

ORIGINAL

Encounter of Pepper-CPGE for the elderly and patients with schizophrenia: an innovative strategy to improve patient's recreation, rehabilitation, and communication

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Abstract : In Japan, humanoid robots has been introduced in the medical and elderly care environment. The application program of Care Prevention Gymnastics Exercises for Pepper (Pepper-CPGE) made by Xing Company, Japan is a body-brain gymnastics recreation program for 40 minutes tailored to the elderly's functional level. It consists of moving, watching/healing, and playing. "Move the body" exercise and other active range of motion activities are done according to the music. Pepper-CPGE was introduced as a clinical trial at the Mifune hospital, beginning in May 2018. At the units where clinical trials are done, 80% of the patients are with mental illness diagnosis with decreased physical functions often moving by wheelchair only. When Pepper-CPGE was introduced, the following changes were observed : (1) communication between patients and nurses during rehabilitation care using Pepper-CPGE was increased ; (2) patients were interactive, engaged, and actively participated in the Care Prevention Gymnastic Exercises using Pepper-CPGE ; (3) patients had fun and enjoyed talking to Pepper-CPGE. Interventions using Pepper-CPGE appear to be an effective rehabilitation strategy to increase engagement and participation of elderly patients who require long-term care and rehabilitation. *J. Med. Invest.* 66 : 50-53, February, 2019

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INTRODUCTION

The aging of society is a serious issue in Japan (1). In addition, there is also the issue of nurse shortage and caregivers (2). Sedentary behavior (Sitting or lying down with the exception of sleeping) and lack of physical activity threatens health. Studies concerning behaviors of inpatients especially with severe mental illness is limited, but hopefully, decreasing sedentary behavior and improving physical activity in this population should be a high priority in clinical practice (3).

Schizophrenia is a chronic mental illness characterized by cognitive impairment symptoms that continues to be a core and consistent mental deficit. Previous studies have shown that physical activity is positively associated with cognitive performance (4). The lifespan of people with severe mental illness is shorter as compared to the general population. This excessive mortality rate is mainly due to the physical illness (5). These effects are frequently the results of a sedentary lifestyle and weight gain, which increase the risk of cardiovascular disease and premature death (6). Aerobic dance is recommended as a nonpharmacological intervention for patients with schizophrenia who are in daycare or rehabilitation settings (7).

Tanioka *et al.* (8) conducted studies focusing on the applications of humanoid robots in providing nursing care, and communicating

with patients (9). In one study, Tanioka *et al.* evaluated a rehabilitation program using the Care Prevention Gymnastics Exercises for Pepper (Pepper-CPGE), the purpose being the assessment of the various challenges accompanying its application and use (10). As these research studies progress, it may be that healthcare providers will be able to entrust parts of medical care which are currently provided by human beings to humanoid robots. With the active use of humanoid robots, healthcare providers can utilize their time to engage more on human healthcare by interacting with patients (11). As a result, these healthcare professionals such as nursing staff and occupational therapists (OTRs) can provide genial care in rehabilitation practice.

This study is aimed at clarifying the changes to a hospital unit on the introduction of a group recreational and physical activity program by OTRs with the use of the humanoid robot, Pepper.

METHOD

What is the Pepper-CPGE

The application program of Care Prevention Gymnastics Exercises for Pepper (Pepper-CPGE) was made by Xing Company, Japan. It is a body-brain gymnastics recreational activity program for 40 minutes tailored to the level of activity consisting of moving, watching/healing, and playing. "Move the body" when doing the exercise and other active range motion activities are performed according to the music.

Analysis methods

Transaction/interaction among elderly persons, nursing staff,

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OTRs and Pepper-CPGE was recorded by video camera. Descriptions of the interactions and transcriptions were made and analysis followed after the transcripts and video recordings were transcribed from the interaction.

Subjects and Data Collection Period

Pepper-CPGE was introduced as a clinical trial at the Mifune hospital, from May 2018 to the present. Wards undergoing clinical trials account for 80% of the patients with schizophrenia who have decreased physical function and have to move using a wheelchair. Data collection period was from June 2018 to October, 2018.

Ethical Consideration

The data collection procedure was performed following the Private Information Protection Law, with approval from the Tokushima University Hospital Ethics Board (approval number 3046) and Mifune Hospital (approval number 20180502). The purpose and methods used in the study were explained to all subjects and their guardians. Participants were assured that their personal information were protected, that the report would be done as an aggregate, and will be used only for research purposes. Informed consents were obtained prior to the commencement of the study.

RESULTS

The results revealed three important themes, namely : the use of Pepper-CPGE can create a unique scenario to stimulate patient's interest (Figure (a)), Pepper-CPGE can serve as a valuable tool to lead therapeutic physical exercises for patients (Figure (b)), and Pepper-CPGE establish communication to patients by asking questions (Figure (c)). These themes are explained in detail under each figure.

Figure (a) demonstrates the scene before the start of a recreational activity with Pepper-CPGE. Previous to this experiment, the introduction of Pepper-CPGE, an OTR played a major role as presenter alongside two other OTRs who led and guided the patients through the activity. After the introduction of Pepper-CPGE, three OTRs led and verbally interacted with the patients, indicating that Pepper was influencing the therapists time and



(a) The scene before start of a recreational activity by Pepper-CPGE.



(b) Recreational and rehabilitation activity run by Pepper-CPGE.



(c) The scene of intentional communications between Pepper-CPGE and patient.

Figure. Pepper-CPGE for elderly patients : recreation, rehabilitation, and communication

allowing the OTR's to participate later. However, it took time for the OTR to operate Pepper-CPGE because of the difficulty of setting up the robot and the time it took to manipulate.

Some patients showed interest in the occupational therapy activity as the activity was carried out by Pepper-CPGE. As these patients verbally interacted with Pepper-CPGE by chanting, "Pepper! Pepper!" several other patients also began to show interest in the robot.

Figure (b) shows the Pepper-CPGE interacted with patients verbally and the patients followed its prompts while demonstrating calisthenics exercises. The robot appeared unique to the patients and many of them demonstrated interest in Pepper-CPGE. During the recreational activity, there were some altercations between patients with utterances such as "Getout", "I can't see Pepper", and "Be quiet!, I want to listen to Pepper's talking" because each patient found the desire to see the robot. The patients performed the calisthenic exercises according to the instructions by Pepper-CPGE. When Pepper-CPGE explained the nature and duration of the calisthenics afterwards, some patients responded saying, "Wow, we did so much exercise." The patients did not argue with each other after the recreational activity was completed.

Figure (c) depicts a scene of intentional communications between Pepper-CPGE and an individual patient. Pepper-CPGE asked the patient questions about his knowledge and experiences, and the patients responded to the questions. At the time, the surrounding patients listened to the conversation between Pepper-CPGE and the patient and initiated new conversations with other patients, asking, "Have you been to Hokkaido?"

DISCUSSION

The Pepper-CPGE plays the role of presenter of the recreational activity, while the OTR who had previously presented recreational activity activities observed the responses of individual patients. It had been a challenge for the OTR to pay attention to the others when presenting the recreational activity, as the OTR had focused on the presentation itself. However, in order to understand the reactions of individual patients, the OTR needed to be in the position of the presenter. In introducing Pepper-CPGE in the recreational activity, the patients who showed favorable responses to the robot played a key role in creating a good environment. The OTRs consciously interacted with the patients who fell behind in the recreational activity.

As Locsin (12, 13) stated, "engaging in the process of the changes in persons is essential in nursing." Introduction of Pepper-CPGE brought changes in the relationships of the patients with other patients, nurses, and OTRs. Pepper-CPGE symbolized technology and how the use of technology can bring about changes in relationships between patients and others around them. During communications among patients, expressions of emotions such as anger were observed as well as mirthful laughter and calm conversation. Use of Pepper-CPGE was considered to be an efficient way to establish and enhance communication among patients, medical staff, and the robot itself through interventions by OTRs and nurses.

Furthermore, with the introduction of Pepper-CPGE in the recreational activity, the OTRs must consider three important elements in order to achieve the objectives of the activity : (1) creating an environment that allows patients to see Pepper-CPGE easily and for the robot to move easily, (2) continuing verbal interactions with the patients until Pepper-CPGE started, and (3) considering the order and locations of the patients who will engage in the activity.

Communications between Pepper and patients were intentional communications, and were initiated by patients seated at the front

row near Pepper. Interactions between OTRs and patients during the recreational and physical activity by Pepper were also intentional communications by the OTRs.

Physical activity is beneficial for cognitive function in the elderly. The current evidence suggests that physical activity may help to improve cognitive function and, consequently, delay the progression of cognitive impairments in the elderly (14). Also, it was reported that long-term regular physical activity, including walking, is associated with significantly better cognitive function and less cognitive decline in older women (15). Fuji *et al.* (16) demonstrated that intentional communication increases sympathetic nerve activity, in dementia patients receiving long-term care and who exhibit good communication capacities.

However, neurocognitive dysfunction is a critical target symptom of schizophrenia treatment. A positive correlation between physical activity level and neurocognitive function has been reported in healthy individuals, but it is unclear whether such a correlation exists in patients with schizophrenia and whether the relationship is different according to inpatients or outpatients. Especially, the long-term benefits of physical activity on neurocognitive function among patients with schizophrenia, specifically among inpatients, remain unclear (17). A lack of clarity exists regarding the relationship between objectively measured physical activity and sedentary behavior and cardiometabolic outcomes in people with schizophrenia (18).

Cognitive impairment represents a significant source of disability among individuals with schizophrenia (19). Some patients had cognitive issues who had difficult time following instructions by the Pepper-CPGE. In this study, it also showed that repetitive behaviors by patients involving cognition and responding to questions from Pepper-CPGE occurred during intentional communications between Pepper CPGE and patients. The verbal interactions of OTRs to the patients were also intentional communications, which are all envisioned to improve cognitive functions of the patients with schizophrenia.

The introduction of Pepper-CPGE alone was considered to stimulate the patients and influence the daily life activities among those who were living their lives routinely every day. Furthermore, the intentional interactions of OTRs with the patients during the recreational activity by Pepper-CPGE were considered to increase communications between OTRs and the patients and enable the OTRs to grasp the conditions of the individual patients.

Boredom did not set in among patients talking or interacting with the Pepper-CPGE. However, it was observed that patients having problems with hearing and visual acuity had difficulty understanding and following instructions from the Pepper-CPGE. Some of them did not like the physical movement by the Pepper-CPGE. It was important for such patients to participate and be encouraged by OTRs and nurses, and repeatedly explain at the earshot level the presentation by Pepper-CPGE in interacting with patients. On the other hand, when gymnastics and music that were familiar to the patients from the past have been applied, many patients enjoyed participating in the program. It has been a challenge for some patients to initiate and follow some activities such as mouth exercises (where they were instructed by Pepper-CPGE to sing) and gymnastic activity (where they were asked to follow the active range of motion exercises from the audio-visual monitor). Some patients did not like the song being played by the Pepper-CPGE program and made this known to the OTR.

LIMITATIONS

In this study, the relationships between the patients and medical care providers were observed during and after the recreational activity with Pepper-CPGE. The study provided valuable informa-

tion on improving communication and increasing engaging activities in rehabilitation strategies among patients with schizophrenia, particularly the use of robotic technology. However, a qualitative analysis is needed to describe the perceptions and experiences of patients who participated in this innovative program of using Pepper-CPGE. Also, developing competencies on the use of Pepper-CPGE technology among OTRs and nursing staff are considered imperative as future development plans to ensure consistency and continuity of practice.

CONCLUSIONS

With the integration of Pepper into the clinical practice, three important changes on the way patients, nurses and Pepper establish interaction and participation to rehabilitation therapy : (1). communication between patients and nurses using Pepper-CPGE has been increased ; (2) patients participate actively in the CPGE when Pepper led the activity ; and (3). patients felt happy and satisfied talking with Pepper. Optimization of Pepper in clinical practice was a potential strategy to improve communication and improve physical rehabilitation among elderly and patients with mental illness.

CONFLICT OF INTEREST

There is no actual or potential conflict of interest that exist in this manuscript.

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