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Analysis on the Characteristics of Muscle Exertion in Electromyogram During Downward Kick --Take Ten Elite Male Tea Kwon Do Athletes in China as Examples

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Abstract

Using the technique of Telemetry EMG system, we test 10 Chinese Elite Male Taekwondo athletes' front downward kick action (select three group of muscles). The results as follows: 1) the left biceps femoris muscle contains the most contractibility and strength; 2) the first force muscles are left erector spinae, right erector spinal and the left gluteus maximus; 3) the right tibialis anterior muscle is the muscle owns longest duration; 4) the greatest contribution of muscle is left femoral two head of the muscle; 5) the mobilization rates are as follows: the left femoral head two muscle fascia lata >Left tensor fasciae latae> Left gluteus maximus, and are more than 100%. The results show that: the surface EMG test analysis technology can be used for testing the rationality of Taekwondo chop technique action. Therefore, this new technology provides theoretical guidance and practice reference for skills and strength training of Taekwondo athletes.

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Key words: Taekwondo, elite athlete, front downward kick, EMG;

1 Research objects and methods

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1.1 Research objects

Take our national team 10 master-class above Taekwondo athletes front splitting action under the muscle surface EMG characteristics as a research subject .

1.2 Research methods

1.2.1 Measurement methods

1.2.1.1 Selection of testing muscle and Electromyographic calibration test

After the experts consultation visit with the author of books and literature reading ultimately identified three groups of test muscle; Before the test, according to electromyographic testing principle of the selected three groups of muscles calibration.

1.2.1.2 EMG test

With Finland's (MegaWin6000-16) EMG testing instrument and Sony cameras simultaneously on 10 elite Taekwondo athletes front splitting technique selected in three groups of muscle surface EMG testing. In order to ensure the accuracy of experimental data, each movement 34 times EMG signal acquisition, each time interval time for the acquisition of 12 minutes, electromyography of the sampling rate is 1000Hz, reach our country elite Taekwondo athletes front the next split action of each block in the muscle EMG.

1.2.1.3 Data processing

The original EMG signals were standard processed^[1] with Finland's (MegaWin6000-16) software, get data (including surface EMG electromyogram, power ratio, strength value, EMG sequence, duration, and muscle EMG percentage mobilization than numerical.

2 Results and analysis

2.1 The rate of Taekwondo athletes front splitting technique of muscle strength, integral electromyography and force

Through the observation of Table 1, we can see that, in elite Taekwondo Athletes of China front the next split technical movement, exercise muscles EMG electromyogram: left femoral head two muscle (963.00mv/s); followed by Left tensor fasciae latae (859.00mv/s) and the left half semimembranosus tendon (303.00mv/s); the smallest is right the semimembranosus tendon (70.00mv/s). Visible in the front lower splitting technique, contraction is the largest of the left femoral two muscle, contraction is the smallest right tendon Semimembranosus muscle. Force of muscle strength: the left femoral head two muscle (22.17kg) maximum, followed by left vastus medialis muscle (14.11kg), left medial head of gastrocnemius muscle (13.34kg), the smallest is the right rectus abdominis muscle (0.85kg). Visible front the next split technical action in muscle strength is the largest of the left femoral head two muscle, followed by left vastus medialis muscle and the left medial head of gastrocnemius muscle, strength the smallest is the right rectus abdominis. Muscle power ratio: left lateral head of gastrocnemius muscle (0.07kg.s/MV), followed by (the left rectus

femoris, left vastus medialis muscle, right lateral head of gastrocnemius muscle) are 0.06kg.s/MV, the smallest have (the left rectus muscles, the right rectus abdominis muscle, fascia lata, Zuo Kuo is right the tensor fascia lata)0.01kg.s / mv.

Table1 Muscle emg is integral electricity value, force electric ratio and muscle strength

No	Muscle name	Integral electromyography (uv.s)	Sort	Muscle strength (kg)	Sort	Force electric ratio kg.s/mv	Sort
1	Left spinal erector muscle	179.00	13	4.82	17	0.03	5
2	Right spinal erector muscle	199.00	10	5.18	15	0.03	5
3	The left rectus abdominis	195.00	11	1.97	22	0.01	7
4	The right rectus abdominis	141.00	18	0.58	24	0.01	7
5	Left gluteus maximus	285.00	4	7.04	11	0.02	6
6	The left femoral two biceps	96.00	1	22.71	1	0.02	6
7	Right gluteus maximus	149.00	17	4.32	18	0.03	5
8	The right stock two muscles	233.00	7	7.44	10	0.03	5
9	The left medial vastus muscle	251.00	6	14.11	2	0.06	2
10	The left rectus femoris	177.00	14	10.71	5	0.06	2
11	Left vastuslateralis muscle	182.00	12	6.11	13	0.03	5
12	Left tensor fasciae latae	859.00	2	7.61	9	0.01	7
13	The right vastus medialis muscle	195.00	11	8.18	7	0.04	4
14	The right rectus femoris	141.00	18	6.37	12	0.05	3
15	he right vastus lateralis muscle	156.00	15	5.93	14	0.04	4
16	Right tensor fasciae latae	201.00	9	1.96	21	0.01	7
17	The left half of the semimembranosus tendon	303.00	3	4.26	19	0.01	7
18	The left medial head of gastrocnemius muscle	285.00	4	13.34	3	0.05	3
19	Left lateral head of gastrocnemius muscle	152.00	16	10.14	6	0.07	1
20	Left anterior tibial muscle	119.00	20	1.99	20	0.02	6
21	Right tendon Semimembranosus muscle	70.00	21	1.10	23	0.02	6
22	Right medial head of gastrocnemius muscle	264.00	5	12.18	4	0.05	3
23	Right lateral head of gastrocnemius muscle	121.00	19	7.79	8	0.06	2
24	Right anterior tibial muscle	213.00	8	5.06	16	0.02	6

2.2 Duration of Taekwondo athletes front splitting technique of muscular contraction sequence and muscle activity

Through the observation of Table 2, we can conclude that, in elite Taekwondo Athletes of China front the next split technical movement, muscle force order: firstly, the muscle force with (Left spinal erector muscle, erector spinae, right and left gluteus maximus, right gluteus maximus, the right femoral two muscles), are 0.00s, followed by the left rectus femoris (0.04s). Finally, three muscles are (left medial head of gastrocnemius muscle, left, right lateral head of gastrocnemius muscle tendon semimembranosus) for 0.22s, visible in the TaeKwondo chop technique in left, right, erector spinae, erector spinae, left gluteus maximus, the earliest activation, whereas the left medial head of gastrocnemius muscle, left, right lateral head of gastrocnemius muscle tendon semimembranosus three muscles later is activated, a description of the type of muscle for fast muscle, in Taekwondo athletes front splitting technique, first mobilized participation power. Muscle activity duration: turn right tibialis anterior muscle (0.88s), Left tensor fasciae latae(0.84s), left gluteus maximus (0.80s), and left and right anterior tibial muscle tendon semimembranosus shortest (0.22s), the muscle strength endurance muscles, they in Taekwondo athletes front the next split technology action of long time in force.

Table2 The sequence of Muscles send force and the duration time of muscle activity

No	Muscle name	Power order	Sort	Duration (s)	Sort
1	Left spinal erector muscle	0.00	1	0.55	12
2	Right spinal erector muscle	0.00	1	0.55	12
3	The left rectus abdominis	0.14	4	0.61	10
4	The right rectus abdominis	0.13	3	0.52	14
5	Left gluteus maximus	0.00	1	0.80	3
6	The left femoral two biceps	0.15	5	0.70	7
7	Right gluteus maximus	0.00	1	0.75	4
8	The right stock two muscles	0.00	1	0.80	3
9	The left medial vastus muscle	0.14	4	0.24	18
10	The left rectus femoris	0.04	2	0.68	8
11	Left vastuslateralis muscle	0.14	4	0.26	17
12	Left tensor fasciae latae	0.00	1	0.84	2
13	The right vastus medialis muscle	0.00	1	0.62	9
14	The right rectus femoris	0.00	1	0.72	6
15	he right vastus lateralis muscle	0.00	1	0.58	11
16	Right tensor fasciae latae	0.00	1	0.74	5
17	The left half of the semimembranosus tendon	0.16	6	0.30	16
18	The left medial head of gastrocnemius muscle	0.22	7	0.54	13
19	Left lateral head of gastrocnemius muscle	0.22	7	0.32	15
20	Left anterior tibial muscle	0.00	1	0.22	19
21	Right tendon Semimembranosus muscle	0.22	7	0.22	19
22	Right medial head of gastrocnemius muscle	0.00	1	0.52	14
23	Right lateral head of gastrocnemius muscle	0.00	1	0.54	13
24	Right anterior tibial muscle	0.00	1	0.88	1

2.3 The rate of Taekwondo athletes front splitting action under the muscle EMG activity contribution rate and mobilization

Through the observation of Table 3, we can conclude that muscle electromyographic activity of the contribution rate: is the largest of the left femoral head two muscle (41.4%), followed by Zuo Kuo fascia lata (37.9%), the left half of the semimembranosus tendon (19.8%); contribution rate minimum right tendon semimembranosus muscle (4.60%). Visible in the Taekwondo athletes front splitting technology under the action of muscle strength (in the left femoral head two muscle fascia lata, Zuo Kuo left the semitendinosus, semimembranosus) three muscles plays the most important role. Muscle mobilization rates were as follows: the left femoral head two muscle (226%) > Left tensor fasciae latae (169.8%) > left gluteus maximus (105.3%) > left medial head of gastrocnemius muscle (86.6%) > left vastus medialis muscle (77.5%) > ... Right rectus sheath (15.1%). Visible, in the former chop technique moved in two, left femoral quadriceps mobilization rate more than 100%, while the right rectus abdominis muscle mobilization rate was the lowest, only 15.1%.

Table 3 The contribution rate and mobilization rate of muscle electrical activity

No	Muscle name	Contribution rate (%)	Sort	Mobilization rate (%)	Sort
1	Left spinal erector muscle	7.60	17	42.9	14
2	Right spinal erector muscle	8.50	12	52.8	10
3	The left rectus abdominis	8.20	14	32.0	19
4	The right rectus abdominis	6.0	21	15.5	23
5	Left gluteus maximus	12.2	7	105.3	3
6	The left femoral two biceps	41.4	1	226.0	1
7	Right gluteus maximus	6.4	20	65.4	7
8	The right stock two muscles	10.0	9	28.6	21
9	The left medial vastus muscle	11.6	8	77.5	5
10	The left rectus femoris	8.2	14	59.2	8
11	Left vastuslateralis muscle	8.4	13	33.6	18
12	Left tensor fasciae latae	37.9	2	169.8	2
13	The right vastus medialis muscle	9.1	11	53.1	9
14	The right rectus femoris	6.5	19	41.4	15
15	he right vastus lateralis muscle	7.2	18	38.5	17
16	Right tensor fasciae latae	9.3	10	38.7	16
17	The left half of the semimembranosus tendon	19.8	3	43.5	13
18	The left medial head of gastrocnemius muscle	18.7	4	86.6	4
19	Left lateral head of gastrocnemius muscle	10.0	9	66.1	6
20	Left anterior tibial muscle	7.80	16	28.4	22
21	Right tendon Semimembranosus muscle	4.6	22	13.1	24
22	Right medial head of gastrocnemius muscle	17.2	5	48.3	12
23	Right lateral head of gastrocnemius muscle	7.90	15	30.9	20
24	Right anterior tibial muscle	14.0	6	50.2	11

3 Conclusions and suggestions

3.1 Conclusions

3.1.1 The left shares biceps is contraction of most of the muscle in Chinese Elite Male Taekwondo athletes front splitting technique. Contractility maximal muscle is femoral head two muscle. contraction is the smallest right tendon semimembranosus; The left shares biceps is the muscle with the strongest strength in all of the involved muscles. It followed by the left vastus medialis muscle and the left medial head of gastrocnemius muscle. The smallest is the right rectus abdominis muscle.

3.1.2 In the front splitting technique of Chinese Elite Male Taekwondo athletes, the first muscles which moves first with strength are the left erector spinae, erector spinae, right and left gluteus maximus, right gluteus maximus and the right femoral head two muscle. They are followed by the left rectus femoris. finally the three muscles which move last with strength are medial head of the left gastrocnemius muscle, the lateral head of the left gastrocnemius muscle and the right half of the tendon semimembranosus muscle; the lasting time of the muscle activity is: the right tibialis anterior muscle fascia lata > Left tensor fasciae latae > left gluteus maximus, the left tibialis anterior muscle and the right half of the tendon semimembranosus are shortest.

3.1.3 In the front splitting technical movement of Chinese Elite Male Taekwondo athletes, the contribution rate of the muscle electromyographic activity is: the left femoral head two muscle comes first; followed by left tensor fasciae latae and the left half tendon semimembranosus; minimum contribution rate is right tendon Semimembranosus muscle. The rates of muscle mobilization were as follows: the left femoral head two muscle

fascia lata >Left tensor fasciae latae> left gluteus maximus > left medial head of gastrocnemius muscle vastus medialis muscle >...>the right rectus abdominis. The mobilization rate of the right rectus abdominis muscle is minimum. It is worth mentioning that among the mobilization rate of the left femoral head two muscle, left tensor fasciae latae and left gluteus maximus, each of them is more than 100%.

3.1.4 Surface EMG technique can be applied in the Taekwondo athletes technical action about the scientific, rational analysis of their actions. At the same time, it will also provide scientific basis and practical reference to the Taekwondo athletes strength training, to some extent improving the efficiency and level of strength training.

3.2 Suggestions

3.2.1 Muscle activity is the manifestation of the strength of muscle and the order of the muscle discharge reflects the sequence of the muscle activity^[2]. In the front splitting technique training, it is necessary to strengthen the stimulation response training of the left erector spinae, erector spinae, right and left gluteus and other muscles.

3.2.2 During the time of final three section in Taekwondo competition, the outcome depends on player's muscular endurance. So it is necessary to strengthen the endurance and strength of the right tibialis anterior muscle, Left tensor fasciae latae and the Left gluteus muscle which are involved in a long time moving.

3.2.3 In strength training of the elite male taekwondo athletes, to strengthen the strength and endurance of left femoral two head muscle, left tensor fasciae latae and the left semitendinosus semimembranosus muscle training is accordance with the goal of the muscles' long time maintenance in the higher contribution rate.

3.2.4 The left femoral two head muscle with maximum contractile capacity, the maximum force and maximum mobilization rate is one of the most important factors for the front splitting technique. So the muscle training should be put in the first place.

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