

CASE REPORT

KAATSU resistance training decreased the sinus pause in a patient demonstrating sick sinus syndrome. A case report

I. Satoh

Int. J. KAATSU Training Res. 2006; 2: 53-56

The effectiveness of KAATSU resistance training (Kaatsu) has been established as a method not only to increase muscle size and power but also to benefit patients with orthopedic and cardiac diseases. The method is a low-intensity resistance exercise (20~30% of one repetition maximum, 1RM) with a restriction of the venous return using a specially designed pressurized cuff or belt at the proximal end of the upper or lower extremities. The increases of growth hormone (GH) and insulin-like growth factor-1 (IGF-1) by Kaatsu resistance training are considered to play an important role in elucidating the mechanism of Kaatsu. In this case, the sinus pause of a patient with sick sinus syndrome (SSS) decreased to approximately 40% with Holter ECG monitoring after Kaatsu resistance training. The mechanism regarding such an improvement by Kaatsu is herein discussed. Therefore, an additional effect of Kaatsu is reported concerning the decreased sinus pause observed in a SSS patient.

Key words: holter ECG, Kaatsu resistance training, sick sinus syndrome, sinus pause, vagal hypertonus.

Correspondence to:
I. Satoh, MD, Satoh Heart
Clinic, 6-2 Sakeda, Ube,
Yamaguchi 755-0054, Japan
isatoh@gb-3.so-net.ne.jp

See end of article for
author affiliation

CASE REPORT

An eighty-four-year-old female consulted with my clinic asking for a second opinion about the need for her to receive a cardiac pacemaker implant. One year previously, she fell unconscious, while taking care of her husband who had been hospitalized for acute myocardial infarction. She was diagnosed as sick sinus syndrome (SSS) at the same hospital and was advised to have a cardiac pacemaker implanted. However, she declined the doctors' recommendation at that time because her husband was in critical condition. One month later, her husband died and she became quite exhausted after holding the funeral and a series of Buddhist memorial services all by herself. Since then, she had complained of easy fatigability, a sense of heaviness in the chest and stiffness of her shoulders.

PRESENT CONDITION

The patient's condition was as follows: 140 cm in height, 47 kg in body weight, 48 per minute in pulse rate with arrhythmia and pause (longer than 2 seconds), 140/70 mmHg in blood pressure. Neither anemia nor pitting edema was observed. In addition no heart murmur was audible, but her heart rate was slow and irregular.

PHYSICAL EXAMINATION

Her examination findings revealed as follows. Chest X-ray showed slight cardiomegaly with a 54%

cardiothoracic ratio. ECG showed sinus arrhythmia with a sinus pause (2.3 sec). Holter ECG (FUKUDA DENSHI SCM-5000) showed 1426 pauses/day, of which 90% occurred in the middle of the night. The maximum pause was 3.3 seconds (Fig.1). Bradycardia (less than 40 beats per minute) was observed in 74 times/day, and her average heart rate was 61 beats/min.

CLINICAL CAUSE

Because a longest pause of 3.3 seconds is considered to be too short to have a cardiac pacemaker implanted, she was administered ALOTEC (Orciprenaline Sulate) 10 mg, 2 tablets a day after breakfast and before sleep. Thereafter, her symptoms slightly improved, but her heavy sense in the chest remained. At six months after the administration of ALOTEC, the pause decreased to 653 pauses/day from 1426/day at the first medical examination. Thereafter, she underwent the first Kaatsu to alleviate the stiffness of her shoulders on the recommendation of her friend, and her backache had improved after this treatment and the pause decreased to 400 pauses/day one week after the first Kaatsu as shown in Fig.2. The method of Kaatsu resistance training is shown in the Table 1. The heavy sense of the chest disappeared six minutes after beginning the first Kaatsu and the effect lasted one and a half days. This drastic improvement led us to investigate the possibility that such Kaatsu may have a potentially



Figure 1. The pause (3.3seconds) recorded by Holter ECG. It showed 1426 pauses a day, of which 90% occurred in the middle of the night. (HA, 84 yrs, female, 04/11/25)

Table 1. Kaatsu Resistance Training

Site;	the proximal end of the bilateral arm
Device;	Kaatsu Master
Setting Pressure;	120mmHg
Intensity of Exercise;	approximately 20% of 1RM
Procedures;	30 repetitions for each of the following: (1) clenching and opening the fingers and toes, (2) arm curls with the toes raised, and (3) pushing the arms down with the heels raised
Exercise Time;	9 minutes in total
Recording;	Holter Electrocardiogram

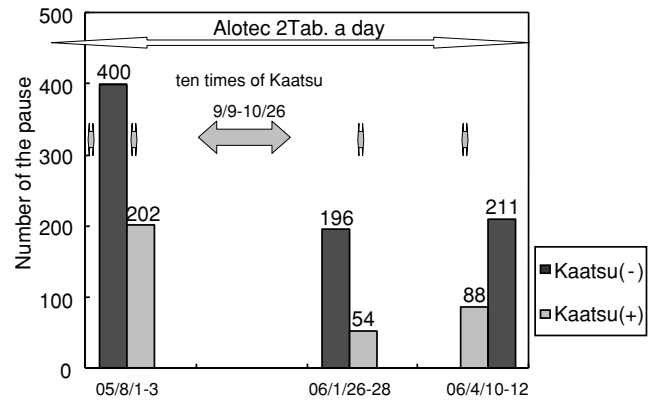


Figure 2. The effect of Kaatsu on the sinus pause. Note the marked decrease of the pause by Kaatsu in each measurement.

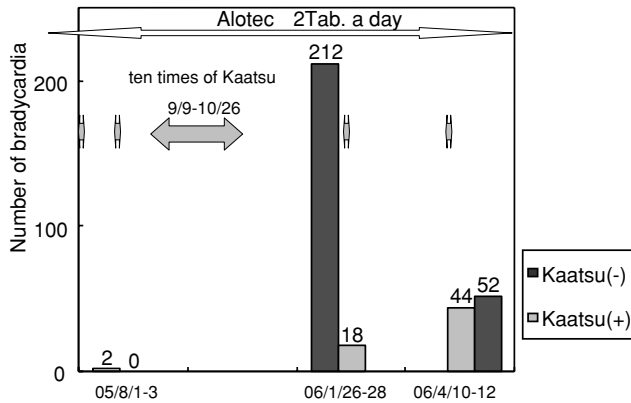


Figure 3. The effect of Kaatsu on bradycardia. Changes in bradycardia were similar to those in the pause.

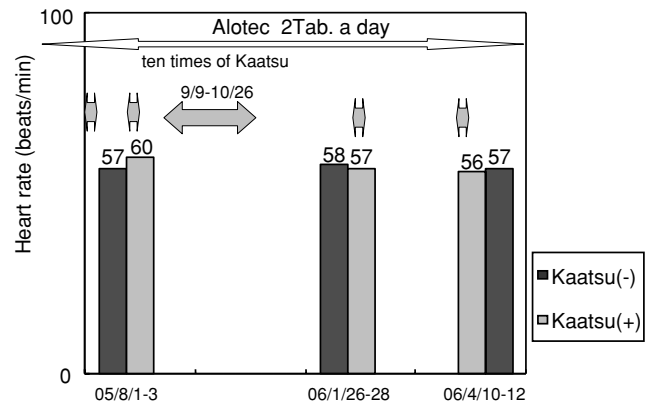


Figure 4. The effect of Kaatsu on the average heart rate per day. The average heart rate did not change by Kaatsu.

positive effect on reducing sinus pause. To investigate this effect, the pause, bradycardia, and average heart rate were measured with Holter ECG before and after Kaatsu for consecutive 48 hours. One week after the first Kaatsu, the first measurement of Holter ECG after undergoing Kaatsu was made. The result of the first measurement of the pause, bradycardia, and heart rate with Kaatsu are shown in Fig.2-4. The pause decreased markedly by Kaatsu to 202

pauses/day from 400/day (Fig.2), bradycardia disappeared to 0/day from 2/day (Fig.3), and average heart rate increased slightly to 60/min.from 57/min. (Fig.4), suggesting the vagal hypertonus is softened and the sympathetic nerve is slightly activated.

Since her complaints dramatically improved after this training, she thereafter underwent Kaatsu once or twice a week for two months (ten times in total), but she cancelled the thirteenth Kaatsu session due to

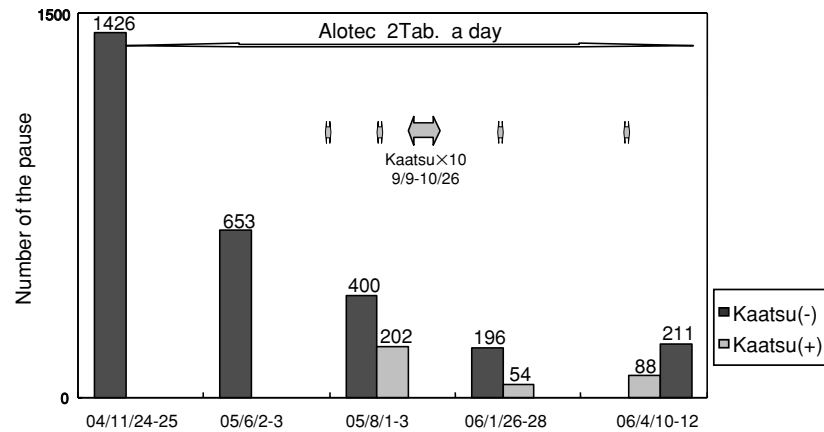


Figure 5. Changes in the pause by Alotec and Kaatsu. The pause decreased to 653 from 1426 at an initial medical examination by administration of Alotec 6 months later. Furthermore, it decreased to 400 by Kaatsu one week later.

a complete recovery of the symptoms based on her own judgment. At three months after the discontinuation of Kaatsu, she was still in good condition, and a second measurement was done. The results were as follows. The pause decreased to 54/day from 196/day, bradycardia to 18/day from 212/day. On the other hand, the average heart rate decreased to 57/min from 58/min. The result of second measurement shows almost same improvement in the decreased pause and bradycardia as the first measurement, however, the average heart rate did not increase. A third measurement was made three months after the second one. The patient had been in doing well for 6 months without Kaatsu. This time, Kaatsu resistance training was performed on the first day to check the duration of the effect on decreasing the pause by Kaatsu. However the results were similar on both the first and the second measurement as follows: The pause and bradycardia decreased to 88/day from 211/day and to 44/day from 52/day, respectively. The average heart rate decreased to 56/min. from 57/min, which was the same as that obtained for the second measurement. Each measurement shows a marked decrease in the pause and bradycardia, however, the heart rate did not change after Kaatsu.

DISCUSSION

Kaatsu resistance training has been developed since 1967 by Yoshiaki Sato (Sato, 2005). It consists of low-intensity resistance training (20%~30% of 1RM) with a restriction of the venous return using a specially designed belt while applying pressure at the proximal end of the upper or lower extremities. This revolutionary method has been established not only to build up the body (Takarada et al., 2000; Yasuda et al., 2005; Abe et al., 2005) but also to recover from

bone fractures (Sato, 2005), patella tendonitis (Sato, 2005), and for rehabilitation from cerebral palsy (Odagiri, 2004), heart disease (Nakajima, 2005), a low physical fitness level (Takano et al., 2005) and for the overall improvement of frail elderly individuals (Ishii, 2005). The supersecretion of bioactive substances such as growth hormone (GH) (Takarada et al., 2000) and insulin-like growth factor-1 (IGF-1) (Abe et al., 2005) greatly contributes to the mechanism of increasing the muscle size and power. Furthermore, GH and IGF-1 act on heart muscles as well as skeletal muscles, thereby directly augmenting cardiac contractility. The indirect effect of GH on the heart includes a decreased peripheral vascular resistance (Cittadini et al. 1999)

A decrease in the sinus pause of a sick sinus syndrome patient by Kaatsu is herein reported and discussed concerning the mechanism of decreasing the sinus pause by Kaatsu. A sinus node dysfunction is common in the elderly, and most of cases do not complain about symptoms. However, some patients may experience syncope, palpitations, or dizziness. The causes of syncope are mainly due to hypertonus of the vagal nerve and partially degenerative or ischemic changes of the atrioventricular conduction system (Ferrer, 1982). A pacemaker implantation may be indicated when the sinus pause is longer than several seconds. However, the longest pause of 3.3 seconds in this case was considered to be too short for cardiac pacemaker implantation. The administration of ALOTEC (Orciprenaline Sulfate) 20 mg a day was not sufficient to control the symptoms of the patient. However, when the patient underwent Kaatsu for another purpose, it effectively improved the patient's heavy sense in her chest, and the pause decreased to 400 a day from 653 a day one week after the first Kaatsu (Fig.5). In addition, Kaatsu dramatically

decreased the pause at all three times of measurements by Holter ECG.: The pause decreased to a rate of 51% at the first measurement, to a rate of 28% at the second one, and to a rate of 40% at the third. There are two possibilities concerning to the mechanism by which the pause decreased by Kaatsu. One is mainly due to a quick recovery from the vagal hypertonus. Iida et al. (2005) reported a high frequency of RR variability (HF_{RR}), a marker of the parasympathetic activity, decreased after Kaatsu in both legs, while LF_{RR}/HF_{RR} , a quantitative marker of sympathetic nerve activity, increased in men. It is unclear whether Kaatsu can keep maintain such acute effects for a long term. However, it is likely that Kaatsu may improve the autonomic nerve function in a patient with SSS. Another mechanism might be partially due to an improvement in the ischemic changes to the nerve conduction system. However, further studies are needed to clarify the effects of Kaatsu training on the sinus node functions in patients with SSS..

.....

References

- Abe T**, Yasuda T, Midorikawa T, Sato Y, Kearns CF, Inoue K, Koizumi K, Ishii N (2005) Skeletal muscle size and circulating IGF-1 are increased after two weeks of twice a daily "KAATSU" resistance training. *Int J KAATSU Training Res* **1**:6-12.
- Cittadini A**, Longobardi S, Fazio S, Saaca L (1999) Growth hormone and the heart. *Miner Electrolyte Metab* **25**:51-55.
- Ferrer MI** (1973) The sick sinus syndrome. *Circ* **47**:635-641.
- Iida H**, Takano H, Meguro K, Asada K, Onuma H, Morita T, Kurano M, Sakagami F, Uno K, Hirose K, Nagata T, Takenaka K, Suzuki J, Hirata Y, Furuichi T, Eto F, Nagai R, Sato Y, Nakajima T (2005) Hemodynamic and autonomic nervous responses to the restriction of femoral blood flow by Kaatsu. *Int J KAATSU Training Res* **2**:57-64.
- Inoue K**, Sato Y, Ishii N (2002) Application to rehabilitation of Pressure muscle training method. (in Japanese with English abstract) *Jap J Clin Sports Med* **10**:395-403.
- Ishii N** (2005) The effect of Kaatsu training. (in Japanese) The first meeting of Japan Kaatsu training. An abstract P.24.
- Nakajima T** (2005) Heart rehabilitation by Kaatsu training. (abstract in Japanese) A special lecture at [The first meeting of Japan Kaatsu Training Society]. P.26.
- Odagiri K** (2004) The effect of Kaatsu training on various diseases. (in Japanese). *J Clin Sports Med* **21**:253-257.
- Sata S** (2005) Kaatsu training for patella tendonitis patients. *Int J KAATSU Training Res* **1**:29-32.
- Sato Y** (2005) The history and future of Kaatsu training. *Int J KAATSU Training Res* **1**:1-5.
- Takarada Y**, Nakamura Y, Aruga S, Onda T, Miyazaki S, Ishii N (2000) Rapid Increase in plasma growth hormone after low-intensity resistance exercise with vascular occlusion. *J Appl Physiol* **88**:61-65.
- Yasuda T**, Abe T, Sato Y, Midorikawa T, Kearns CF, Inoue K, Ryushi T, Ishii N (2005) Muscle fiber cross-sectional area is increased after two weeks of twice daily Kaatsu -resistance training. *Int J KAATSU Training Res* **1**:65-70.

Author affiliation

I. Satoh, Satoh Heart Clinic, 6-2 Sukeda, Ube, Yamaguchi 755-0054, Japan