

LETTER TO THE EDITOR

Evaluation of Foulage Therapy in the Treatment of Tibialis Anterior Exercise Fatigue in Shot Putters by Surface Electromyography and Isokinetic Test based on Ecological Sports Concept

Shenrong Wei*

Department of Physical Education, Chang'an University, Xi'an 710064, China

*Email: weihy627@163.com

To observe and evaluate the foulage therapy efficacy in the treatment of tibialis anterior exercise fatigue in shot putters by surface electromyography and isokinetic test. A total of 120 patients with tibialis anterior exercise fatigue treated at our hospital were enrolled (shot putters). The patients were randomized into foulage therapy group and rest control group, with 60 cases in each group. The model of left tibialis anterior exercise fatigue was built under isokinetic training mode, which was performed before and after treatment. During modeling, surface electromyography was applied to measure each indicator in the passive movement of ankle. There was no significant difference regarding the integral electromyography, maximum amplitude, median frequency and slope between both groups under isokinetic mode before therapy ($P > 0.05$). After 5 minutes of rest, another test showed profound decrease in the maximum amplitude and gain rate, integral electromyography and gain rate, median frequency and gain rate as well as slope and gain rate ($P < 0.05$). However, when foulage therapy was performed, the enhancement of the above indicators was significantly higher in the foulage therapy group than those of the rest control group ($P < 0.05$). Application of foulage therapy could markedly improve muscle fatigue.

I Introduction

Kaijun Yu, Ruiyi Gong, Longjie Sun, Xiaotao Wang. Buslaev published "Effects of Health Literacy on Health Promotion Behavior and Medical Ecology Resource Utilization" on Issue: 107, Pages: 989-994, Article No: e107116, Year: 2019, in the article, supporting the lifestyle with health promotion has been the issue mentioned by international health organizations. Medical technology has been promoted, while the problem of chronic diseases still could not be broken through. Finally, suggestions are proposed, according to the results, expecting to help people follow health promotion behaviors to maintain or improve the health status, reduce unnecessary medical ecology resource utilization, and promote the quality of life.

For athletes, training or competition is a common event. When the training and competition intensity exceeds the capacity of the body, temporary physiological decline occurs, which is a kind of change that caused by large-amount and high-intensity training aiming to improve the athletic performance (Zhang and Sun 2017). This is what

is often called exercise fatigue. Fatigue is a normal response to training, which is largely divided into muscle fatigue, visceral fatigue, and nerve fatigue (Bao and Shi 2015). The fatigue degree can be generally estimated by the athlete's self-perception and some external manifestations. For shot putters, because of the high intensity of training, it is easy for tibialis anterior muscle fatigue to occur, which makes them a group with high incidence of this disease. Once the tibialis anterior muscle fatigue problem occurs, it will inevitably lead to a reduction in athletes' life quality and exercise efficiency (Hua et al. 2017).

The tibialis anterior muscle originates from the lateral aspect of the tibia, of which the tendon descends under the deep side of the superior and inferior support bands of the extensor muscle and ends at the medial aspect of the medial cuneiform and the first metatarsal bone (Hui et al. 2017). The main function of tibialis anterior is to extend the ankle joint and introvert the foot, which is dominated by the deep peroneal nerve. With the further development of the research, application of fouflage therapy in the treatment of tibialis anterior exercise fatigue (as shown in Figure 1) has been well promoted. However, adoption of surface electromyography and isokinetic tests in the evaluation of the therapeutic effect of fouflage therapy in the tibialis anterior muscles fatigue in shot putters was rarely seen. This study conducted a detailed analysis aiming to provide valuable reference for clinical treatment. The report is as follows.



Figure 1. Application of fouflage therapy in the treatment of tibialis anterior exercise fatigue

II Method

The patient's left lower extremity was selected and a Biodex System-3 multi-joint isokinetic muscle strength tester was used to build the tibialis anterior fatigue model. Three sub-level ankle flexion and extension activities were performed before the test as preparation. Then the patient's file was built and ascientific program was chosen. That is, the speed of isokinetic movement is set as 60 per second. Meanwhile, the patient was immobilized, with the body and the left thigh fixed onto the test chair, and the left ankle joint bundled on the head of measuring arm. During the test, the range of ankle joint motion was reasonably set, and the tested left lower limb was well weighed. Click on the start button, the patient was told to dorsal stretch the power arm. In the case of maximum joint mobility, the patient was told to flex the joint back to its original position. The ankle joint was flexed and extended repeatedly in this form (Wu and Yu 2016). The isokinetic muscle strength evaluation IN training system was adopted to record the muscle contraction mechanical signals during exercise and build the tibialis anterior muscle fatigue model. On that basis, when the first modeling was completed, patients of the rest control group were allowed to lay down for 5 minutes. On the other hand, fouflage therapy was applied on the patients of the research group for 5 minutes by

massage experts. The following acupuncture points were rubbed: Zusanli, Yangling Spring, Shangjuxu and Fenglong. Press the thumb rib face on the patient’s left anterior muscle and rub it repeatedly in an upper and lower order. Attention must be paid to the patient’s feeling during the massage, and we should make sure that the strength is comfort and tolerable.

III Results

As shown in Table 1 and Table 2, There was no significant difference regarding each indicator between both groups under isokinetic mode before therapy ($P > 0.05$).

Table 1. The surface electromyography of the rest control group before treatment ($\bar{x} \pm s$)

Group	Indicator	Value
Rest control group (n=60)	Integral electromyography	211.49±150.76
	Maximum amplitude	55.68±10.42
	Median frequency	31.29±20.52
	Slope	65.04±111.28

Table 2. The surface electromyography of the foulage therapy group before treatment ($\bar{x} \pm s$)

Group	Indicator	Value
Foulage therapy group (n=60)	Integral electromyography	185.93±149.05
	Maximum amplitude	50.93±9.52
	Median frequency	87.99±32.10
	Slope	56.77±11.90

After 5 minutes of rest, another test showed profound decrease in the maximum amplitude and gain rate, integral electromyography and gain rate, median frequency and gain rate as well as slope and gain rate ($P < 0.05$). However, as shown in Figure 2 and Figure 3, when foulage therapy was performed, the above indicators were markedly increased in the foulage therapy group ($P < 0.05$).

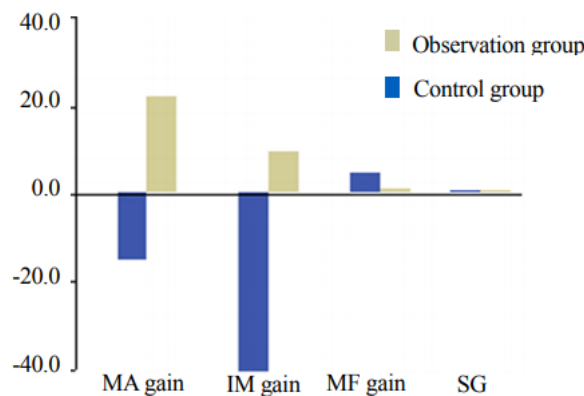


Figure 2. The effect of foulage therapy on the surface electromyography gain of tibia lis anterior

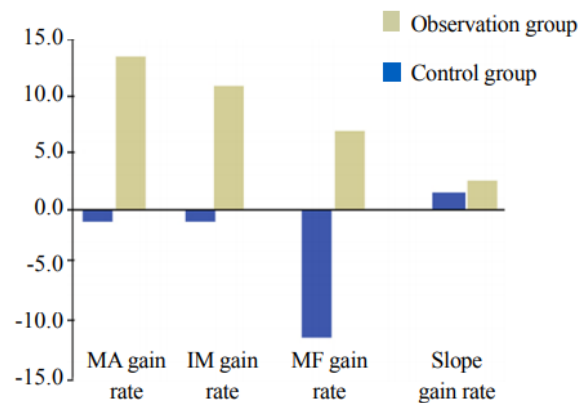


Figure 3. The effect of fouflage therapy on the surface electromyography gain rate of tibialis anterior

IV Discussion

When muscle fatigue occurs, the maximum amplitude of electromyography transforms from high frequency to low frequency. When fatigue leads to lay off, the same final value is obtained. When the maximum contraction force is reduced to 50%, the corresponding descent curve of center frequency presented with typical fatigue sensitivity, and therefore presents significant indication of fatigue. The theory of traditional Chinese medicine was strictly followed in the fouflage therapy group, with the selected acupuncture points being the stomach meridian of foot-yangming, the yangling spring of gall bladder meridian, the Zusanli, the Shangjuxu and the Fenglong, ect., which could significantly improve the patient's symptoms. At the same time, the surface electromyogram also presented with good changes, indicating that the patient's muscle fatigue was markedly alleviated through the improvement of local blood circulation. The results of this study demonstrated that with the increasing times of ankle flexion and extension exercise in both groups, there was a significant reduction in the integral electromyography, maximum amplitude, median frequency, slope of tibialis anterior. Meanwhile, the integral electromyography of the fatigued muscle was elevated, which is positively correlated with the amplitude, intensity and the slope. Moreover, the median frequency was decreased. The results are in line with related studies (Abdel 2016, Esen Salman et al. 2019).

The problem that needs to be noted during the operation is that the modeling process must be scientific and reasonable (Wang 2017). The patient's left lower extremity was selected and a special multi-joint isokinetic muscle strength tester was used to build the tibialis anterior fatigue model. The patients were introduced to the basic methods and essentials of the isokinetic muscle strength test. Three sub-level ankle flexion and extension activities were performed before the test as preparation. A scientific program was chosen and the patient was strictly immobilized. Finally, the test was performed. At all stages of the test, the myoelectric signal of the anterior tibial was measured using a wireless telemetry surface electromyography. For patients in the fouflage therapy group, attention must be paid to the patient's feeling during the massage, and we should make sure that the strength is comfort and tolerable.

V Conclusion

To sum up, when fouflage therapy was performed, the enhancement of the maximum amplitude and its gain rate, integral electromyography and its gain rate, median frequency and its gain rate, slope and its gain rate were significantly higher in the fouflage therapy group than those of the rest control group, indicating that the myoelectric

signal of tibialis anterior can be positively improved by fouflage therapy. Given that, we concluded that application of fouflage therapy can significantly improve muscle fatigue. Meanwhile, the surface electromyography and isokinetic test are reasonable and scientific methods to evaluate the fouflage therapy efficacy in the treatment of tibialis anterior exercise fatigue in shot putters. The reasons of exercise fatigue may be that the fast muscle fiber compensates effectively during the reduction of slow muscle fiber discharge. Moreover, under isokinetic mode, the slow muscle fiber can be well recruited and form a large torque together with the fast muscle fiber, thus enhancing muscle strength of the tibialis anterior as well as improving the muscle fatigue. However, given the limited sample size in this study, a large sample size research should be conducted in the future to fully support our results.

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