A STUDY ON THE EFFECTS OF ACUPUNCTURE ON THE EXPLOSIVE POWER OF SHOULDER JOINT ABDUCTION AND ADDUCTION IN FEMALES

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The purpose of this study was to investigate the effects of acupuncture on the power of the shoulder joint muscles. Twenty healthy female college students performed 5 times adduction and abduction tests on the shoulder muscles at a constant speed of 60 °/s before and after acupuncture. In this study, kinetic data was analyzed by the CON-TREX isokinetic test training system. The results showed that the acupuncture shoulder muscles in the meridians of the Zhongfu, Tianfu, Binao, Xiabai, Jianliao, Naohui, and Xiaoluo acupoints for 15 minutes can improve the muscle bursting power of the muscles in the acupoints. As a result, acupuncture can be used as an auxiliary method to enhance the explosive power of athletes. Different acupoints should be selected according to the muscle groups needed for different sports in order to improve athletic performance.

KEYWORDS: isokinetic, muscle stimulation, athletic performance.

INTRODUCTION: Acupuncture is a widely used method of treating diseases that restores body balance, prevents and treats diseases (Vincent & Richardson, 1986). Acupuncture has many benefits and has been used to treat many painful diseases (Madsen, Gøtzsche, & Hróbjartsson, 2009) and to improve the overall state of health (Tian, Zhai, Gao, Chen, & Wang, 2017). In recent years, more and more people have been seeking treatment with traditional Chinese medicine and acupuncture because of its curative effect, safety, and relatively low incidence of side effects (Ai, Liu, Luo, & Yang, 2017; Lund & Lundeberg, 2016). Acupuncture is becoming more and more popular in the international community (Ai et al., 2017; Wu, 2016). In recent years, acupuncture has been used to regulate the health of athletes (Shihang, Eungpinithpong, Jumnainsong, & Rattanathongkom, 2017). Acupuncture therapy using special acupoints can enhance parasympathetic activity (Carpenter et al., 2010; Shihang et al., 2017) and reduce fatigue (Li, Wang, Mak, & Chow, 2005). Acupuncture therapy can also promote recovery in long-term, high-intensity training and is an effective means of training recovery (Shihang et al., 2017). Acupuncture may be used in all aspects of exercise to improve athletic performance.

Electrical stimulation has a significant impact on the frequency of muscle contraction and can be used for muscle strength training in exercise training programs, so it can be used as a complementary technique for muscle strengthening (Dehail, Duclos, & Barat, 2008; Dreibati, Lavet, Pinti, & Poumarat, 2010). The use of muscle stimulation can help enhance the explosive power of the shoulder joint muscles.

There is a correlation between the stimulation of acupoints and the characteristic activities occurring on multiple levels of the brain, cerebellum, and the limbic system (Mucha, Ambroży, & Mucha, 2017) which can produce a sensory response to the stimulation (Hui et al., 2005). However, research on the explosive power of the shoulder joint muscle after acupuncture is still relatively rare. Therefore, the purpose of this study was to use isokinetic
instruments to measure the effect of acupuncture on the explosive power of shoulder joint abduction and adduction.

**METHODS:**

**Participants:** A total of 20 healthy female college students (18.5≤BMI≤24) from Jilin Sports Institute were recruited, with an average age of 20.71±1.69 years old, weight of 57.6±5.8 kg, and height of 164.05±4.39 cm. The primary arm of all subjects was the right arm, no fainting experience, no history of right arm injury, and no strenuous exercise. There were no abnormal symptoms in the test. Informed consent was signed by each participant. This study was approved by the Jilin Provincial Sports Ethics Committee (JLSU-IRB no. 2018006).

**Research design:** Each subject was required to complete the isokinetic muscle strength test of the shoulder joint muscles before and after acupuncture. The full shoulder adduction (Add) and abduction (Abd) performed 15 times with a speed of 60°/s. The pre-test is Pre and the post-test are in post. A constant velocity device (CON-TREX MJ, Zurich, Switzerland) was applied to the upper arm of the subject. The subject’s initial posture was set with a 90 degree abduction of the shoulder. The forearm was in a neutral position and the shoulder was at 90 degrees from the horizontal plane. The axis of rotation of the device was aligned with the anatomical axis of the shoulder. The upper arm was secured to the unit by a strap. First, after warm up, the subjects performed five complete adduction and abduction tests of the shoulder muscles at a constant speed of 60°/s. The final angle was used as the maximum motion boundary range. Second, subjects underwent acupuncture therapy. The selected acupoints were Zhongfu (LU1), Tianfu (LU3), Binao (LI14), Xiabai (LU4), Jianliao (SJ14), Naohui (SJ13), and Xiaoluo (SJ12) (Figure 1). Acupuncture was performed lifting, thrusting, swirling and rotating for 15 minutes with a 0.25 mm x 40 mm disposable stainless steel needle. Subjects then performed five complete abductions and adductions at a speed of 60°/s. Kinematics (angle, speed) and dynamics (torque) were recorded during constant speed and manual measurements.

![Figure 1: Acupuncture points](https://commons.nmu.edu/isbs/vol37/iss1/101)

**Statistical Analysis:** Statistical analysis was performed using SPSS® Software Version 22 (SPSS Inc., Chicago, IL, USA). Test values before and after acupuncture were compared using the paired t-test. The maximum torque (Nm), maximum average torque (Nm), average work volume (J), and average power (W), of the adductor and abductor muscles of the shoulder joint were selected as indicators. Differences were considered significant with a p value < 0.05.

**RESULTS:** In this study, data were collected through the use of an isokinetic dynamometer. Results are shown in Table 1. There were significant differences in max torque adduction, work average adduction, work volume adduction, work volume abduction, power average adduction and power average abduction before and after acupuncture. The max torque adduction increased following acupuncture (+Δ70%, p<0.001). The average work adduction increased following acupuncture (+Δ13%, p<0.001). The average work abduction increased following acupuncture (+Δ43%, p<0.001).
increased from increased following acupuncture (+Δ69%, p<0.001). The average work volume adduction was increased from following acupuncture (+Δ70%, p<0.001). The average work volume abduction was increased from following acupuncture (+Δ80%, p=0.002). The Average Power adduction was increased from following acupuncture (+Δ58%, p<0.001). The Average Power abduction was increased from following acupuncture (+Δ67%, p=0.002). There was no significant difference in average max torque abduction and average work abduction (Table 1).

### Table 1: Isokinetic muscle force parameters before and after acupuncture

<table>
<thead>
<tr>
<th></th>
<th>Pre60°/s</th>
<th>Post60°/s</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Average max Torque Add (Nm)</td>
<td>29.25</td>
<td>7.12</td>
<td>41.29</td>
</tr>
<tr>
<td>Average max Torque Abd (Nm)</td>
<td>-15.47</td>
<td>24.61</td>
<td>-7.21</td>
</tr>
<tr>
<td>Average Work Add (Nm)</td>
<td>24.11</td>
<td>7.17</td>
<td>34.94</td>
</tr>
<tr>
<td>Average Work Abd (Nm)</td>
<td>-19.57</td>
<td>7.28</td>
<td>-12.39</td>
</tr>
<tr>
<td>Average Work volume Add (J)</td>
<td>28.45</td>
<td>10.08</td>
<td>40.17</td>
</tr>
<tr>
<td>Average Work volume Abd (J)</td>
<td>25.08</td>
<td>8.47</td>
<td>31.26</td>
</tr>
<tr>
<td>Average Power Add (W)</td>
<td>19.69</td>
<td>8.58</td>
<td>33.91</td>
</tr>
<tr>
<td>Average Power Abd (W)</td>
<td>15.94</td>
<td>6.16</td>
<td>23.78</td>
</tr>
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Note: Difference were considered significant when p<0.05.

**DISCUSSION:** There were significant improvements in the measurements of the adductor muscles of the shoulder joint after acupuncture. Although maximum torque of the abduction muscle group improved after acupuncture, it was not significant. This may be due to the acupoints selected. The main muscles of the shoulder joint are the pectoralis major, latissimus dorsi, teres major, and deltoid. The main abductor muscles of the shoulder joint are the deltoid (middle bundle) and the supraspinatus (Kronberg, NÉmeth, & Broström, 1990). The acupoints selected in this study included Zhongfu (LU1) which corresponds to the pectoralis major and pectoralis minor muscles, Tianfu (LU3) located at the biceps, Xiabai (LU4) located at the radial edge of the biceps, Binao (LI14) located at the lower end of the deltoid, Jianliao (SJ14) located at the deltoid (posterior) and the small round muscle, and Naohui (SJ13) located between the long and lateral head of the triceps and Xiaolu(SJ12) located Triceps muscle belly. Therefore, it can be speculated that the degree of muscle activation can be related to the selected acupoints. Acupuncture can effectively stimulate the muscles around the acupoints. Past research has shown that electrical stimulation can be used in muscle strength training in athletic training programs, and that muscles are stimulated by direct electromyographic stimulation (Dehail et al., 2008; Dreibati et al., 2010). Therefore, acupuncture is an effective way to stimulate muscles. We can speculate that the specific acupoints used in acupuncture help to increase the maximum torque and maximum average torque of the muscles around this position and improve the explosive power of the shoulder joint muscles.

In this study, the average power of the shoulder abduction and adductor muscles significantly improved after acupuncture. The change in average power is related to work load and cycle time. Effective acupuncture has been shown to stimulate muscles to increase movement speed (Yoshihiro, 2016). Acupuncture stimulation enhances work efficiency by driving muscle strength, and the average work volume of shoulder muscles significantly increased. In the past, research on the effect of acupuncture on the tension and contraction of the elbow flexor indicated that acupuncture stimulation may affect muscle strength and explosiveness (Kaneko, Furuya, & Sakamoto, 2012). Acupressure has been shown to stimulate the Zusanli point, which increases the explosive power of the lower limbs (Mucha et al., 2017). Our results showed that acupuncture effectively increases the average work of muscles.
CONCLUSION: After acupuncture stimulated the acupoints of the forearm muscles, the maximum torque, maximum average torque, average work volume, and average power of the subjects all improved significantly. The acupoints selected in this study were Zhongfu (LU1), Tianfu (LU3), Xiabai (LU4), Binao (LI14), Jianliao (SJ14), Naohui (SJ13), and Xiaolu (SJ12) which are concentrated on the adduction and abduction muscles of the shoulder joint. Our results confirmed that the explosive power of the muscles associated with adduction and abduction significantly improved after acupuncture. The results of our study suggest that acupuncture may be used as an auxiliary technique to improve muscle explosiveness and athletic performance. However, different acupoints should be selected according to the muscle groups needed for different sports in order to improve athletic performance. May be used in weightlifting or weight training.

REFERENCES


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