EFFECTS OF ACUPUNCTURE ON ENDURANCE OF SHOULDER JOINT ABDUCTION AND ADDUCTION IN WOMEN

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The purpose of this study was to investigate the effects of acupuncture on the endurance of shoulder joint abduction and adduction in women. We used isokinetic instrument to measure the shoulder muscles endurance. The Zhongfu, Tianfu, Binao, Xiabai, Jianliao, Naohui, and Xiaoluo were selected. The paired t-tests were used to compare pre and post. There was a significant difference in average max adduction torque, average adduction / abduction work, average adduction / abduction power, adduction / abduction total work, and total work (adduction + abduction). The increase in the measured torque after needle correction may be due to the phenomenon of de qi in the muscles near the shoulder joint, which increases the speed of muscle fiber conduction. Therefore, acupuncture can increase muscle endurance by stimulating the nerves and muscles.

KEYWORDS: torque, work, speed, isokinetic

INTRODUCTION: Acupuncture originated in China about 2,500 years ago (Ahmedov, 2010). It is used to treat low back pain and neck pain, rotator cuff tendinitis, and shoulder pain (Batra, Chari, & Negi, 1985; Pathmann, 1980; Wang, 1995; Zhang, 1991) and thus, enhance the performance of a professional or amateur athlete (Akimoto et al., 2003; Dhillon, 2008; Huang et al., 2007). Acupuncture is a Chinese medicinal technique based on the principle of meridian energy balance. It is an “external treatment,” involving meridians and acupuncture points and application of needling techniques. It aims to restore the balance of the body and prevent and treat diseases (Vincent & Richardson, 1986). In 1979, the World Health Organization presented a list of 43 diseases that can be treated or managed by acupuncture. Therefore, acupuncture will not only disappear with the passage of time but have more treatment methods. The efficacy of acupuncture is widely known both in China and across the world. Previous studies have reported that laser acupuncture significantly improves wrist pain during radial deviation and ankle joint pain, and reflexology can effectively increase range of motion (ROM) and improve pain of the ankle joint (leading to pain-free ROM) (Sedky Adly, Sedky Adly, Sedky Adly, & M. H. Serry, 2017). Therefore, laser acupuncture can provide proper relaxation and increase joint freedom. Previous studies have reported that increased joint range of motion improves athletic performance (Poole, Glenn, & Murphy, 2007; Tiran, 2010). The subjective ratings of physical well-being of athletes during the competition period were significantly improved, especially with respect to muscle tension and fatigue (Miyamoto et al., 2003). Acupuncture treatment improves the physical well-being of elite football players (Akimoto et al., 2003). Therefore, the athletic performance of the players may be improved. Previous studies have indicated that the profile of mood state scores during the game showed that the control group had higher mental fatigue than the acupuncture group. The acupuncture group showed a decrease in fatigue score during the competition, indicating that acupuncture treatment has a better effect on the mood status. Therefore, acupuncture treatment has a beneficial effect on the physical and mental conditions of elite female football players in sports competitions (Akimoto et al., 2003). The mechanism of acupuncture may involve generation of motor-evoked potentials that stimulate neurons, thus, stimulating the surface of the skin to induce limb reflex (Maioi, Falciati, Marangon, Perini, & Losio, 2006). Therefore, this study aimed to investigate the effect of acupuncture on muscle endurance during shoulder abduction and adduction after
acupuncture. An isokinetic force instrument was used to determine the changes in torque, work, power, and speed of the shoulder muscles after acupuncture.

**METHODS**: Eighteen healthy female subjects (mean ± SD, age, 20.71 ± 1.69 years; body mass, 57.6 ± 5.8 kg; and height, 164.05 ± 4.39 cm) were recruited. These subjects were students from Jilin Sport University. The inclusion criteria were as follows: dominant right arm; age ≥ 18 years; no current musculoskeletal injuries; no acupuncture treatment within the past year; absence of cognitive, language, visuospatial, or attention deficits that could prevent the subjects from following experimental procedures; and no history of muscle disease. A total of 18 patients who met the aforementioned criteria and provided written informed consent were included in the final analysis performed in this study. This study was approved by the Ethical Committee of Jilin Sport University (JLSU-IRB no. 2018007).

An isokinetic device (CON-TREX MJ) was applied to the subject’s upper arm. The subject’s initial posture was as follows: the shoulder was abducted at 90°; the forearm was in the neutral position; and the shoulder was positioned at 90° in the horizontal plane. The rotation axis of the device was aligned to the anatomical axis of the shoulder. The upper arm was fastened to the device using straps.

In the first step, after warm-up, the full shoulder adduction (Add) and abduction (Abd) performed 15 times with a speed of 180°/s. The ROM boundaries are set before strength testing commences. In the second step, the subject was exposed to acupuncture therapy. The seven acupuncture point of Zhongfu (LU1), Tianfu (LU3), Binao (LI14), Xiabai (LU4), Jianliao (SJ14), Naohui (SJ13), and Xiao Luo (SJ12) were selected (Figure 1). A stainless needle (0.25 × 40 mm) was then inserted into the appropriate acupuncture point; the needle remained in place for 15 min and was rotated at 2, 5, and 10 min after insertion. In the third step, full shoulder abduction and adduction was performed lifting, thrusting, swirling and rotating for 15 minutes 15 times at a speed of 180°/s (Figure 2). The kinematic (speed) and kinetic (torque) parameters were recorded during isokinetic instrument. The pre and post last time repetition were used for analysis. Statistical analysis was performed with SPSS® software version 22 (SPSS Inc., Chicago, IL, USA). Paired t-tests were used to compare pre- and post-acupuncture. Significance was set at a P-value < 0.05.

![Figure 1: Acupuncture points.](image1.png)

![Figure 2: Experimental procedure.](image2.png)

**RESULTS**: There was a significant difference in average max torque Add, average work Add/Abd, average power Add/Abd, total work Add/Abd, and total work (Abd + Add). The average max torque adduction increased following acupuncture (+Δ62%, p<0.001). The average Work adduction increased following acupuncture (+Δ59%, p<0.001). The average Work abduction increased following acupuncture (+Δ68%, p<0.001). The average Power adduction increased following acupuncture (+Δ69%, p<0.001). The average Power abduction
increased following acupuncture (+Δ59%, p<0.001). The total Work Add abduction increased following acupuncture (+Δ58%, p<0.001). The total Work Add abduction increased following acupuncture (+Δ67%, p<0.001). The total Work (Abd + Add) increased following acupuncture (+Δ62%, p<0.001). There was no significant difference in average max torque Abd and average max speed Add/Abd (Table 1).

**Table 1: Comparison of the results of isokinetic abduction and adduction characteristics before acupuncture and after acupuncture**

<table>
<thead>
<tr>
<th></th>
<th>Pre Mean (SD)</th>
<th>Post Mean (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average max Torque Add (Nm/kg)</td>
<td>0.37 (0.12)</td>
<td>0.59 (0.15)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Average max Torque Abd (Nm/kg)</td>
<td>-0.29 (0.17)</td>
<td>-0.34 (0.28)</td>
<td>0.278</td>
</tr>
<tr>
<td>Average Work Add (J/kg)</td>
<td>0.45 (0.21)</td>
<td>0.76 (0.20)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Average Work Abd (J/kg)</td>
<td>0.43 (0.20)</td>
<td>0.63 (0.19)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Average Power Add (W/kg)</td>
<td>0.27 (0.09)</td>
<td>0.39 (0.10)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Average Power Abd (W/kg)</td>
<td>0.19 (0.09)</td>
<td>0.32 (0.07)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Average max Speed Add (/s*kg)</td>
<td>1.04 (0.09)</td>
<td>1.08 (0.11)</td>
<td>0.069</td>
</tr>
<tr>
<td>Average max Speed Abd (/s*kg)</td>
<td>-1.04 (0.09)</td>
<td>-1.07 (0.10)</td>
<td>0.095</td>
</tr>
<tr>
<td>Total Work Add (J)</td>
<td>126.52 (56.07)</td>
<td>217.98 (58.61)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Total Work Abd (J)</td>
<td>120.84 (55.49)</td>
<td>180.14 (52.77)</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Total Work (Abd + Add) (J)</td>
<td>247.36 (108.00)</td>
<td>398.11 (101.42)</td>
<td>P &lt; 0.001</td>
</tr>
</tbody>
</table>

Note: Difference were considered significant when p<0.05.

**DISCUSSION:** Based on isokinetic test results, previous studies have reported that the application of acupuncture (acupuncture point True ST.36) in young football players increased knee extension and flexion strength and significantly increased peak torque (Ozerkan et al., 2007). The acupuncture points used in this study were Zhongfu (LU1), Tianfu (LU3), Binao (LI14), and Xiabai (LU4). These acupuncture points are muscles near the shoulder joint. Therefore, increasing the joint torque, previous studies have shown that athletes can rely on increased muscle fiber conduction velocity to produce higher torque (Quinzi, Camomilla, Felici, Di Mario, & Sbriccoli, 2013; Sbriccoli et al., 2010). It is possible to increase the speed of muscle fiber conduction through needle correction. The related physiological reaction phenomenon after acupuncture is called "de qi." After de qi, torque and muscle strength of the upper and lower extremity can increase (Kwon, Lee, Park, & Hahm, 2017). In this study, the increase in the measured torque after needle correction may be due to the phenomenon of "de qi" in the muscles near the shoulder joint, which increases the speed of muscle fiber conduction. Therefore, shoulder joint torque, power, and total work increase after acupuncture.

Previous research has reported that acupuncture has an effect on exercise performance, such as for football players, and found that acupuncture can significantly improve exercise muscle strength (Ozerkan et al., 2007). Through animal experiments, it is proved that acupuncture can improve muscle endurance and has an anti-fatigue effect (Liu, Liang, Zeng, & He, 2009). Studies have also shown that forearm massage can effectively improve muscle endurance (Molouki, Hosseini, Rustaee, & Tabatabaei, 2016). Stimulating muscles and nerves can increase muscle endurance. After 15 times of repeated abduction and adduction after acupuncture, average max torque Add, average power Add/Abd, and total work Add/ Abd improved, thus improving muscle endurance.

**CONCLUSION:** The results show that acupuncture stimulates the nervous system near the shoulder joint, stimulating the muscles near the acupuncture points to increase joint work and power. Therefore, acupuncture treatment can increase muscle endurance by stimulating the nerves and muscles. These findings also provide clinical value in the rehabilitation of patients with neuromuscular diseases. Acupuncture stimulation on female subjects significantly improved muscle endurance. Acupuncture stimulation had no side effects and did not cause excessive musculoskeletal damage. Acupuncture may be used in competitive in the future.
REFERENCES


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