

Kaatsu training for patella tendinitis patient

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Low-intensity Kaatsu resistance training performed by patients with moderate vascular occlusion is known to cause skeletal muscle hypertrophy over a short term. In our patients who used such training as a part of their rehabilitation, we have seen the same results, as well as a quenching analgesic effect. Herein, we report the effect of Kaatsu resistance training in a patient with patella tendinitis. The patient was a 17-year-old male who played basketball and came to us with intense pain at the lower edge of the patella in the right knee and was confirmed by an MRI image which showed a high intensity signal in the area of the patella tendon. Initially, we gave a dose of antiphlogistic analgetic, a steroid injection, and prescribed hospitalization for 1 month. Kaatsu resistance training was also recommended in an attempt to prevent muscle atrophy. The vascular occlusion point for the Kaatsu training cuff was the proximal end of the right limb, which had an occlusion pressure ranging from 160-180 mmHg. The exercise components that were used in combination with the Kaatsu training program were SLR, hip abduction, hip adduction, calf raise, toe raise, squat, crunch, back extension, and shooting. The exercise protocol was performed at about 30% of 1RM, with 3 sets of 15 repetitions, 5 to 6 times per week, for 3 weeks. T2 weighted MRI images (axial and sagittal) of the right patella tendon prior to beginning Kaatsu training showed high intensity signals, however, after 3 weeks of Kaatsu training, the signal intensity was reduced and the thigh circumference was increased by 7 mm and 2 mm for the right and left sides, respectively. Further, there was no evidence of muscle atrophy. The present patient was then treated with appropriate anti-inflammatory drugs and 1-month of hospitalization. During that time it was possible to completely relieve the inflammation and avoid muscle atrophy with Kaatsu training, and the patient quickly returned to playing basketball. In conclusion, this low-intensity resistance training was able to be performed without applying excessive load, which may have caused further damage, and we intend to use Kaatsu training with future patients to help them return as early as possible to full activities.

Key words: rehabilitation, prevent muscle atrophy, low-intensity Kaatsu resistance training, basketball

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INTRODUCTION

A method of low-intensity resistance training for patients with moderate vascular occlusion was established 1983 by Yoshiaki Sato of Japan and termed Kaatsu resistance training, after which it received patents in Japan, the United States, England, Germany, France, and Italy. During the performance of Kaatsu resistance training, blood flow in the proximal ends of the legs or arms is limited by placement of a pressurized cuff or belt. In our hospital, this training method has been often utilized as part of the rehabilitation process since 1997, since it is able to achieve skeletal muscle hypertrophy in a short time. Takarada et al. (2000a) showed that low-intensity resistance exercise performed by older female patients with vascular occlusion induced muscular hypertrophy and a concomitant increase in strength in the elbow flexor muscles, even when the intensity of the exercise was much lower than expected to induce muscular hypertrophy.

The mechanisms underlying the effects of such externally applied occlusive stimuli have been proposed to include: the additional recruitment of

fast-twitch fibers in a hypoxic condition (Takarada et al., 2000a); moderate production of reactive oxygen species (ROS) promoting tissue growth (Rao and Berk, 1992; Suh et al., 1999; Suzuki and Ford, 1999); and a stimulated secretion of catecholamines and growth hormone (Takarada et al., 2000b). Interestingly, it has been shown that growth hormone levels in blood were 290-fold higher at 15 minutes after exercise training than during rest (Takarada et al., 2000b). In addition, Fujino et al. (2000) showed that Kaatsu training decreased muscle atrophy in the early phase following anterior cruciate ligament reconstruction and tended to accelerate the recovery from muscle atrophy.

Many athletes come to our hospital following a sports related injury, including patella tendonitis, that is often referred to as jumper's knee, which is a relatively common overuse injury experienced by basketball, volleyball, distance running, long jumping, mountain climbing, figure skating, and tennis participants (Klucinec, 2001; Ferretti et al., 1983). Common symptoms related to this condition include pain, aching and swelling at the inferior pole of the

patella, weakness around the knee, and various degrees of quadriceps atrophy (Klucinec, 2001). Most athletes with patella tendonitis do not initially agree to nonoperative treatment and continue to train with the pain, however, by continuing to overuse the patella tendon, the pain can become chronic and recalcitrant in nature. If it becomes severe, pain can adversely affect both training and performance. This difficult problem can be very frustrating to both the athlete and treating physician (James et al., 1997).

Our experience has shown that the effects of Kaatsu training are useful for both the prevention of muscle atrophy and for increasing performance ability, following both surgical and nonoperative treatment methods.

PATIENT

The patient was a 17-year-old male who played basketball and complained of chronic pain in the knee, though he continued to play without treatment for a long period. At first, the pain was only evident following basketball activity, however, by the time he came to us, the pain was continuous during and after such activity, and was prolonged, with symptoms worsening each day and more pronounced in the right knee. Further, walking and using the stairs were becoming more difficult. The right knee was scanned using magnetic resonance imaging (MRI), which demonstrated a high intensity signal on T2 weighted coronal images (Figure 1).

TREATMENT PLAN

As initial treatment, a dose of antiphlogistic analgesic and a steroid injection was given into the right knee and 1 month of hospitalization was prescribed. We expected that more than 1 month of inactivity would be required before the patient could

return to playing basketball, however, time was critical since he was an important member of the team and many important games were scheduled. However, in an attempt to speed up the recovery period, Kaatsu training was also prescribed in order to prevent muscle atrophy of the right quadriceps and the resultant decrease in performance ability.

KAATSU TRAINING

Vascular occlusion with Kaatsu was initiated, prior to beginning the exercises, at the most proximal point of the right limb, with an occlusion pressure between 160-180 mmHg. The exercise components that were used in combination with the Kaatsu training program were SLR, hip abduction, hip adduction, calf raise, toe raise, squat, crunch, back extension, and shooting. The exercise protocol was performed at about 30% of 1RM, with 3 sets of 15 repetitions, 5 to 6 times per week, for 3 weeks.

Table 1. Changes in physiological characteristics.

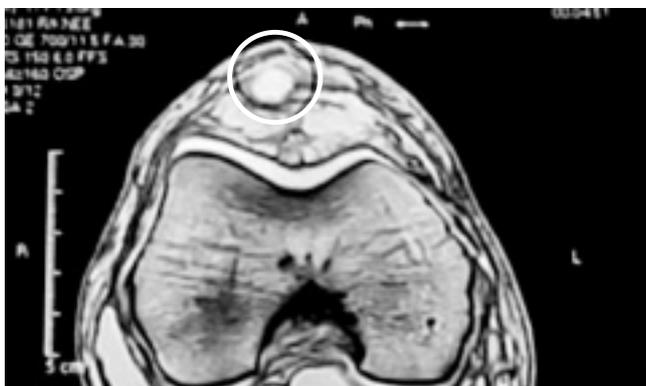
	Before training	2 Weeks	3 Weeks
Height (cm)	183.0	-	-
Weight (kg)	70.8	70.5	70.3
% Fat (%)	14.3	13.3	14.0
COL-R (cm)	35.1	35.3	35.0
COL-L (cm)	35.0	35.5	35.5
COT10-R (cm)	46.0	46.7	46.7
COT10-L (cm)	46.5	46.7	46.7
COT15-R (cm)	50.0	50.7	50.7
COT15-L (cm)	50.5	50.7	50.7

COL: Circumference of lower leg

COT: Circumference of thigh (COT-10: 10cm from patella, COT-15: 15cm from patella)

R: right leg L: left leg

There was no evidence of muscle atrophy after 3 weeks.



(a)



(b)

Figure 1. MRI T2 weighted images of right knee obtained prior to hospitalization.

(a) Axial slice, (b) Sagittal slice.

A high intensity signal (circled) is seen in the area of the patella tendon.

RESULTS

Table 1 shows the changes in the physiological characteristics of the patient over a 3 week period. Circumference of the lower leg (COL) was 35.1 cm and 35.0 cm, for the right and left sides, respectively, before Kaatsu training, 35.3 cm and 35.5 cm, respectively, after 2 weeks, and 35.0 cm and 35.5 cm, respectively, after 3 weeks. The circumference of the thigh was also measured at 10 cm (COT-10) and 15 cm (COT-15) from the patella. COT-10 was 46.0 cm and 46.5 cm for the right and left sides, respectively, before Kaatsu training, 46.7 cm and 46.7 cm respectively, after 2 weeks, and 46.7 cm and 46.7 cm respectively, after 3 weeks, while COT-15 was 50.0 cm and 50.5 cm, respectively, before Kaatsu training, 50.7 cm and 50.7 cm, respectively, after 2 weeks, and 50.7 cm and 50.7 cm, respectively, after 3 weeks. Therefore COT-10 increased by 7 mm and 2 mm on the right and left sides, respectively, and COT-15 increased 7 mm and 2 mm, respectively, after 3 weeks of Kaatsu training. There was no evidence of muscle atrophy. Figure 1 shows T2 weighted MRI images (axial and sagittal) of the right patella tendon prior to beginning Kaatsu training, with high intensity signals circled. After the 3 weeks of training, the intensity was significantly lower (Figure 2).

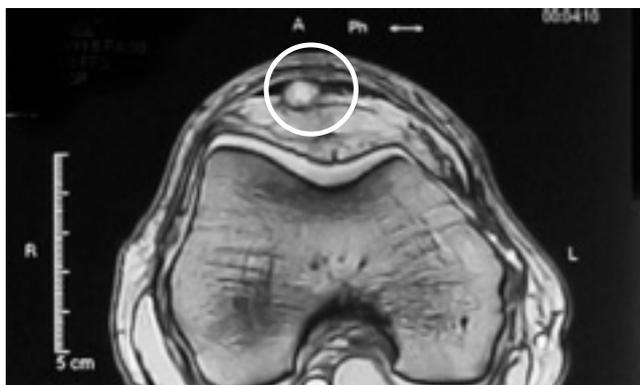
Pain and swelling in the affected knee were decreased 1 week after beginning Kaatsu training, and the patient was able to jog without pain. The next week, he began basketball training with running shots and jump shots, though he required ice on the knee afterwards, because of pain that appeared following shooting practice. Although pain in the knee after training continued, the patient was able to leave our hospital 1 week earlier than originally planned. At that time, we provided a supporter to

attach to the knee when playing basketball and instructed him to cool down carefully after playing. Two weeks after leaving the hospital, he was able to participate in a game.

DISCUSSION

Klucinec (2001) noted that treatment for patella tendinitis can be a very tedious process for the patient, as well as athletic trainers and physical therapists. He also stressed that even though prevention and education are important components, athletes, in their desire to compete, often play through the pain and refrain from alerting a health care professional to their symptoms. Further, in the case of patella tendinitis, the initial symptoms tend to get worse if they are overlooked or the patient is not compliant with treatment. The present patient had a strong desire to compete and, as a result of continuing to play basketball while ignoring the pain, the condition worsened. When he finally came to our hospital, the symptoms were serious and medical treatment was expected to be difficult.

Patella tendonitis improves in many cases by stopping training and rest, however, many athletes are not able to comply for fear of losing a chance to appear in a game and the possibility of muscle atrophy and the resulting decrease in performance. We have found that Kaatsu training is a good answer for these concerns. The chief characteristic of Kaatsu training is that quickly leads to muscle hypertrophy, even when the intensity of the exercise is much lower than expected to induce muscular hypertrophy (Takarada et al., 2000a). In addition, Fujino et al. (2000) showed that such training prevented muscle atrophy following surgery to reconstruct the anterior cruciate ligament. It appears as though Kaatsu



(a)



(b)

Figure 2. MRI T2 weighted images of the right knee obtained following Kaatsu training.

(a) Axial slice, (b) sagittal slice.

The signal from the patella tendon area (circled) has a lower intensity As compared to before training.

training is useful for the prevention of muscle atrophy and performance ability, following either surgical or nonoperative treatment methods.

In this case, we chose nonoperative treatment for this patient and recommended Kaatsu training to prevent muscle atrophy during the rest period. As a result, COT-10 and COT-15 on the right side both increased by 7 mm after 3 weeks of training, with no evidence of quadriceps muscle atrophy. We attributed these positive results to the effects of the Kaatsu method. Additionally, the pain and swelling in the affected knee were noticeably decreased 1 week after beginning Kaatsu training, and the patient was able to jog without pain. We have seen the same effects in others, though we have not determined which type of patient can benefit the most from this training but we are continuing to examine the usefulness of Kaatsu training in a variety of patients. In conclusion, it appears as though Kaatsu training is useful for the treatment of patella tendonitis and we will continue to recommend it in appropriate situations.

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