CASE REPORT

A case of dementia presenting remarkable improvement in activities of daily living through KAATSU training

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Int. J. KAATSU Training Res. 2011; **7**: 13-17

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The number of patients with dementia is increasing markedly, and effective treatment and methods for prevention are needed. Moderate exercise decreases the progression of dementia. We report a case of dementia presenting remarkable improvement in activities of daily living (ADL) through KAATSU training. The patient was a 78-year-old woman with brain atrophy detected by magnetic resonance imaging (MRI) at the age of 73. She had a remarkable decrease in ADL and vitality at the age of 76 and was diagnosed with frontotemporal dementia (FTD) at the age of 77. In initial presentation, she had a humpback and Parkinsonian gait. Her muscle strength in the abdomen, lower back, and thighs was remarkably decreased, and her trunk rotation and sense of equilibrium were also reduced. At first, the training protocol was low-intensity resistance exercises using self-weight workouts and KAATSU-walk training. For upper extremities exercises, dynamic movement using the truncal muscle group was performed, and for lower extremities exercises, the sense of equilibrium was stimulated using standing exercises. The load and degree of difficulty were increased gradually. The average 10-meter walk time, the number of steps, and the average timed up and go test time were lower after 6 months than after 2 months. The average bilateral femoral circumference increased after 6 months compared with after 2 months. In conclusion, a patient with FTD performed KAATSU training for 6 months and had a remarkable improvement in motor function. Thus, KAATSU training may be effective in improving ADL in patients with dementia.

Key words: elderly people, frontotemporal dementia, KAATSU training, activities of daily living

INTRODUCTION

Approximately 24.3 million people suffer from dementia around the world, and this number is expected to double every 20 years to 81.1 million by 2040 owing to the rapid increase in the number of elderly people (Ferri et al., 2005). Senile dementia is predominantly caused by neurodegenerative diseases and cerebrovascular diseases. Alzheimer's disease (AD) is the most common neurodegenerative disease, and various symptoms occur, including memory and orientation disturbance, depression, aggressive behavior, hallucination, and delusion. Recently, early diagnosis of dementia has been encouraged, owing to the increase of older men living alone, home-nursing insurance, and the emergence of anti-dementia drugs such as Donepezil hydrochloride, a cholinesterase inhibitor. Frontotemporal dementia (FTD), characterized by progressive aphasia and curious behavior with personality change, is also a neurodegenerative dementia, and it has been gaining some attention as a differential diagnosis (Grossman et al., 2002).

It has been reported that aerobic training for elderly people without dementia may delay the onset of dementia (Larson et al., 2006). KAATSU training is performed under conditions using low-intensity and short time loading (Takarada et al., 2000a, b). It can now be applied to muscle training in healthy subjects, elderly people, and patients with various diseases (Karabulut et al., 2010; Nakajima et al., 2010; Ozaki et al., 2011).

In this report, we present a case of dementia presenting remarkable improvement in activities of daily living through KAATSU training.

CASE REPORT

The patient was a 78-year-old Japanese woman that had been diagnosed with depression at the age of 53. In her MRI findings, brain atrophy was detected at the age of 73. She had a remarkable decrease in ADL and vitality at the age of 76 and then was diagnosed with FTD when she fell down at home at the age of 77. Although the idea of a home nurse had been introduced by a local doctor, she refused to take part. However, she was later introduced to KAATSU training, and she received a check-up at this hospital. She displayed neither an even temper nor cooperativeness at that time. At initial presentation, she had a humpback and Parkinsonian gait. Her muscle strength in the abdomen, lower back, and thighs was remarkably decreased, and her trunk rotation and sense of equilibrium were also reduced.

Since she could hardly walk without assistance, several evaluations were difficult to perform. This study was approved by the ethics committee of the University of Tokyo.

METHODS

The patient performed KAATSU training one day per week. The training protocol began with low-intensity resistance exercises using self-weight workouts and KAATSU-walk training. For upper extremities exercises, dynamic movement using the truncal muscle group was performed, and for lower extremities exercises, the sense of equilibrium was stimulated using standing exercises. The load and degree of difficulty were increased gradually. Specifically, she initially performed three sets of upper extremities, chest presses, rowing, three sets of lower extremities, leg extensions, knee ups, and KAATSU-walk training (Table 1). Initially, however, she could hardly perform the training menu. In the middle of the training period (after 3 months), she performed three sets of upper extremities, chest presses, rowing, side raises, three sets of lower extremities, leg extensions, sitting leg curls, knee ups, and KAATSU-walk training. Furthermore, later on (after 5 months), she performed three sets of upper extremities, chest presses, rowing, side raises, three sets of lower extremities, squats, standing leg curls, leg extensions, and KAATSU-walk training.

RESULTS

There were no side effects during this study.

Bilateral mid-upper arm circumference increased after 6 months compared with after 4 months (Fig. 1A; right: +1.0 cm, left: +1.5 cm). Bilateral lower leg circumference also increased after 6 months compared with after 2 months (right: +1.0 cm, left: +1.0 cm). In particular, bilateral thigh circumference also increased after 6 months compared with after 2 months (right: +2.0 cm, left: +3.0 cm), suggesting enlargement of the femoral muscle group.

Shoulder range of motion increased after exercise compared with before exercise, not only as an immediate effect (Fig. 1B; right flexion: +5.7°, left flexion: +2.1°, right horizontal abduction: +4.6°, left horizontal abduction: +2.5°), but also as a long-term effect after 6 months compared with after 2 months (right flexion: +17.5°, left flexion: +15.0°, right horizontal abduction: +22.5°, left horizontal abduction: +2.5°). Posture in KATSU-walk training also improved as shown in Fig. 2.

The 10-meter walk time was lower after 6 months than after 2 months (Fig. 3A; before exercise: -18.5 sec, after exercise: -9.4 sec). The number of steps for the 10-meter walk was also lower after 6 months than after 2 months (before exercise: -24, after exercise: -14). These findings suggest improvement in walking speed. The timed up and go test time also improved after 6 months compared with after 2 months (Fig. 3B; before exercise: -16.3 sec, after exercise: -2.4 sec).

Table 1. Training menu during KAATSU training

Initial period (Before 3 Months)	Middle period (From 3 Months to 5 Months)	Late period (After 5 Months)
3 sets of upper extremities	3 sets of upper extremities	3 sets of upper extremities
chest presses	chest presses	chest presses
rowing	rowing	rowing
3 sets of lower extremities	side raises	side raises
leg extensions	3 sets of lower extremities	3 sets of lower extremities
knee ups	leg extensions	squats
KAATSU walking	sitting leg curls	standing leg curls
	knee ups	leg extensions
	KAATSU walking	KAATSU walking

Figure 1A

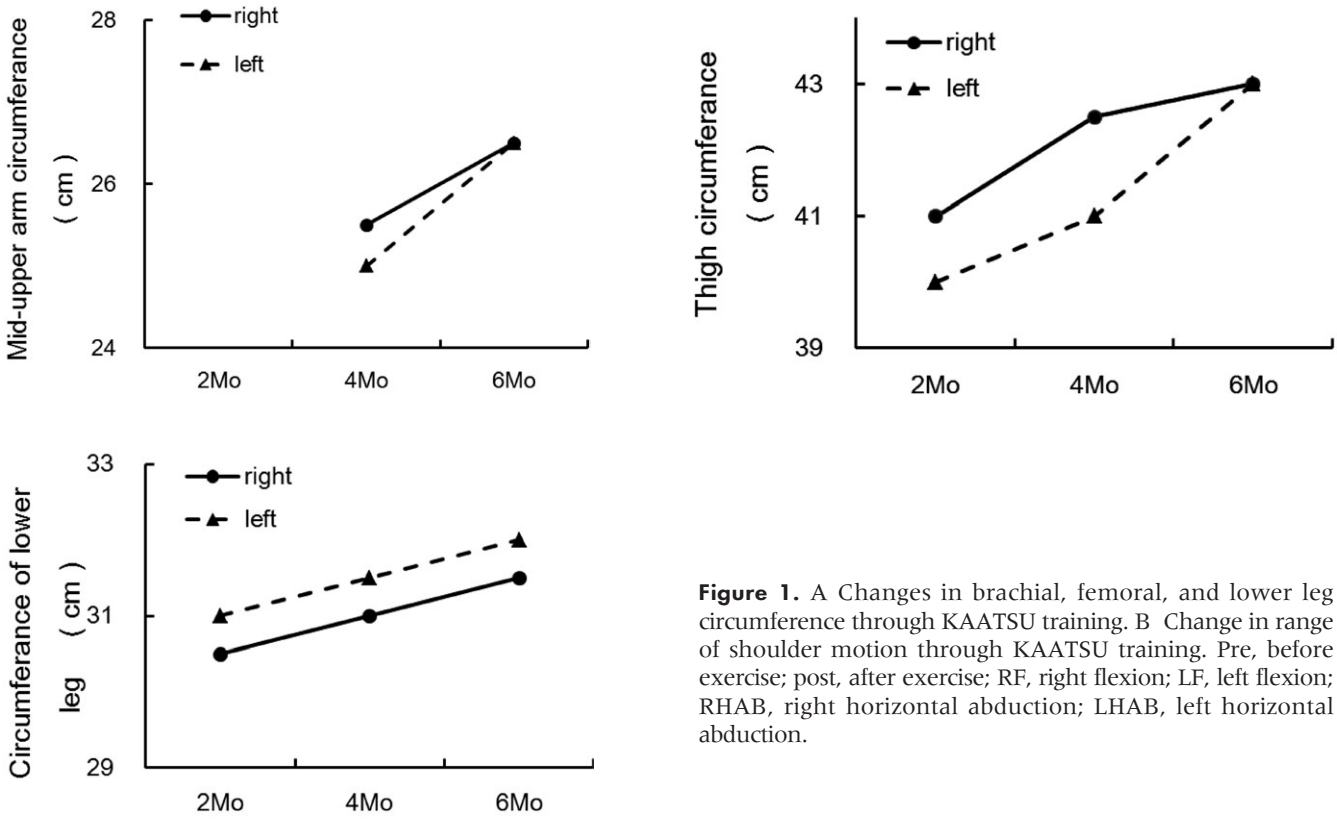
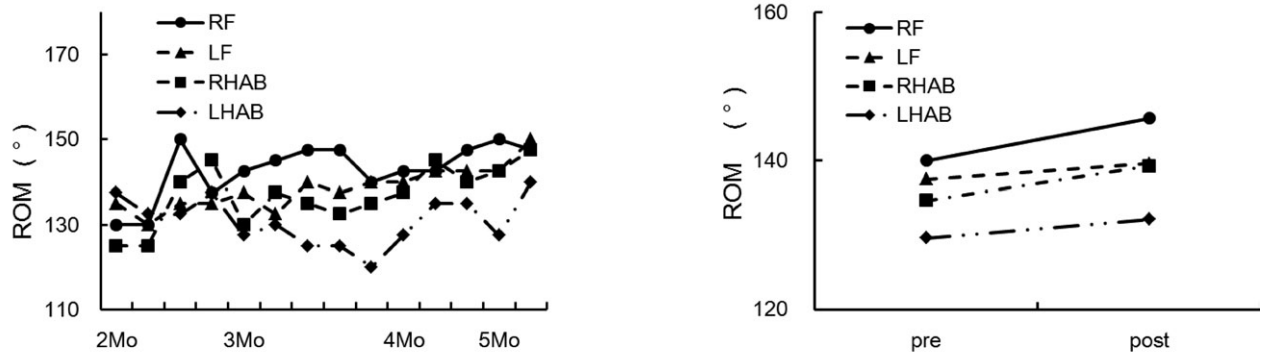


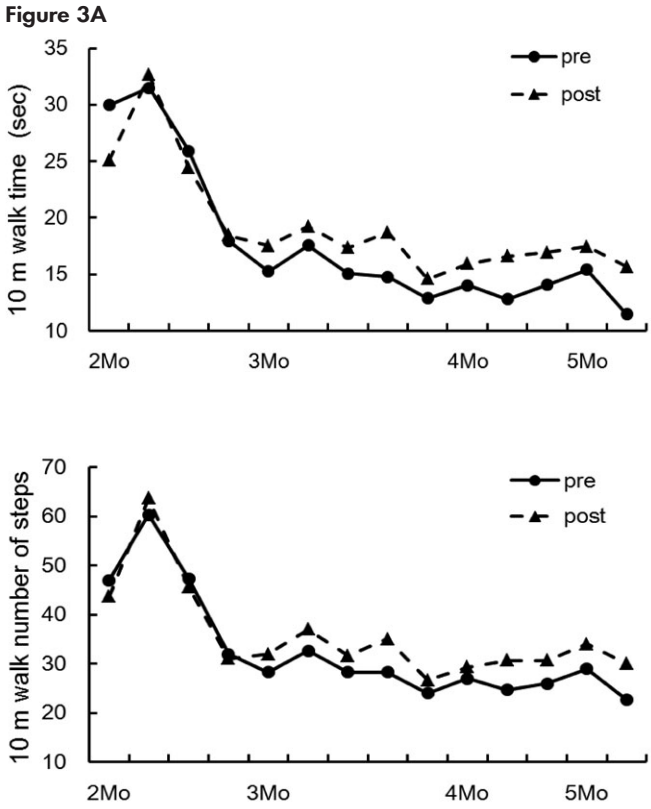
Figure 1. A Changes in brachial, femoral, and lower leg circumference through KAATSU training. B Change in range of shoulder motion through KAATSU training. Pre, before exercise; post, after exercise; RF, right flexion; LF, left flexion; RHAB, right horizontal abduction; LHAB, left horizontal abduction.

Figure 1B



2 Mo 6 Mo

Figure 2. Change of posture in KAATSU-walk through KAATSU training.



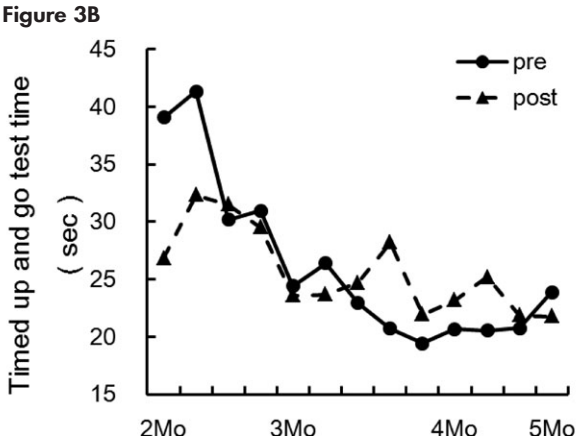


Figure 3. A Changes in 10-meter walk time and number of steps through KAATSU training. B Change in timed up and go test time through KAATSU training. Pre, before exercise; post, after exercise.

DISCUSSION

KAATSU training is a novel form of strength training which not only affects the endocrine system, including growth hormone secretion, but also stimulates many muscle fibers and brings about muscle hypertrophy and muscle power enhancement (Takarada et al., 2000a, b). It also has pleiotropic effects including the improvement of obesity and an effect on bones. It can also be applied to muscle training in healthy subjects, elderly people, and patients with various diseases (Karabulut et al., 2010; Nakajima et al., 2010; Ozaki et al., 2011). Furthermore, we have performed KAATSU training on a total of 2,000 patients mainly with cardiovascular diseases, and serious adverse side effects have not been observed. Thus, KAATSU training is safe under a director familiar with appropriate methods (Nakajima et al., 2006). In this paper, we reported for the first time that an elderly patient with dementia, who had muscle atrophy and decreased quality of life, had a remarkable improvement in quality of life through KAATSU training.

Regular exercise has been reported to delay the onset of dementia in a prospective cohort study (Larson et al., 2006). In this study, moderate exercise induced an approximately 40% decrease in the risk of dementia. They conducted a follow-up survey on 1,750 subjects (aged 65 years and older) without cognitive disturbance over a period of 6 years, and the subjects declared their exercise patterns, including walking, hiking, aerobics, setting-up exercises, swimming, water aerobics, weight training, and stretching every 2 years. A total of 158 of the 1740 subjects developed dementia during 6.2 ± 2.0 years. Of this number, 107 subjects were diagnosed with AD. The incidence rate of dementia was 13.0/1,000 person-year [hazard ratio 0.62 (p=0.004, 95% confidential interval 0.44-0.86)] in subjects who performed exercise three times or more every week, whereas it was 19.7/1,000 person-year in those that exercised less than three times every week. Furthermore, the decrease in risk associated with exercise was greater in subjects with a poor performance level than those with a maintained performance level.

Regular exercise also improves cognitive function in patients with dementia. The basic mechanisms remain unclear, but brain-derived neurotrophic factor (BDNF) may be involved. BDNF, which is produced mostly in the cerebral cortex and hippocampus, is known to play an essential part in the life, growth, and maintenance of neurons and is strongly related to study, memory, and cognitive function (Zigova et al., 1998; Lee and Son, 2009). In the hippocampus of patients with AD, a decrease in BDNF has been reported (Pedersen et al., 2009). Recent studies showed that BDNF plays an important role in the beneficial effects of exercise training on dementia (Ding et al., 2006; Griesbach et al., 2004; Kim et al., 2010; Vaynman et al., 2003, 2004). It remains unexamined whether KAATSU training can enhance BDNF secretion. However, there is a possibility that

KAATSU training may improve cognitive function via BDNF. In addition, we measured cerebral blood flow in healthy subjects using near-infrared spectroscopy and compared KAATSU training to low-intensity training without KAATSU. In this study, cerebral blood flow increased significantly in the KAATSU training group, suggesting favorable influence on the cerebral center (Morita et al., 2010). From these observations, it is likely that KAATSU training may improve cognitive function and delay the onset of dementia by promoting BDNF secretion and improving cerebral blood flow. However, further studies are needed to clarify this possibility.

The pleiotropic effect and safety of KAATSU training has been established. However, how KAATSU training is provided for elderly people and patients with dementia is important, since they often find it difficult to continue performing training in terms of understanding instructions and their ability to concentrate. In an NIH Consensus Statement (NIH Consensus Development Panel on Physical Activity and Cardiovascular Health, 1996), tips on continuing exercise training included being conscious of the effects of exercise training, performing pleasant exercise activities, satisfying exercises, and recognizing the safety of exercise. In these points, KAATSU training, a man-to-man training program involving communication with a partner, appears to be a very suitable and effective method.

In conclusion, a patient with FTD who performed KAATSU training one day per week over 6 months had increased extremity circumference, increased range of shoulder motion, improved static and dynamic position, and improved 10-meter walk and timed up and go tests, resulting in the improvement of ADL. In addition, KAATSU training appears to be a useful method for improving ADL and cognitive function in patients with dementia.

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