient, but improving the skills and qualities that individual staff members bring to their interventions was important (Perrin, 1997). Occupational therapy for daily activities, such as washing, dressing sanitary services and eating improved functional scores (Baldelli et al., 2007). Previous studies also referred to the lifestyle or life balance in the field of occupational therapy (Jackson, Carlson, Mandel, Zemke, & Clark, 1998; Pentland, & McColl, 2008). However, in Japan, the number of patients with advanced dementia has increased far more rapidly than any other country, and the recent situation regarding care facilities for patients with advanced dementia is rapidly changing in terms of quantity and quality. The number of therapists and caregivers is far from enough (Japanese Ministry of Health, Labour and Welfare, 2011b), and how such patients with advanced dementia should be managed with occupational therapy in care facilities is still being debated. It is clear that occupational therapists experience difficulty with elderly patients suffering from advanced dementia who lack activity or occupation. Further research may be required to investigate the criteria for a well-balanced life for elderly patients with advanced dementia, in order to know how much intervention and rest time should be provided.

Limitations of the present study were an inability to propose a clear solution to improve the status of the patients with dementia, as described in the previous paragraph. The present study reported only the behavioral and physiological aspects of the patients. Effects of intervention on the states of patients, variation of the data among facilities, psychological evaluation of the patients, and theoretical and practical proposals to improve QOL of the patients and caregivers should be investigated in the future.

The present study reported daily activities and the awake/sleep status during the daytime in patients with dementia in a care facility. Serial monitoring of behavior and recording of biological activity revealed precise knowledge of actual daily situation in patients with advanced dementia.

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