THE STUDY OF UPPER ARM MUSCLES TRAINING FOR JUDO PLAYERS

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The aim of this study was to find a more efficient way for upper arm muscles training. The participants were twenty university judo team players. They were randomly divided into "experimental" and "control" groups. The experimental group was trained by a new method to give muscles continuous activation. The control group was trained traditionally using a tyre inner tube. The upper arm pull technique of judo was the training movement. The training was last for six weeks, twice a week and two hours per time. Changes of upper arm circumference, maximum arm strength, and electromyogram of upper arm muscles were compared to evaluate the effects. All data were analyzed by SPSS. The results showed that continuous impact muscle training was more effective for both muscle strength and explosive power training. The results of this study could be used in practical muscle training programs.

KEY WORDS: upper arm muscles, muscle strength, explosive power.

INTRODUCTION: Muscle strength often plays a major role in athletic performance. Muscle power is produced by strength and speed (Power = Force × Velocity); therefore, strength, velocity, and power can be considered as the most important parts of the athlete's performance. Increasing strength and velocity can enhance explosive power. Power is a result of strength (Force) × velocity. Strength and velocity can be enhanced by weight training, resistive exercise or plyometric training, etc. (Westcott, 1987). To enhance explosive power, procedures and/or methods should be used that stimulate and speed up muscle contraction and produce the greatest power. Muscle strength must be stimulated as much possible during training to obtain maximum contraction. In addition, muscle strength training would be more effective while the training movements are similar to the movements during competition. Generally, muscle movement consists of concentric and eccentric contractions, thus producing the power required in exercise and athletic competition. Furthermore, the upper arm muscle group's strength and explosive power are an important element in many competitive sports (Lu, 1992). Athletes with better muscle strength and explosive upper arm power would take advantage. The strength, endurance, explosive power, and reaction of the muscles are essential in judo. According to many studies, eccentric contraction training works well for the promotion of muscle strength and has an excellent reputation in many countries. The most popular way to develop the upper arms muscles strength of judo players is by tyre inner tube training. Its effect has been well recognized and highly recommended by professional judo coaches. However, the best way of enhancing explosive power is to increase both muscle strength and speed. Maximal explosive power is formed from rapid concentric and eccentric contractions of the muscles (Sale, 1986). An inner tube's limited extension slows down the speed of the training movement (Elliot, 1989), slowing down the speed of contractions (Wilson, 1993). Therefore, it does not fit the pattern of creation maximal explosive power. A better way of training using a different method would seem to be indicated. This study attempts to examine the effects of inner tube training in comparison to training with a new method.

METHODS: The 20 participants in the study were university judo team members. They were randomly divided into two groups: (1) The experimental group: 10 participants (19.5 ± 0.53 years) were trained using a new type of continuous impact training method (Figure 1); and (2) The control group: 10 participants (21.4 ± 0.70 years) were trained using the inner tube of motorcycle tyres (Figure 2). The training movement was the upper arm pull technique of judo. The movement focuses on strength and explosive power of the upper arms. Each group was trained twice per week for six weeks, with each session lasting two hours. All the participants were tested by measurement of upper arm circumference, tennis ball throwing distance and maximum strength of the upper arms (Figure 3) before and after the experiment in order to find out the differences and efficiency of 2 training methods. All the data were analysed by SPSS ($\alpha = 0.05$).

Figure 1. Continuous impact method for the experimental group (left). Motorcycle tyre inner tube method for control group (right).

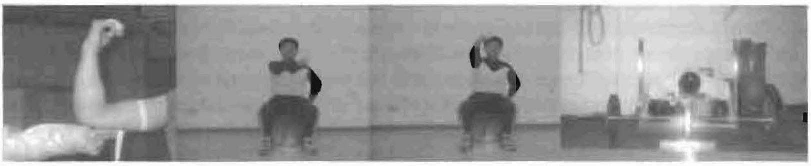

Figure 2. Upper arm circumference, tennis ball throwing, and maximum strength of upper arms.

This study used Bio Pac, tensiometer, and electromyogram (EMG) to record the tension variations and the contraction of the muscles of the upper arms including the biceps brachii, triceps brachii, anterior deltoid, and posterior deltoid (Figure 4). The original muscle strength data were then converted into integrated electromyograms (IEMG) by Acknowledge software so as to observe the change of muscles by the reading (Figure 6.7).

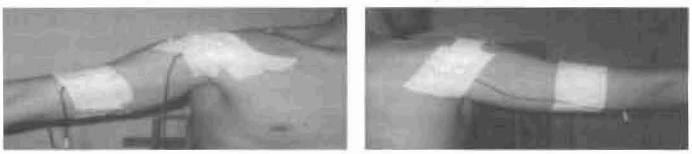

Figure 3. Upper arms muscles and EMG.

RESULTS AND DISCUSSION: There were significant increases in the explosive power of the right arm muscle and the maximum strength of the upper arms after training using the continuous impact method. There were no significant increases in explosive power or maximum strength of the upper arms after training by the tyre inner tube method.

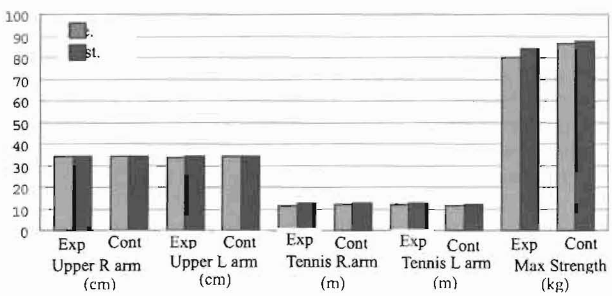

Figure 4. Training efficiency parameters comparison.

The circumference of the upper arms, tennis ball throwing distances, and maximum strength of the upper arms were all improved after training in both the experimental and the control groups. Both groups made progress according to the average parameters measured before and after the experiment (Figure 5). The results show that the new method was effective in enhancing both explosive power and maximum strength of the upper arm muscles. These results are same as found by Ho (2000). However, the results also show that there was no significant progress made by the two groups. Yet the progress of the experimental group was more than the control group as indicated by the percentage increase in progress (Table 1).

Table 1. Student's t-test analysis of training efficiency.

		EXPERIMENTAL GROUP		CONTROL GROUP		T VALUE	P VALUE
		M ± S.D.	Progress Value (%)	M ± S.D.	Progress Value (%)		
Upper Arm Circumference	R	0.23 ± 0.51	0.6	0.02 ± 0.48	0.1	0.942	0.359
	L	0.17 ± 0.41	0.5	0.15 ± 0.85	0.5	0.66	0.948
Ball Throwing	R	1.01 ± 1.31	10.5	0.70 ± 1.40	7.0	0.486	0.633
	L	0.73 ± 1.63	8.1	0.98 ± 1.56	9.6	-0.347	0.732
Maximum Strength		3.75 ± 3.77	4.6	1.05 ± 9.75	1.4	0.816	0.431

According to Figures 6 and 7, the results showed:

(1)Timing: The experimental group took an average of 0.39 seconds to finish a cycle, while the control group took 0.32 seconds (Table 2). Nevertheless, it should be noted that extensions continued during the entire cycle for the experimental group, but for the control group, extensions only occurred during the first half of the cycle, with contractions during the second half. This means that the control group's muscles were only trained for half the cycle,

(2) Electromyogram: T e EMG reading for the posterior deltoids of the experimental group was significant higher than the control group. There were non-significant differences in the EMG reading for the biceps brachii or anterior deltoids between the experimental and control groups. (Table 2) The EMG reading indicate that the continuous impact training method worked more efficient than the tyre inner tube method for the development of explosive power.

Table 2. EMG t-test.

	Experimental Group M±S.D.	Control Group M±S.D.	t-value
Biceps brachii(volt)	0.053 ±0.034	0.041 ±0.016	0.918
Triceps brachii(volt)	0.098 ±0.046	0.125 ±0.047	-1.142
Anterior deltoid(volt)	0.106 ±0.014	0.120 ±0.019	-1.667
Posterior deltoid(volt)	0.338 ±0.030	0.183 ±0.021	11.819*
Movement time(sec)	0.3915 ±0.136	0.3167 ±0.082	

(3) Tension: According to the EMG reading, muscle activity and contraction time of the experimental group were higher and longer than the control group. The lower activity and shorter contraction times meant higher resistance in the muscles and weaker explosive power. Therefore, the training using the tyre inner tube method did not work as well as training using the continuous impact method.

The number of tension peaks for the experimental group was determined by the number of balls that passed through the central hole, with the height of the peaks dependent upon the diameter of the hole. Only one tension peak occurred for the control group for a greater period of resistance for the longer inner tube. The agonist muscles (triceps brachii and posterior deltoids) of the experimental group worked stronger than the antagonist muscles (Figure 6). The agonist muscles of the control group contracted before the pulling tension occurred, then relaxed after the peak tension occurred (Figure 7). The inner tube became resisted while it was pulled, so resistance in the anterior deltoids became stronger to allow the participant to keep his balance while pulling. Resistance for the continuous impact training method occurred when the balls rubbed against the hole. The new method should produce greater explosive power than the inner tube, since resistance is discontinuous then the muscles can keep to offer strength while the resistance is paused.

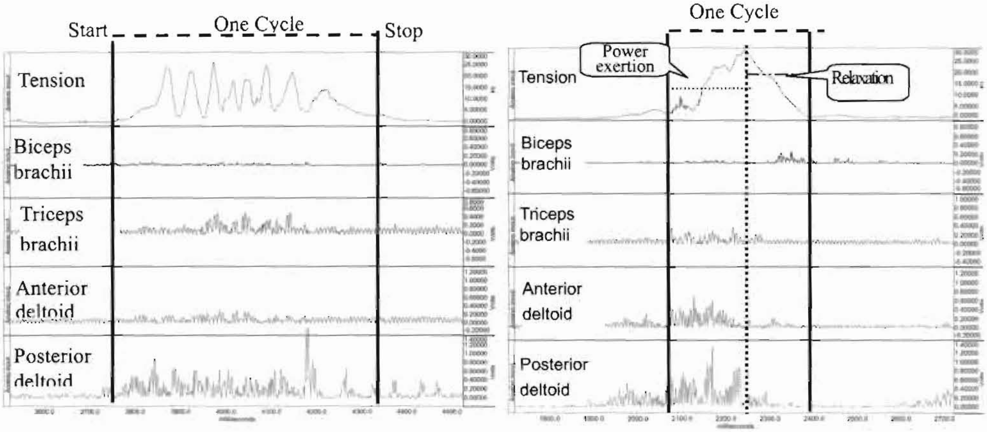

Figure 6. Pulling tension and EMG signals of four upper. Pulling tension and EMG signals of four upper arm muscles for experimental group arm muscles for control group.

CONCLUSIONS: Tyre inner tubes have been used for strength development and explosive power training in many athletic disciplines. This method is also very popular and has a recognized reputation in training of judo athletes. While it seems quite good for training muscle endurance and strength, according to the pattern of muscle contraction and training principles it is not ideal for explosive power training. A new method must be developed that more closely matches the basic training principles for increasing explosive power, while using movements that mimic movements used during competition. The continuous impact training method was designed based on the principle of producing explosive power (Power = Force × Velocity). The effectiveness of the continuous impact method has been proved by several previous studies (Crowed, 1993; Liu, 1998; Ho, 2000). According to this study, the continuous impact method worked the muscles of upper arms in a manner that better matches the principle of producing explosive power. We can say that the continuous impact method is more efficient, and works better for explosive power training than the traditional tyre inner tube method. However, some results were non-significant. Since the training period for this study only lasted six weeks at four hours per week, future studies should consider extending the experiment time in an attempt to obtain more significant results in the enhancement of explosive power with the continuous impact training method.

REFERENCES

Elliot, B.C., Wilson, G.J., & Kerr, G.K. (1989). A biomechanical analysis of the sticking region in the bench press. *Medicine and Science in Sports and Exercise*, **15**, 455-460.

Ho. H.C (2000). *A Study of Chen's Power Machine for the Training of Upper's Strength and Power.* Institute of Coaching Science, NCPES.

Lu S.S. (1992). The Relationship between Upper Body Anaerobic Power and Muscle Strength in Elite Wrestlers, *Journal of Physical Education and Sports.* Vol. **2**, No. **2**, 233-242.

Sale, D. G. (1986). Neural adaptation in strength and power training. In Jone, N. L., *Medicine Science and Sports*, **6**, 253-259.

Westcott, W.L. (1987). *Strength fitness: Physiological principles and training techniques.* Boston: Allyn and Bacon.

Wilson, G.J., Newton, R.U., Murphy, A.J., & Humphries, B.J. (1993). The optimal training load for the development of dynamic athletic performance. *In. J. Sport Biomechanics*, **5**, 390 - 402.