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Medical Image Analysis of the EMG Characteristics of the Main Force Muscles in the Kickboxing Athletes' Leg Control and Lower Split

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Keywords: Medical Image Analysis, Leg Control Followed by Split, Muscle EMG Characteristics, EMG Research.

Abstract: With the progress of social science and technology and the change of people's concept of life, various research fields have gradually influenced each other. Medical image analysis of EMG characteristics is a very powerful research method commonly used in many research fields, including many sports, such as Taekwondo. The research of this paper is based on the medical image analysis of the muscle EMG characteristics of the leg control technique, using the EMG instrument to collect the muscle state and strength required by the action, to further analyze and study the leg control technique. In the experiment, the electromyography testing instrument selected in this paper is wireless electromyography, and through collecting and analyzing the medical images of 16 muscles such as left vertical spine muscle of 10 Taekwondo athletes, and then selecting the mathematical software to further process and analyze the data obtained in the experiment, then building the data model and forming an intuitive chart for analysis. In the experimental analysis, this paper collected the medical image of the EMG characteristics of the leg control and the next split movement to analyze, and studied the muscle force rule of the leg control and the next split movement of Taekwondo athletes, and obtained more detailed and scientific data information of the leg control and the next split movement. So as to provide scientific basis for the daily movement training of Taekwondo athletes and improve the training effect of athletes.

1. Introduction

Taekwondo is a very popular sport in China, because it is popular among young people and even has become an Olympic event. Chinese Taekwondo athletes have won several gold medals in this event. Many Taekwondo movements need to use legs, leg method accounts for a high proportion in

the whole, the key to win Taekwondo competition is also leg method. Attack the opponent's head with a downward split. Even if the opponent quickly retreats to avoid the attack, we can quickly slide to attack the opponent's chest again. Leg control is a cross kicks of a curved leg, which is held in the air so that other movements can be connected at any time. Leg control can defend, but also can quickly connect other movements to attack. The action of leg control and take-off is a kind of aggressive action, which is deeply loved by Taekwondo athletes. In the traditional match field, leg control is not allowed, but the emergence of new rules makes leg control technology useful. In Taekwondo, it is against the rules to control the leg below the waist, but it is not a foul to connect other movements immediately after controlling the leg. Therefore, as long as we master the leg control action skillfully, we can reasonably use the leg control to take down the split action within the specified range [1].

With the progress of social science and technology and the change of people's concept of life, various research fields have gradually influenced each other. Medical image analysis of EMG characteristics is a very powerful research method in many research fields, including many sports, such as Taekwondo. The research of this paper is based on the medical image analysis of the muscle EMG characteristics of the leg control technique, and the specific scientific instruments are selected to collect the muscle state and strength of the athletes to complete the leg control technique, so as to further analyze and study the leg control technique. Through this test experiment, we can get more detailed and scientific data and information of the leg control and chopping, which can provide more scientific learning suggestions for Taekwondo athletes to learn and train the leg control and chopping [2]. In this study, the medical impact analysis of EMG is used in Taekwondo. Through the research on the movement data of athletes, some scientific and reasonable conclusions can be obtained, which can provide some scientific suggestions for the movement of athletes, and can help athletes reduce unnecessary physical damage and improve their daily training efficiency. The research on the muscle strength state and strength related to movement can provide some scientific support and theoretical basis for the training of athletes, and according to the test data and research results, make a special training program for Taekwondo athletes.

A complex Taekwondo attack action is composed of many simple actions, so athletes must learn to coordinate the body muscle groups, through the coordination between the muscles to complete a complex limb action. In this paper, through the study of EMG and the measured EMG data, we can clearly reflect the muscle's output sequence and output when doing a certain action, and then we can judge the coordination between muscles [3]. The ingenious and scientific order of muscle output can make the cooperation between body muscle output and muscle reach the best, and make the athletes have a good movement rhythm, make full use of their physical strength, and then improve the athletes' sports level. In the technical action practice of leg control and chopping, it is necessary to strengthen the explosive force and endurance of the output muscles of Taekwondo athletes, and take the action training under the condition of increasing load, and strengthen the coordination of exercise, which can greatly reduce the body injury. The coach can make a special training plan to reduce the time required for the related muscle response according to the strength state and strength of the muscles needed to complete the action. In Taekwondo competition, the key to win or lose lies in whether the athletes have good muscle endurance. Therefore, they can exercise muscle endurance, enhance muscle endurance and improve the training effect of the athletes in regular training [4].

Medical image analysis of EMG characteristics is a very powerful research method in many research fields, including many sports, such as Taekwondo. In this paper, through the analysis of the medical image of the EMG characteristics of the leg holding technique, as well as the collection of muscle state and strength, we can further analyze and study the movement. In this experiment,

ten Taekwondo athletes were selected. Through literature review, we learned that the muscles used to complete the movement are symmetrically distributed on the left and right sides of the body. There are 22 pieces in total. This experiment is to collect the integral value and contribution rate of these muscles when they exercise. In this experiment, mega win EMG signal analysis software [5] is selected to transform the collected EMG signal into the data information needed for analysis, and then mathematical software is selected for further processing and analysis of the data. The data analysis methods needed include descriptive statistics, t-test, etc. According to the experimental data in the computer software for graphic modeling, the chart can clearly and intuitively see the data changes, but also can be more specific to know the muscle output state and output size. Leg control and chop down is the basic movement of Taekwondo. This study provides scientific basis for the movement training of Taekwondo and improves the effect of daily training of athletes by collecting and analyzing the medical image of EMG characteristics of leg control and chop down, as well as the strength state and strength of muscles [6].

2. EMG Principle and Feasibility Analysis of EMG

2.1 Research on the Principle of Electromyography

Electromyogram is a kind of map which can record the changes of bioelectric signals from muscle cells with time series images. Electromyogram detection is a graph recorded on the recording device after amplifying the potential difference emitted by muscle action. The electrode piece of EMG is pasted on the epidermis of the tested muscle. The EMG detection is non-invasive, easy to use and widely used. The method of "integral" is often used in quantitative aspect, also known as "integral EMG". The bioelectricity produced by muscle cells in motion can produce a certain potential difference. The amplifier can detect this potential difference signal, and then form a graph through amplification and recording. SEMG can convert the collected signal into a digital signal, and then input it into a computer through the communication system [7]. Then through the mathematical software to model the experimental data information and through the chart this simple and intuitive mathematical model can be very easy to analyze and observe the conclusion. As a new painless and noninvasive detection technology, EMG signal detection technology is called as a professional scientific research instrument for treatment, detection and evaluation by many people. This technology has been managed in various research fields because of its advantages of simple and easy to use, and has been paid attention and praised by many experts. Moreover, this technology has a very strong advantage in many research fields. In these fields, EMG signal detection technology is widely used Domain plays an important role in the research of domain [8].

2.2 Feasibility Analysis of Electromyography

Now the technology of electromyography has been quite mature. It is very common to use the technology of electromyography in the research of sports activities at home and abroad, and the relevant research results have been very rich. Now we can use sEMG analysis technology to analyze and study many complex movements in sports events. According to the chart of test results, we can judge the state and function of muscles intuitively and simply. This simple EMG test method has many advantages, such as painless, noninvasive and so on. Therefore, electromyography technology has become a common choice to detect the muscle function of athletes. Because of its simple and painless advantages, it is widely loved by athletes. Through reference [9], we can see that:

(1) Surface electromyography can study and analyze the strength and state of muscle, but this technology can only collect data in the moment of testing. Muscle EMG signal is real-time changing, so it has certain real-time and local.

(2) The larger the intensity of muscle contraction, the larger the data measured by the instrument, the larger the amplitude displayed by EMG, so EMG can directly express the muscle contraction intensity.

(3) The cross-sectional area of the measured muscle is closely related to the discharge quantity. The larger the discharge quantity is, the longer the duration is, the larger the cross-sectional area is, and the greater the discharge quantity is. Therefore, the EMG can be used to judge the output state of the muscle.

(4) The muscle state can be analyzed by EMG, and the ratio of fast muscle to slow muscle can be observed by average power frequency.

(5) Surface electromyography has some limitations. It can only show the activity of muscle surface, so it cannot judge the internal state of muscle. At the same time, when collecting data, the electrode paste is very vulnerable to the influence of the external environment, resulting in the error of the final result.

From the literature, we can know that there are many papers using EMG analysis technology in Taekwondo movement research, but most of them are about single movement research and analysis. For example, there are a lot of research and Analysis on the cross kick movement and the down split movement, but these studies have no specific test on the specific strength state and strength of the muscles in the movement, and these vital data information are exactly what the athletes need most, and they can make more scientific training programs based on them [10]. This paper analyzes the medical image and EMG characteristics of the leg control and leg down splitting movement, finds out the strength state and strength of the muscles related to the movement. Through the EMG analysis, the medical image analysis and research of the muscle EMG of the leg control and leg down splitting movement in Taekwondo can improve the training program of the athletes in Taekwondo, and make the athletes know the strength state of the muscles more clearly It can improve technical movements more scientifically and improve athletes' sports results [11].

3. Test of Integral Value and Contribution Rate of EMG

3.1 Documentary Method

In this paper, we refer to the related journals and papers in CNKI and Wan Fang database, as well as a large number of materials and entity books related to the controlled leg down splitting, to assist in completing this experimental research and writing this paper.

3.2 Expert Interview

This article consulted many Taekwondo experts to understand and sort out the development trend of leg control joint and the relevant information used in the competition, and to understand the relevant rules about this action in the competition field. At the same time, many medical experts were consulted about the feasibility of the research action experiment design and the related professional information of EMG technology. In addition, the research and understanding of the expert professor on the technique of leg control and down splitting, as well as some professional suggestions given by them are sorted out.

3.3 Experimental Method

1) Test instruments and materials

The professional instruments needed in this experiment are surface electromyography, computer, synchronizer, camera, disposable electrode patch, 75% alcohol, etc.

2) Pre experiment

Two athletes from a taekwondo gymnasium were selected. By consulting various literature and combining with professional knowledge in medicine and other related fields, the muscles used to complete the leg control and lower split technique were selected, and the data related to the strength and muscle state of the muscles were collected with the surface electromechanical instrument. Through this pre experiment, the output muscles that complete the action of leg control and down splitting are selected accurately, and the predetermined experimental process is simply operated, which makes corresponding preparations for the formal experiment. At the same time, through this pre experiment, it also proves that this experiment has certain feasibility, and this experiment can draw the data and conclusions required by the paper [12].

3) Tested muscles

The test sequence of muscles is in order of the vertical spinal muscles on the left and right sides, the rectus abdominals on the left and right sides, the semitendinosus Semi membranous muscles on the left and right sides, the rectus femoris on the left and right sides, the intestinal muscles on the left and right sides, the gastrocnemius muscles on the left and right sides, and the tibia anterior muscles on the left and right sides [13].

4) Experimental steps

(1) Connect the surface electromyography, computer and camera, and handle a certain number of muscle patches. Record and count the muscle state of athletes, and rank the athletes. Then explain the special precautions and test contents for the athletes. Allow the athletes to fully warm up before the experiment for at least 15 minutes to prevent injury due to sports.

(2)Use 75% alcohol cotton to clean the skin on the muscle surface of athletes and reduce the impedance, which can make the experimental data more accurate. Paste the surface electrode along the direction of the muscle fiber, and stick it on the highest point of the muscle abdomen, then turn on the electrometer, video recorder and laptop, and debug the receiver, and input the athlete's information in time in the computer. Before the experiment, check whether the instruments are installed in place, try to test whether the signals can be received, and then the athletes make the leg control and chopping action according to the requirements, in which the leg control needs to control the leg for one second and then do the chopping technology, three actions need to be done, each action needs to be separated by one minute, and finally check whether the data has been entered and whether there is any omission.

(3)At the end of all muscle tests, the staff needs to remove the athlete's electrode stickers in time and clean the athlete's skin.

(4)When attaching electrodes to athletes' muscles, it is necessary to stabilize the electrodes to ensure that they do not loosen or fall off in the process of athletes' movements, otherwise it will affect the instrument's receiving test signals, resulting in errors in the test results. When the athlete's muscle test is over, the friction between the athlete's body and the electrode should be reduced when the electrode is removed. The friction may cause damage to the instrument. In the process of experiment, we should try to reduce the interference of athletes in the surrounding environment, and suggest finding a quiet indoor environment test; otherwise this interference will affect the technical performance of athletes, and make the final test results produce errors.

3.4 Mathematical Statistics

In this experiment, mega win EMG signal analysis software is selected to transform the EMG signals collected in the experiment into data information that can be directly analyzed. Then, mathematical software is selected to further process and analyze the data. The data analysis methods that need to be used include descriptive statistics, t-test, etc. In this experiment, the average and standard deviation are chosen to represent the final data results, which is very convenient for observation and analysis [14].

3.5 Data Modelling

According to the experimental data, the mathematical model is established with specific software. In this paper, the histogram, line chart and radar chart are selected, which are very convenient for comparison and analysis. The chart can show the strength state and strength of athletes' muscles intuitively. Finally, these test data need to be simply studied and analyzed [15].

4. Results Analysis

4.1 EMG Integral and Contribution Rate of Muscles in Leg Control Stage

Through the EMG integral contribution rate, we can judge the muscle's output state and observe the muscle's output. These data and information provide a more scientific and reasonable theoretical basis for athletes to make daily training program.

Table 1: EMG integral value and contribution rate of right muscles in leg control stage

Electromyographic integral and contribution rate of athletes	Right vertical spinal muscle (A)	Right rectus abdominis(B)	Right gluteus maximus (C)	Biceps femoris, right(D)	Semimembranous muscle of right semitendinosus (E)	Right gastrocnemius muscle (F)	Right rectus femoris (G)	Right tibialis anterior muscle (H)
No.1	22.61 21.75%	8.14 7.83%	7.34 7.06%	7.63 7.34%	5.86 5.56%	2.70 2.59%	41.1 39.53%	8.59 8.26%
No.2	7.51 11.89%	6.19 9.77%	8.15 12.86 %	10.48 16.54%	4.75 7.5%	3.93 6.2%	19.25 30.38%	3.09 4.87%
No.3	7.71 12.4%	7.01 11.28 %	6.43 10.34 %	8.05 12.96%	7.76 12.48%	3.96 6.37%	16.83 27.08%	4.41 7.09%
No.4	12.43 15.96%	7.83 10.06 %	6.74 8.66%	10.83 13.98%	5.23. 6.72%	2.73 2.79%	23.12 29.69%	9.46 12.14%
No.5	16.73 18.61%	1.84 1.87%	12.62 12.84	4.53 4.61%	8.83 8.94%	8.52 8.67%	18.3 16.62%	40.68 41.18%

			%					
No.6	15.61 17.49%	2.83 3.03%	10.47 10.96 %	5.77 6.04%	4.46 6.76%	7.12 7.46%	16.23 16.99%	44.23 46.31%
No.7	8.35 11.96%	8.01 11.47 %	7.78 11.14 %	10.21 14.62%	5.79 8.29%	3.33 4.77%	18.99 27.2%	7.36 10.54%
No.8	20.31 19.58%	7.19 6.79%	8.64 8.33%	9.44 9.1%	4.66 4.49%	2.49 2.4%	34.11 32.89%	12.88 12.42%
No.9	11.42 18.32%	8.54 10.34 %	7.16 8.67%	9.78 11.84%	5.24 6.34%	2.93 3.55%	27.67 37.69%	9.89 11.97%
No.10	19.24 18.81%	7.52 7.33%	8.13 7.95%	8.04 7.06%	4.91 4.8%	3.2 3.13%	39.94 39.04%	10.33 10.1%
average value	4.65 12.63%	0.77 8.9%	0.67 9.07%	1.18 11.21%	0.89 6.72%	0.58 3.76%	9.39 29.81%	2.84 9.93%

Table 2: EMG integral value and contribution rate of left muscles in leg control stage

Electromyographic integral and contributin rate of athletes	Left vertical spinal muscle (A)	Left rectus abdominis(B)	Left gluteus maximus (C)	Biceps femoris, right(D)	Semimembranous muscle of right semitendinosus(E)	Left gastrocnemius muscle (F)	Left rectus femoris (G)	Left tibialis anterior muscle (H)
No.1	3.27 3.10%	1.2 1.44%	12.92 12.25%	7.14 6.77%	9.86 9.33%	9.62 9.12%	18.37 17.41 %	43.15 40.88%
No.2	1.14 1.28%	2.6 2.25%	26.87 23.26%	4.91 4.25%	13.45 11.64%	19.91 14.24 %	19.25 30.38 %	41.35 35.8%
No.3	1.71 2.23%	3.23 4.25%	14.73 19.19%	3.15 4.1%	7.76 12.48%	3.96 6.37%	16.83 27.08 %	24.83 34.35%
No.4	2.36 2.21%	1.64 1.54%	14.47 13.58%	5.49 5.15%	5.23. 6.72%	2.73 2.79%	23.12 29.69 %	45.23 42.43%
No.5	3.21 3.27%	1.84 1.87%	12.62 12.84%	4.53 4.61%	8.83 8.94%	8.52 8.67%	18.3 16.62 %	40.68 41.18%
No.6	2.33 2.44%	2.83 3.03%	10.47 10.96%	5.77 6.04%	4.46 6.76%	7.12 7.46%	16.23 16.99 %	44.23 46.31%
No.7	1.47	2.31	12.26	3.67	5.79	3.33	18.99	40.54

	1.43%	2.72%	14.46%	4.33%	8.29%	4.77%	27.2%	44.44%
No.8	3.43 3.23%	1.87 1.76%	11.95 11.26%	9.44 9.1%	4.66 4.49%	2.49 2.4%	34.11 32.89 %	41.86 35.89%
No.9	4.59 4.20%	2.34 2.14%	14.79 13.54%	9.48 8.66%	12.57 11.51%	8.84 8.09%	17.45 15.99 %	39.19 35.87%
No.10	2.18 2.18%	2.04 2.04%	12.65 14.0%	8.04 7.06%	4.29 4.8%	9.8 9.79%	19.76 19.73 %	41.2 41.14%
average value	0.95 2.57%	0.57 2.27%	4.36 14.04%	1.83 5.52%	2.54 7.87%	1.68 8.98%	1.25 18.53 %	5.83 39.84%

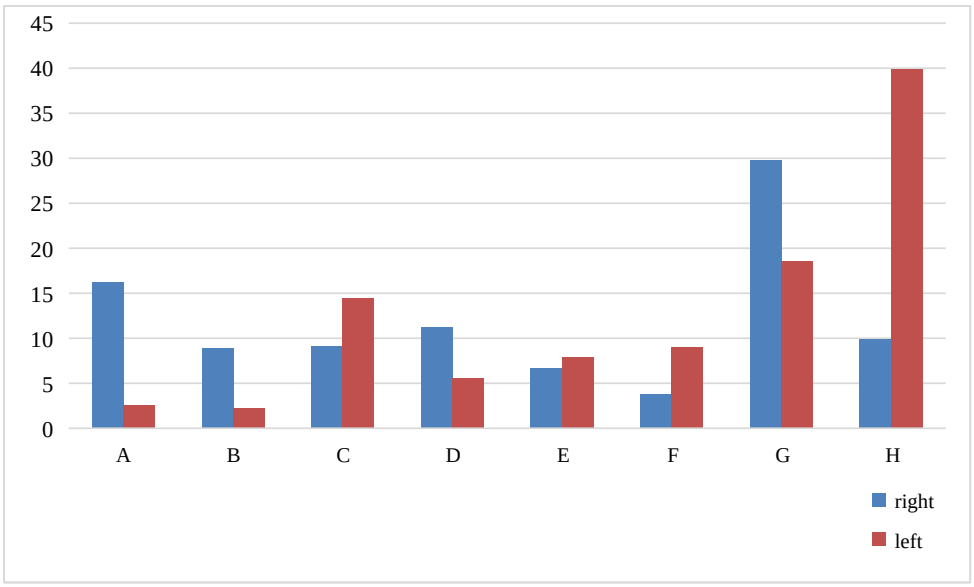

Figure 1: Average muscle contribution rate in leg control stage

From the data in Table 1 and table 2, it can be easily analyzed that the integral value and contribution rate of each athlete are different according to the strength of leg control muscles. Through the observation of histogram, it can be concluded that the muscle with the largest contraction force is the left tibial anterior muscle, and the muscle with the smallest contraction force is the left rectus abdominis. In addition, the rectus femoris on the left and right sides have a relatively large force, which are the basis for completing the action. The above three muscles are the key muscles in the process of completing the research action, and they are very active in the whole process.

As can be seen from Figure 1, for athletes with different physical conditions and muscle functions, the ratio of contribution rate of each muscle to the total contribution rate is also different in the process of leg control. In the process of leg control, the order of contribution rate is: left anterior tibialis, right rectus, left rectus, and right vertical spine, left gluteus maximus. The first three muscles are supporting muscles, and the last two muscles play the role of leg retraction. Therefore, in the process of leg control, it is necessary for athletes to pay special attention to

maintaining body balance and producing contractile muscles in daily training.

Through the research and analysis of leg control movement, in the process of completion, with the beginning of the movement center of gravity gradually deviated, so that the weight of the body gradually shifted to the left leg, the corresponding muscles began to output in turn, the strength was transferred between the muscles, and completed the downward split with mutual cooperation. The left tibialis anterior muscle can stabilize the left leg and maintain balance, which is also the first muscle to exert force.

4.2Integral and Contribution Rate of Muscles in the Down Splitting Stage

Table 3: Electromyographic integral value and contribution rate of left muscles in the down splitting stage

Electromyographic integral and contribution rate of athletes	Right vertical spinal muscle (A)	Right rectus abdomins (B)	Right gluteus maximus(C)	Biceps femoris, right(D)	Semimembranous muscle of right semitendinosus(E)	Right gastrocnemius muscle (F)	Right rectus femoris (G)	Right tibialis anterior muscle (H)
No.1	22.57 18.47%	1.2 1.44%	12.92 12.25%	7.14 6.77%	9.86 9.33%	9.62 9.12%	18.37 17.41%	43.15 40.88%
No.2	19.69 17.53%	2.6 2.25%	26.87 23.26%	4.91 4.25%	13.45 11.64%	19.91 14.24%	19.25 30.38%	41.35 35.8%
No.3	27 19.81%	7.01 11.28%	6.43 10.34%	8.05 12.96%	7.76 12.48%	3.96 6.37%	16.83 27.08%	4.41 7.09%
No.4	25.43 19.69%	7.83 10.06%	6.74 8.66%	10.83 13.98%	5.23. 6.72%	2.73 2.79%	23.12 29.69%	9.46 12.14%
No.5	14.34 18.61%	1.84 1.87%	12.62 12.84%	4.53 4.61%	8.83 8.94%	8.52 8.67%	18.3 16.62%	40.68 41.18%
No.6	28.51 19.19%	2.83 3.03%	10.47 10.96%	5.77 6.04%	4.46 6.76%	7.12 7.46%	16.23 16.99%	44.23 46.31%
No.7	23.63 18.82%	8.01 11.47%	7.78 11.14%	10.21 14.62%	5.79 8.29%	3.33 4.77%	18.99 27.2%	7.36 10.54%
No.8	27.46 20.49%	7.19 6.79%	8.64 8.33%	9.44 9.1%	4.66 4.49%	2.49 2.4%	34.11 32.89%	12.88 12.42%
No.9	24.09 19.26%	8.54 10.34%	7.16 8.67%	9.78 11.84%	5.24 6.34%	2.93 3.55%	27.67 37.69%	9.89 11.97%
No.10	22.11 18.47%	7.52 7.33%	8.13 7.95%	8.04 7.06%	4.91 4.8%	3.2 3.13%	39.94 39.04%	10.33 10.1%
average value	2.65 18.95%	12.0 3.14%	3.07 10.85%	1.75 6.67%	0.67 3.9%	1.59 5.84%	4.13 31.17%	2.65 10.38%

Table 4: Electromyographic integral value and contribution rate of left muscles in the down splitting stage

Electromyographic integral and contribution rate of athletes	Left vertical spinal muscle (A)	Left rectus abdomins (B)	Left gluteus maximus(C)	Biceps femoris, right(D)	Semimembranous muscle of right semitendinosus(E)	Left gastrocnemius muscle (F)	Left rectus femoris (G)	Left t tibialis anterior muscle (H)
No.1	2.6 3.10%	1.2 1.44%	12.92 12.25%	7.14 6.77%	9.86 9.33%	9.62 9.12%	18.37 17.41%	43.15 40.88%

No.2	1.14 2.3%	2.6 2.25%	13.2 17.6%	4.91 4.25%	13.45 11.64%	19.91 14.24%	19.25 30.38%	41.35 35.8%
No.3	7.71 12.4%	7.01 12.36%	6.43 10.34%	8.05 12.96%	7.76 12.48%	3.96 6.37%	16.83 27.08%	4.41 7.09%
No.4	12.43 15.96%	7.83 10.06%	6.74 8.66%	10.83 13.98%	5.23. 6.72%	2.73 2.79%	23.12 29.69%	9.46 12.14%
No.5	16.73 18.61%	1.84 1.87%	12.62 12.84%	4.53 4.61%	8.83 8.94%	8.52 8.67%	18.3 16.62%	40.68 41.18%
No.6	15.61 17.49%	6.3 5.2%	10.47 15.6%	5.77 6.04%	4.46 6.76%	7.12 7.46%	16.23 16.99%	44.23 46.31%
No.7	8.35 11.96%	8.01 11.47%	7.78 11.14%	10.21 14.62%	5.79 8.29%	3.33 4.77%	18.99 27.2%	7.36 10.54%
No.8	20.31 19.58%	7.19 6.79%	15.3 18.3%	9.44 9.1%	4.66 4.49%	2.49 2.4%	34.11 32.89%	12.88 12.42%
No.9	11.42 18.32%	8.54 10.34%	7.16 8.67%	9.78 11.84%	5.24 6.34%	2.93 3.55%	27.67 37.69%	9.89 11.97%
No.10	19.24 18.81%	5.3 3.6%	11.5 15.8%	8.04 7.06%	4.91 4.8%	3.2 3.13%	39.94 39.04%	10.33 10.1%
average value	0.98 3.68%	1.19 2.65%	9 23.54%	1.8 8.17%	0.92 6.37%	4.29 13.74%	3.62 15.27%	4.47 22.62%

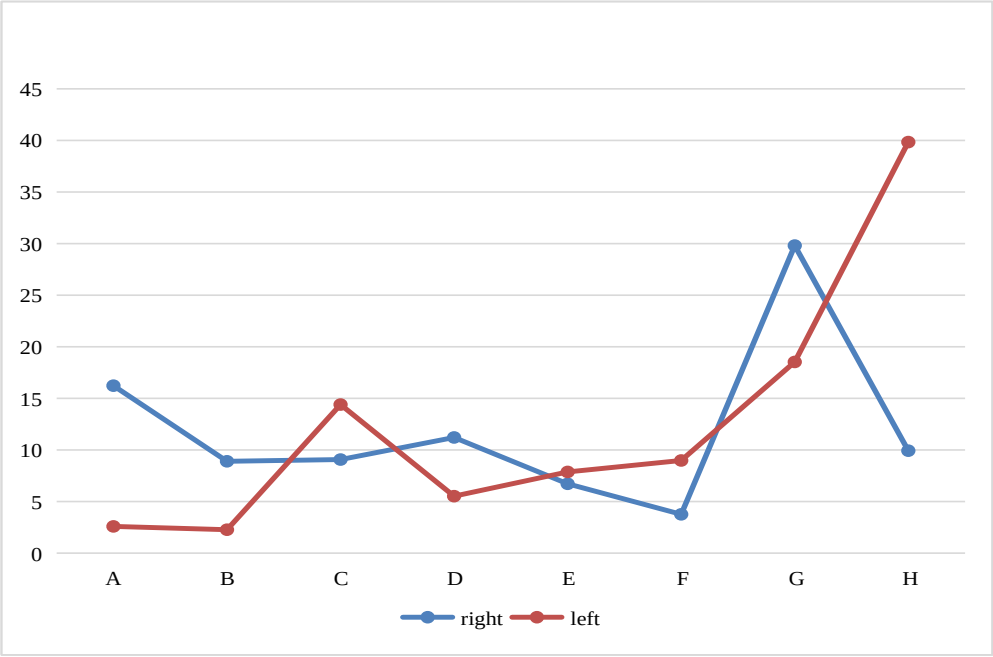

Figure 2: Average muscle contribution rate in the down splitting stage

From the data in Table 3 and table 4, it can be simply analyzed that the integral value of each athlete measured by electromyography instrument is different, and the contribution rate measured is also different. The size of these data is related to the physical condition and muscle state of the athlete. According to the above line chart, it can be observed that the muscle with the largest contraction force is the right rectus femoris, while the opposite is the left rectus abdominis, so the right rectus is the key muscle to complete the action.

After the leg control action is completed, it needs to be connected immediately to the lower split action, which is very aggressive and widely loved by Taekwondo athletes, especially in the field.

From the data in Figure 2, it can be concluded that there is no significant change in the output muscles relative to the leg control action, most of which are located in the thigh and waist abdomen. In Taekwondo competition, athletes will walk around the field constantly to find the best attack opportunities. At this time, with a strong explosive force, they can have a great advantage in the competition field. Meanwhile, muscle endurance is also very important. A competition needs to consume a large amount of physical energy, so a good physical endurance is a necessary condition to win the competition. In addition, specialized training of muscle strength and explosive force is the key to win the Taekwondo competition. The training plan needs to be specially customized according to the physical conditions of the athletes themselves. For example, for some athletes who are not strong enough but have high flexibility, they need to exercise the strength of leg muscles, improve the speed of the athletes' legs, and increase the sensitivity of the athletes. Therefore, we can specially develop personal training methods for the athletes according to the actions we need to practice and the individual physical fitness of the athletes.

4.3 Change of Contribution Rate from Leg Control Stage to Down Splitting Stage

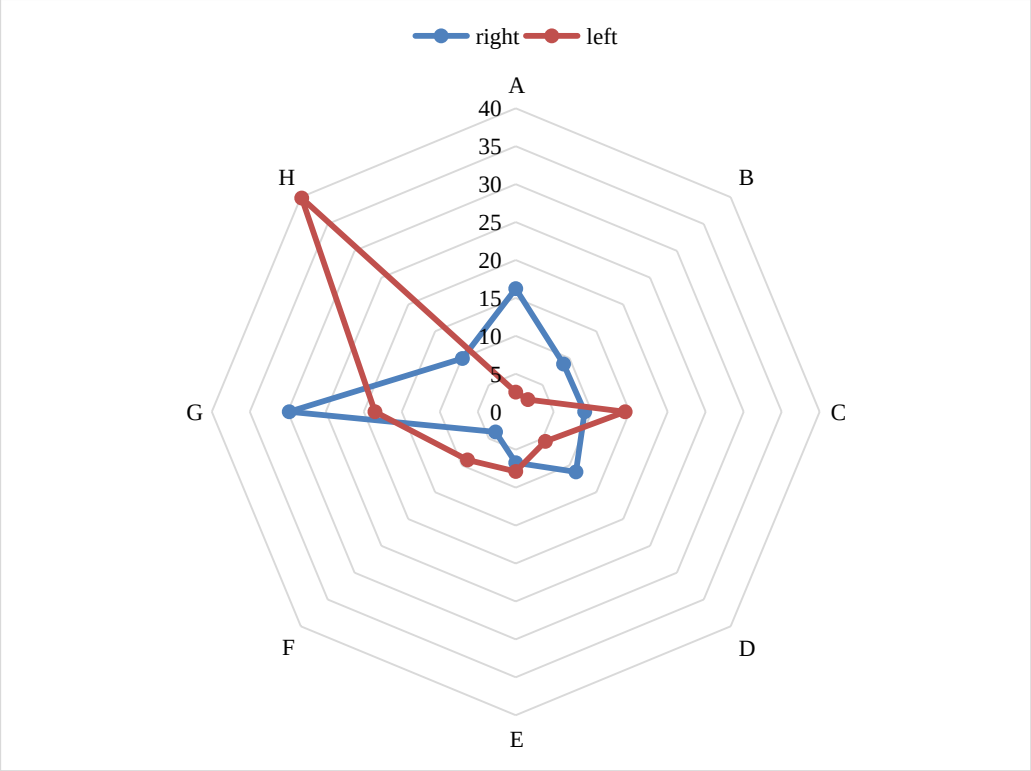

Figure 3: Average muscle contribution rate in legcontrolstage

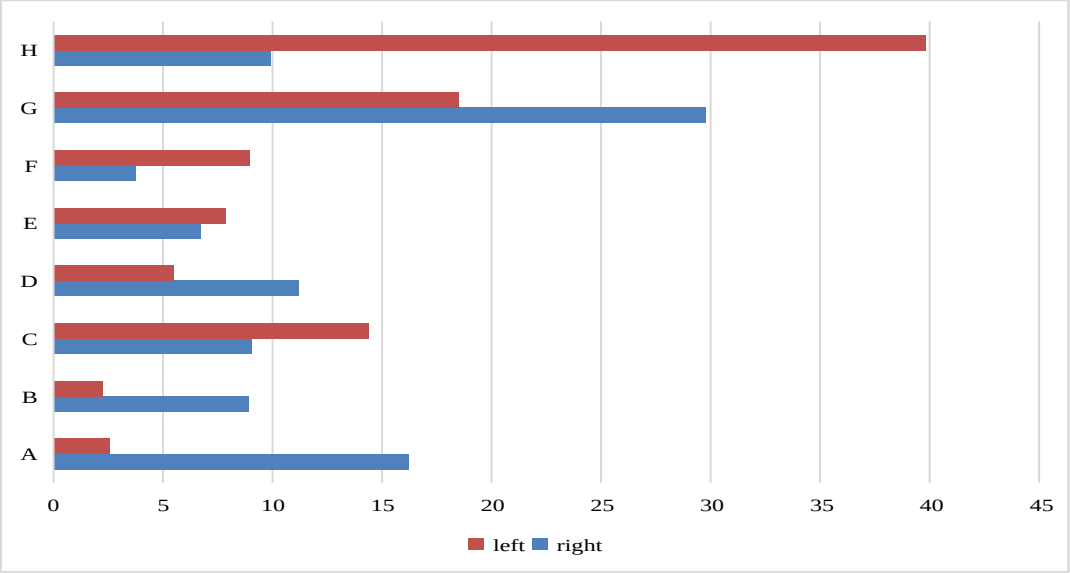

Figure 4: Average muscle contribution rate in the down splitting stage

Through careful observation and comparison of Figure 3 and Figure 4, it can be concluded that the state and muscle output of each muscle in the split action will change greatly when the leg control action is connected. The state and output of some muscles are very obvious, and some of them are basically unchanged. With the change of leg control to downward stroke, the output of some muscles increases, and the output of other muscles decreases. The increase of muscle strength means that this muscle plays a supporting role in the movement conversion. In the process of completing the research action, the contribution rate of each athlete is very different between the leg control action and the down stroke action. The left gluteus maximus and the right rectus abdominis muscle are the basic muscles to complete the conversion of leg control movement to downward splitting movement, although the strength of the muscles has a great change, but the two muscles are in the state of strength in the whole process, so these two muscles are the basic muscles to complete the conversion of the movement. And in the conversion of leg control to the lower split, the strength of tibialis anterior muscle has a very significant change; it is the power muscle to support the conversion of leg control to the lower split. Therefore, the above three muscles are the key output muscles to complete the research action. The output state of these three muscles basically determines the completion quality of the leg control and lower split action. According to their own physical conditions, athletes can exercise these three muscles in the daily training plan. These three muscles can transfer the power to the right leg. It is the right leg that produces huge power and can attack the other side in an instant. After mastering the power state of these muscles, sports can choose to exercise the weak part of their own actions according to the needs, which saves time and improves efficiency for training.

These muscles are symmetrically distributed on the left and right sides of the body. The right leg, as the supporting leg, is also very important in the process of completing the action. The completion of the action of controlling the leg and taking off the split requires not only one leg to attack the opponent, but also another leg to support the body, so as to keep the body stable and maintain the body balance. The stronger the strength of the supporting leg, the higher the stability of the body, and the stronger the balance ability, the stronger the attack When attacking the opponent, the body is more stable and the leg strength is greater. Therefore, in the basic training of Taekwondo athletes

at ordinary times, it is necessary to exercise muscle strength and explosive force consciously, of course, the stability and endurance of the body cannot be ignored, and the flexibility and flexibility of the body muscles can be properly exercised. In the process of the research, if the athletes' body flexibility is not good, then the height of kicking in the down stroke will not be enough, so the attack strength will not be enough, and other high position movements of Taekwondo also need the body to have good flexibility. Also in Taekwondo, body flexibility is very important. Therefore, athletes' daily training should take into account strength and flexibility, explosive force and sensitivity, as well as special customized training methods according to different physical conditions of different athletes. This kind of targeted exercise can reduce the physical injury of athletes and improve the training effect of athletes to the greatest extent.

5. Conclusions

With the progress of social science and technology and the change of people's concept of life, various research fields have gradually influenced each other. Medical image analysis of EMG characteristics is a very powerful research method in many research fields, including many sports, such as Taekwondo. The research of this paper is based on the medical image analysis of the muscle EMG characteristics of the leg holding down split technology, using the electromechanical instrument to collect the related muscle output size and output state of the action, and using the mathematical software to simply model and analyze the measured data. Through this test experiment, we can get more detailed and scientific data information of the leg control and the next split, which can provide more scientific learning suggestions for the athletes to learn the action and play an extremely important role in the competition of the athletes. In this study, the power of gluteus maximus was significantly increased, on the contrary, the power of tibialis anterior muscle was slightly reduced, the power of rectus abdominis was significantly increased, and the power of biceps femoris was relatively weakened. These muscle power states were greatly changed due to the action conversion. The left gluteus maximus and the right rectus abdominis muscle are in the output state during the conversion from leg control to downward splitting, although the output of the muscle has great changes, the two muscles are in the output state during the whole conversion process, so the two muscles are the basic muscles to complete the conversion of the action, and the completion quality of leg control and downward splitting depends on the functional state of the two muscles. The left gluteus maximus and right abdominal straight muscles gradually increase their strength in the process of completing the research action, so these two muscles are the power muscles of the action, and also the key strength muscles supporting the transition process of the action. This experiment focuses on testing the muscles related to leg control and leg down splitting, obtaining a large number of muscle activity data, and based on these data, it analyzes the research action specifically, and puts forward relevant training suggestions for Taekwondo athletes. Therefore, the research content of this paper has a very important role in the leg control and leg down splitting in Taekwondo movement, for the future research in Taekwondo movement Other movements laid the foundation.

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