

Effect of KAATSU training on a patient with benign fasciculation syndrome

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[Objective]

Benign fasciculation syndrome (BFS) is a neurological disorder characterized by involuntary and repeated contractions of synergetic muscles and commonly occurs in the eyelids, arms and legs. BFS is also associated with pain, which may interfere with everyday activities. This report describes the case of a BFS patient who performed KAATSU exercise, a type of exercises performed under the conditions of restricting muscle blood flow.

[Methods]

The patient performed KAATSU exercise of the bilateral upper and lower extremities at a frequency of twice a week for 3 months. Knee extensor strength as measured with a hand-held dynamometer (HHD), QOL scores as assessed by the SF-36v2 questionnaire form, and bilateral femoral muscle mass as measured by MRI were compared before and after exercise.

[Results]

After a 3-month KAATSU exercise program, the right and left knee extensor strength as measured with a HHD increased by about 26% from 30.9 to 38.8 kgf and by about 44% from 39.9 to 57.4 kgf, respectively, and the bilateral femoral muscle mass as measured by MRI increased by about 23% from 8,730 to 10,709 cc. Overall improvement in QOL was also observed, as assessed by the SF-36v2 questionnaire form.

[Conclusion]

For patients with neurological disorders with pain, such as the present patient, active introduction of KAATSU-based exercise is likely to result in improved health-related QOL, as well as increased muscle mass and strength.

Key words: Benign Fasciculation Syndrome, KAATSU training, exercise therapy

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INTRODUCTION

Fasciculation can be seen in healthy people, especially after high-intensity exercise, but is also observed in patients with severe neuromuscular diseases, such as amyotrophic lateral sclerosis (ALS), and thus should be considered in differential diagnosis. Benign fasciculation syndrome (BFS) is a benign disease characterized by fasciculation as a prominent symptom, such as pain, anxiety, fatigability, and paresthesia, and often lasts for several months to years (Fettel et al., 1982). Major causes of BFS include severe stress and anxiety. For treatment, exercise therapy may be performed, but no effective rehabilitation program has been established. KAATSU exercise, a novel, attention-drawing method of low-intensity resistance exercise performed under the condition of restricting muscle blood flow (Takarada et al., 2000b; Abe et al., 2006; Karabulut et al., 2007; Wernbom et al., 2008), causes minimal strain on the musculoskeletal and cardiovascular systems compared to high-intensity resistance exercise and thus is increasingly applied to rehabilitation programs for patients with various disorders. Meanwhile, its effect on BFS patients has

yet to be examined.

This report describes the case of a BFS patient in which KAATSU exercise exerted beneficial effects on the muscles, pain, and quality of life (QOL) of the patient.

Patient

Patient: a 44-year-old man

Diagnosis: benign fasciculation syndrome

Comorbidity: none

Previous medical history: none

Chief complaint: systemic fasciculation, pain

History of present illness: The patient noted fasciculation of the right upper and lower extremities in May 2010. The symptom worsened thereafter and he started using a wheelchair in mid-August. The symptom continued to worsen gradually until a reduction in pain was noted around March 2011 and the patient became able to walk 500-600 m on a flat road without resting. With the expectation for further improvement of symptoms, the patient experienced an introductory session of KAATSU exercise at another hospital in

Table 1. Upper extremity exercise program

Exercise menu	Month	6		7			8			9	
Triple sets		•	•	•	•	•	•	•	•	•	•
Rowing			•				•	•	•	•	•
Side raises			•								
Depressurization						•					

Table 2. Lower extremity exercise program

Exercise menu	Month	6		7			8			9	
Triple set		•	•	•	•	•	•	•	•	•	•
Leg extensions			•	•	•	•	•	•	•	•	•
Leg curls			•	•	•	•	•	•	•	•	•
Squats		•									
Step-up exercises			•	•	•						
Ladder						•					

early May 2011, followed by the initiation of a KAATSU exercise program at our hospital in June 2011.

MATERIALS AND METHODS

This study was approved by the ethics committee of the University of Tokyo. The patient was informed of the methods, procedures and risks, and signed an informed consent document before participation.

Frequency of exercise: 2 sessions of 30 minutes of KAATSU exercise of the upper and lower extremities each week (for 3 months)

Upper extremity exercise program: The KAATSU belt was set at 40-50/140-210 mmHg, exercise menu consisting of triple sets, rowing, side raises, and depressurization (Table 1)

Lower extremity exercise program: The KAATSU belt was set at 40-50/270-400 mmHg, Exercise menu consisting of leg extensions, leg curls, and step-up exercises (Table 2)

RESULTS

Through the 3-month KAATSU exercise program, bilateral thigh muscle volume enhanced by about 23% (0.26%/day) from 8,730 to 10,709 cc (Fig. 1) and right and left knee extensor strength enhanced by about 26% (0.29%/day) from 30.9 to 39.9 kgf and by about 44% (0.49%/day) from 38.8 to 57.4 kgf, respectively (Fig. 2).

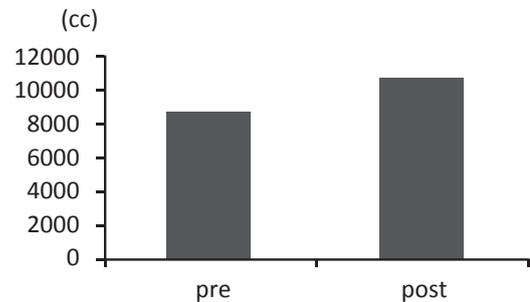


Figure 1. Change in femoral muscle volume before and after KAATSU exercise

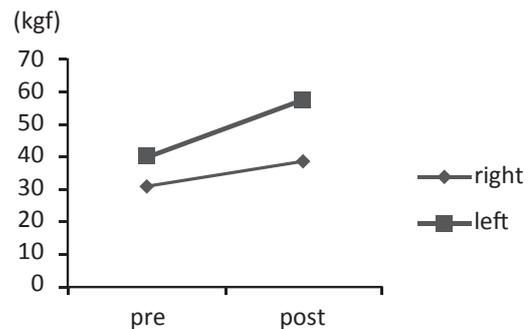


Figure 2. Change in bilateral knee extensor strength before and after KAATSU exercise

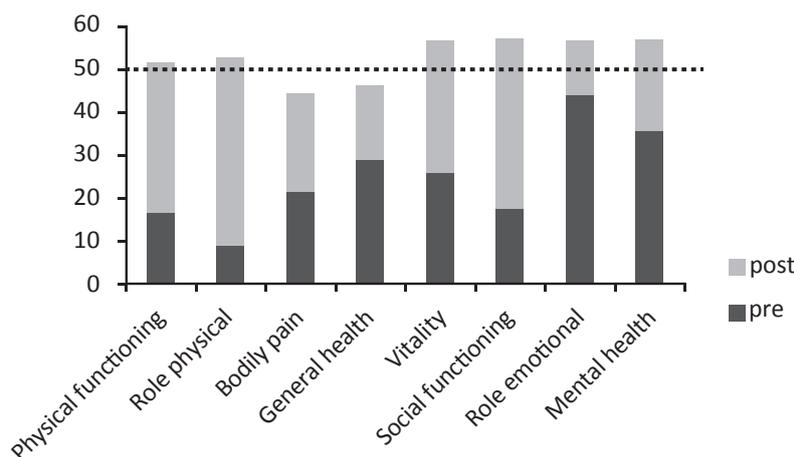


Figure 3. Results of SF-36v2 questionnaire before and after KAATSU exercise

The results of the questionnaire survey using SF-36v2, a measure of health-related QOL, showed improvements in all 8 domains, including physical functioning, role functioning-physical, bodily pain, general sense of well-being, vitality, social functioning, role functioning-emotional and mental health (Fig. 3).

DISCUSSION

We experienced the case of a patient with benign fasciculation syndrome (BFS) in which low-intensity resistance exercise (KAATSU) resulted in a significant enhancement in muscle strength and myopachynsis, as well as improved QOL, including reduced pain, as assessed by a questionnaire survey. These findings suggest the usefulness of low-intensity KAATSU exercise for BFS patients.

Several studies have evaluated the effect of high-intensity resistance exercise on the muscle strength of healthy subjects and patients with various disorders. Hakkinen et al.(2000) applied a 6-month high-intensity knee extension resistance exercise program to middle-aged and elderly subjects and reported 28% and 21% enhancements in maximum muscle strength, respectively. Brochu et al.(2000) also applied a 6-month high-intensity resistance exercise program to an elderly female patient with ischemic heart disease and observed 18% and 23% enhancements in the muscle strength of the upper and lower extremities, respectively. The present patient exhibited 26% and 44% enhancements in right and left knee extension strength, respectively, after a 3-month exercise program. These values were higher than those reported by Hakkinen et al.(2000) or Brochu et al.(2002) and comparable to those reported from studies that applied KAATSU exercise to healthy subjects or athletes (Karabulut et al., 2007; Wernbom et al., 2008). These studies include one reported by Wernbom et al.(2008), which reviewed the effects of high-intensity lower

extremity resistance exercise and low-intensity lower extremity resistance exercise with KAATSU on quadriceps femoris myopachynsis of healthy subjects. A high-intensity exercise program performed 2-3 times/week (3-4 sessions, each consisting of 6-10 repetitions at a 60-120-second interval) resulted in a 3-21% enhancement in muscle mass in 3 months while a low-intensity KAATSU resistance exercise (3-4 sessions, each consisting of 15-30 repetitions at a 30-60-second interval) resulted in a 3.6-19.8% enhancement in muscle mass in the same period. This result demonstrates that low-intensity KAATSU resistance exercise results in a comparable degree of myopachynsis to that achieved by high-intensity resistance exercise. The present patient exhibited a significant enhancement in the cross-sectional area (CSA) of the quadriceps femoris muscle. The CSAs of the biceps femoris and adductor muscles also enhanced after KAATSU exercise. These observations suggest that low-intensity KAATSU exercise is beneficial for BFS patients, as it can induce enhanced muscle strength as well as myopachynsis in these patients.

BFS is a benign disease characterized by fasciculation as a prominent symptom, but is also accompanied by other symptoms, such as pain, anxiety, fatigability, and paresthesia, and often lasts for several months to years (Fettel et al., 1982). Major causes include strong stress and anxiety. Exercise therapy may be performed for treatment, but no effective rehabilitation program has been established. Differential diagnoses include amyotrophic lateral sclerosis (ALS), a serious neuromuscular disorder. Decreased exercise tolerance is also observed as a symptom. In the present case of a BFS patient, low-intensity KAATSU resistance exercise also resulted in improved QOL, as assessed by the SF-36 questionnaire form. Conventional exercise methods have been shown to induce minimal improvement in SF-36-based QOL in elderly subjects (Chou et al., 2012). In contrast, KAATSU exercise is performed

under the conditions of low-intensity strain and stress, which might have led to improved QOL. It is also possible that the exercise program reduced stress, a precipitating factor of BFS, and thereby improved fasciculation.

Exercise is the most effective therapy for sarcopenia and also greatly contributes to improve QOL of patients through such effects as preventing lifestyle-related diseases and delaying the onset of dementia. Aging has often been associated with hyposecretion of growth hormone (GH), and GH hyposecretion has been associated with muscle atrophy and depressive symptoms, thereby affecting patients' QOL (Hull and Harvey, 2003). Although it is unclear how KAATSU exercise induces enhanced muscle strength and the mechanism of myopachynsis, it has been shown that a significant increase in GH level is observed immediately after KAATSU exercise (Takarada et al., 2000a; Takano et al., 2005; Abe et al., 2006). This observation indicates the possible involvement of increased GH level in the mechanism of myopachynsis in BFS patients. It is also possible that increased GH level might have led to improved depressive symptoms and subsequent improvement in QOL, although GH level was not measured in the present case. Future studies should examine whether GH has a role in the improvement of QOL.

In conclusion, KAATSU exercise was safely performed on a patient with BFS and improved muscle strength, muscle volume, and health-related QOL, including reduced pain, as assessed by the SF-36v2 questionnaire form. For patients with neurological disorders with pain, such as the present patient, active introduction of KAATSU-based exercise is likely to result in improved health-related QOL, as well as enhanced muscle mass and strength.

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