

*In-Patient Psychiatric Settings and Emergency Departments.*  
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BRENDON STUBBS<sup>1</sup> AND LEE HOLLINS<sup>2</sup>

<sup>1</sup>Clinical Specialist Mental Health Research  
Physiotherapist, Northampton, U.K.  
Email: brendonstubbs@hotmail.com

<sup>2</sup>Physiotherapist and Physical Intervention Tutor,  
London, U.K.

doi:10.1017/S1041610210001912

### Rehabilitation for dementia using enjoyable video-sports games

The aging of society inevitably leads to an increase in the numbers of elderly with dementia who reside in nursing homes, and delaying disease progression of residents with dementia has become a big concern. Rehabilitation that focuses directly on training cognitive function (e.g. memory training) reveals what patients are unable to do. Realization of their cognitive deficits can devastate their self-confidence and lead to anxiety, depression and the lowering of self-esteem (Small *et al.*, 1997). We propose rehabilitation that encourages patients' motivation for self-improvement through social interaction based on five principles as follows: (1) the activities should be enjoyable and comfortable for patients, (2) therapists should praise the patients naturally to motivate them, (3) the activities should be associated with empathetic two-way communication to make patients feel valued and safe, (4) therapists should encourage the patients to play "social roles" to restore self-worth, and (5) error-less learning based on brain-activating rehabilitation (BAR; Yamaguchi *et al.*, in press) should be adopted wherever possible. It is suggested that the positive feelings activate those areas of the brain related to reward, which plays a critical role in motivation (Berridge *et al.*, 2003), and it is a typical social reward to be praised and appreciated in public.

Based on BAR, we tried to improve residents' cognitive function indirectly by enhancing motivation using enjoyable video-sports games in a group setting. We conducted interventions with nine elderly people with mild to moderate dementia ( $88.9 \pm 4.9$  years of age, mean  $\pm$  SD; three males and six females: one with Parkinson's disease dementia, one with vascular dementia, and seven

with Alzheimer's disease (AD)) residing in a nursing home. All were in the stable phase of dementia, and had been admitted to the nursing home at least three months previously. None of the participants was medicated with donepezil hydrochloride.

We used video sports-games specifically devised for rehabilitation (Hot-plus, SSD Co. Ltd, Shiga Japan). These utilize psychomotor skills, such as hand-eye coordination, require timing, and necessitate fine three-dimensional control of the limbs in space. There were essentially two types of games: those working the upper limbs, and those the lower limbs. An example of the games for upper limbs required a player to grab coins which appeared to be coming out of the TV screen. The players wore bands on their hands equipped with sensors, and when the timing and direction were accurate, they scored points. Games for the lower limbs included those which required the players to move their legs to music. Two Japanese drums were shown on the TV screen, and two balls fell slowly from the top of the TV screen. A player was required to tap his/her feet on a mat equipped with sensors, synchronizing with the balls bouncing on the drums. He/she scored when the timing was accurate. These interventions were conducted once a week for ten weeks.

General cognitive function was measured using Hasegawa's Dementia Scale-revised (HDS-R), which is similar and well-correlated with the Mini-mental State Examination. The visuospatial and constructive function was measured using Kohs block-design tests (Kohs). Behavioral changes were evaluated using the Multidimensional Observation Scale for Elderly Subjects (MOSES), with the subitems of self-care, disorientation, depression, irritability, and withdrawal. No residents had previously experienced playing the video-sports games and so to help the residents enjoy the games, the caregivers (aged  $40.8 \pm 12.9$  years, 7 males and

**Table 1.** The HDS-R, Kohs and MOSES scores

SCALE	BASELINE (MEAN $\pm$ SD)	POST- INTERVENTION (MEAN $\pm$ SD)	PAIRED-T TEST ( <i>p</i> )
HDS-R	18.89 $\pm$ 4.26	25.33 $\pm$ 2.35	0.002
Kohs	20.22 $\pm$ 15.62	37.44 $\pm$ 12.44	0.02
MOSES			
Self-care	15.18 $\pm$ 4.09	15.00 $\pm$ 3.74	0.92
Disorientation	12.01 $\pm$ 2.47	10.64 $\pm$ 2.06	0.15
Depression	12.36 $\pm$ 3.08	10.46 $\pm$ 2.58	0.13
Irritability	9.46 $\pm$ 0.82	9.00 $\pm$ 0.63	0.16
Withdrawal	15.09 $\pm$ 5.13	13.55 $\pm$ 4.53	0.46
Total	64.18 $\pm$ 7.29	58.64 $\pm$ 5.16	0.054

12 females) participated in the sessions. They were taught in advance how to maintain empathetic two-way communication with the elderly participants. They were given a communication checklist of 34 items before commencement, and they kept an observation record to reinforce empathetic communication with residents.

The HDS-R scores improved from  $18.98 \pm 4.26$  (mean  $\pm$  SD) to  $25.33 \pm 2.35$  ( $p = 0.002$ , paired t-test), the Kohs test scores improved from  $20.22 \pm 15.62$  to  $37.44 \pm 12.44$  ( $p = 0.02$ ), and the total MOSES scores improved from  $64.18 \pm 7.29$  to  $58.64 \pm 5.16$  ( $p = 0.054$ ; Table 1). Regarding communication, the sociability of residents also showed an improvement as seen in the MOSES subitems relating to communication and social interaction – i.e. depression, irritability, and withdrawal. According to the caregivers' observation records, the residents' faces became expressive, especially with smiles. Caregivers' communication skills were also improved by self-assessment ( $12.92 \pm 2.07$  items in the checklists with 34 items listed before commencement of the sessions). Communication was not limited to verbal communication; the main purpose of communication was to enjoy exchanges of affection and empathy rather than to obtain information; thus, nonverbal communication was very important. With the aid of the games, a situation promoting communication could be easily created by playing doubles, watching others play, cheering each other on, etc.

Although it is not possible to prove a causal relationship between cognitive improvement and increased communication, a community-based study has shown that communication, i.e. social interaction in the broad sense, has a protective effect in preserving mental function in the elderly (Wang *et al.*, 2002). Furthermore, communication might at least help ameliorate the residents' disuse

syndrome. Disuse syndrome keeps the residents below the mental level expected based on the degree of brain pathology or brain damage. Nursing home residents tend to be passive, apathetic and dependent on caregivers. According to a survey conducted in Japan to explore the characteristics of depressive mood in different care settings, the residents in nursing homes felt more dissatisfied, apathetic and worthless, and unwilling to stay there, compared with community-dwelling residents and the hospitalized elderly (Onishi *et al.*, 2006). A depressive and apathetic tendency leads to cognitive and functional decline in AD; the results of MOSES showed some sign of improvement with regard to depressive tendencies. The cognitive decline resulting from disuse may be a reversible change, and so residents may regain their capacities.

Inter-subjectivity is a major factor in the rehabilitation for dementia; playing video-sports games in a group setting can be effective in improving the cognitive function of elderly people with dementia, especially when performed with trained caregivers who understand the principles of BAR: namely, the importance of creating enjoyment, empathetic two-way communication, using praise, and developing social roles.

### Conflict of interest

None.

### Description of authors' roles

Y. Maki and H. Yamaguchi formulated the research question, designed the study, carried it out, analyzed the data and wrote the letter. K. Takahashi was the doctor in charge of the patients.

## Acknowledgments

This research was supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Science, Sports, Culture and Technology, Japan (18650196) and a Research Grant for Longevity Sciences (21A-12) from the Ministry of Health, Labor and Welfare. The authors thank the residents and care staff of Seseragi-en nursing home, R. Shinohara and Y. Tsunoda.

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- H. YAMAGUCHI,<sup>1</sup> Y. MAKI<sup>1,2</sup> AND K. TAKAHASHI<sup>3</sup>
- <sup>1</sup> Gunma University School of Health Sciences, Maebashi, Japan
- <sup>2</sup> Department of Neurology, Geriatrics Research Institute and Hospital, Maebashi, Japan
- <sup>3</sup> Matsuida Hospital, Annaka, Japan
- Email: yamaguti@health.gunma-u.ac.jp.