The Main Muscle Surface EMG Characteristics of the Rowing Athletes' in Different Roads

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Abstract: Objective: Through the man rowing open athletes of Hubei province for ergometry test of 3 minutes for 60% and 90% maximum load, this article aims to understand the rowing open athletes in ergometry test of main muscle group strength distribution ratio, fatigue and strength characteristics. Methods: 6 man rowing open athletes of Hubei province were chosen for ergometry test of different load test (3minutes for 60% and 90% maximum load). The characterization of surface electromyographic changes was tested in the major exertor muscles, medial head of quadriceps and tibialis anterior muscles. Results: The results showed that: Maximum load test increased from 60% to 90%; IEMG appeared significant difference ($P<0.05$); especially the latissimus dorsi showed very significant difference ($P<0.01$); MF and MPF changed little. Conclusion: 60% load intensity achieves a good training effect on the calf muscles, and 90% load intensity acts on the training of the lower limb muscles.

***Keywords*:** rowing, ergometry, different load, surface electromyograp

1. Introduction

Rowing is a sport in which athletes propel their boats forward by sliding their oars. Rowing is also a major Olympic gold medal, China's rowing program, especially the women's rowing program in this area has been a great development in some major competitions at home and abroad has achieved very good results. Many of our athletes have also broken the world record of land dynamometer performance, which shows that our rowers have reached a high level in physical training. The scientificization of the training level provides a strong scientific guarantee for the improvement of the competitive level.[1]

Surface electromyography (SEMG) can reflect the state of the muscles of the athletes during training in the monitoring of sports training in a timely manner, and can monitor the activation time sequence of the muscle movement, the percentage of work done by the muscle in the process of the movement, the strength of the muscle, the contraction speed of the muscle, the type of muscle fibers, and the fatigue degree of the muscle, etc, which will not cause any damage to the organism during the process of the training and monitoring. The application of surface electromyography (SEMG) in sports has achieved certain research results and has a certain degree of reliability. [2]Domestic and foreign rowing circles in the training practice mostly use the dynamometer results to indicate the rower's special ability, which is considered to be the best indicator for evaluating the rower's ability. Rowing is a speedy power endurance sport, which requires athletes to have better strength qualities and to be able to coordinate the strength of the muscles of the trunk and limbs of the sport. Therefore, it is necessary for rowing to develop its speed, strength and other qualities in a comprehensive way. Accordingly, the purpose of this paper is to study the characteristics of EMG signal changes in rowing athletes by conducting dynamometer tests with different load intensities from the actual training of this sport.[3]

2. Research objects and methods

2.1 Subjects of study

The object of this study is 6 outstanding public men's racers in the Hubei Rowing Team. The training base is the International Water Training Base of Honglian Lake in Hubei Province and the Donghu Water Training Base in Hubei Province. The sports level is more than one level. The athletes have not been injured recently and their physical conditions are good.

2.2 Research methodology

2.2.1 Exercise prescription

MegaWin6000 electromyography, 16-lead from Finland and its analysis software, single-use ECG electrodes, made by

Shanghai Shenfeng, wind turbine dynamometer Concept II (PM4), made in the United States, medical alcohol, razor blades, elastic bandages, sports adhesive tape, razor blades, stopwatch, towels and so on.[4]

2.2.2 Experimental method

Beginning of the test, rowing open-level athletes 60% and 90% different load dynamometer test, the collection of surface EMG; each load test 3min, respectively, 60% and 90% of the athlete's maximum load for the test, the beginning and end of each hit a mark point; on the collected EMG data is saved to the computer Magewin6000 operating software for preliminary sorting and classification and make records .

2.3 Data processing

To process the collected surface EMG data, the EMG signals of the intercepted raw surface EMG spectra of ten pulses after the beginning of the exercise, ten pulses after the end of the exercise as well as the raw graphs of the whole three-minute exercise were sorted out and processed for analysis, and the IEMG, MF and MPF were calculated.SPSS22.0 statistical software was used to calculate the mean standard deviation of the data; paired-sample t-test was used to test the significance of the differences; correlation analysis was used to test the correlation; $P<0.05$ has a significant difference, and $P<0.01$ has a very significant difference; $P<0.05$ has a significant correlation, and $P<0.01$ has a very significant correlation.[5]

3. Research results

According to the EMG results of the quadriceps muscle, 60% intensity exercise for 3 minutes, the test results of the first ten plasma at the beginning of the exercise were compared with the test results of the last ten plasma at the end of the exercise ;90% intensity exercise for 3 minutes, the test results of the first ten plasma at the beginning of the exercise were compared with the test results of the last ten plasma at the end of the exercise.Electromyography results of the tibialis anterior muscle, 60% intensity exercise for 3 minutes, test results of the pre-exercise start ten plasma compared to the post-exercise end ten plasma test results 90% intensity exercise for 3 minutes, test results of the pre-exercise start ten plasma compared to the post-exercise end ten plasma test results.[6,7]

In the ergometer test performed by rowing open class athletes at 60% load, there was no significant change in the tibialis anterior muscle but a significant decrease in the IEMG value of the left quadriceps muscle ($P<0.01$), and in the three-minute ergometer test performed at an exercise load of 90%, there was no significant change in each of the other muscles. Comparing the results of 3-minute ergometer tests with different loads of 90% and 60% exercise, the IEMG values of the medial head of the left quadriceps muscle increased significantly ($P<0.01$) and the rise in IEMG was more pronounced; the IEMG of the medial head of the right quadriceps muscle also increased significantly ($P<0.05$); the muscles' MFs and MPFs were greater in the exercise with a 90% load, and the right tibialis anterior muscle still maintained the maximum value.[8]

4. Analysis and discussion

From this experimental study, we can conclude that the IEMG values of athletes do not increase rapidly at 60% load. There is not much difference between the IEMG values of the left and right muscles; throughout the exercise phase, the IEMG values of the muscles show a small decreasing trend at the beginning of the exercise and at the end of the exercise, which may be due to the excitation of the muscles at the beginning of the exercise, which results in the recruitment of more motor units and makes the IEMG values appear higher at the beginning; after a period of time, the 60% load exercise does not produce too much muscle resistance and therefore does not require mobilization, so a corresponding decrease in IEMG values is produced.

During the 90% maximal loading exercise, the athletes' IEMG values were significantly higher than those of the athletes at 60% maximal loading, with the exception of the tibialis anterior muscle, which showed a slight decrease in IEMG values and a significant increase in all other muscles. Thus some muscles experienced fatigue during exercise; conversely, muscle strength decreased during exercise and IEMG values increased; however, this does not exclude the fact that some muscles still maintained high muscle strength.[9]

Median frequency (MF) and mean power frequency (MPF) were higher in the tibialis anterior muscle of the calf during the 3-minute steady state exercise at 60% loading. mean power frequency (MPF) and median frequency (MF) decreased at 90% loading, and as the duration of muscle activity increased, due to the leftward shift in the spectrum of the electromyographic signals, the amount of muscle activity during the exercise at 90% loading increased, and the mean power frequency (MPF) increased. increased, while the mean power frequency (MPF) and median frequency (MF) decreased. However, the mean power frequency (MPF) of the left and right tibialis anterior muscles remained high throughout the entire process, indicating that the tibialis anterior muscles maintained a high muscle mobilization condition throughout this exercise.

In this study we can conclude that the IEMG values of the athletes are not high in 60% loading situation, which indicates that in this loading situation, the athletes do not need to mobilize more muscle fibers to complete the exercise task, and the IEMG values of the left and right muscles are not much different; in the daily training of the athletes at 90% of their own maximal power can improve the athlete's special strength endurance. From this study we can see that the overall IEMG values of athletes at 90% maximum load athletes are elevated relative to 60% maximum load, with a large rise; the IEMG values of the tibialis anterior muscle show a small decrease in IEMG values from the beginning of the exercise to the end of the exercise, and the other muscles maintain an upward trend, which indicates that some muscles are fatigued in the course of this exercise, which leads to the decrease in the strength of the muscle, the The IEMG values increased, while some muscles still maintained strong muscle strength, and the IEMG values even decreased. This indicates that the size of IEMG is linearly correlated with the exercise intensity.

5. Conclusion

The calf muscles were actively involved in the 60% loading exercise, while the 90% loading exercise could achieve the training effect on the lower limb muscles, so different loading intensity training could train different muscle groups. Therefore, the use of different load training can produce training effects on different muscles of the lower limb.

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