

The effects of spinal mobilization with arm movements on shoulder muscle strengthening

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Abstract. [Purpose] This study was performed to examine the immediate effects of spinal mobilization with arm movements (SMWAMs) for strengthening the shoulder muscles. [Subjects] The subjects of this study were 12 healthy male students who were studying at S University, Busan City. They had no musculoskeletal disease, or upper congenital malformation, and had no history of surgery or neurological disease. [Methods] The SMWAMs were performed on the 4th cervical vertebra (C4). For stimulation of the 5th cervical nerve, the spinous process of the C4 was pushed to the left and held in place. Then the arm was abducted to the point where spinous process was felt, and the range of abduction was examined. Subsequently, the abduction movement was repeated 10 times to the same point, and the gliding of C4 was held until the arm returned to the starting position. During the treatment, the head and the trunk were held in the correct posture. [Results] After SMWAMs had been performed, the muscular strength of shoulder flexion, extension and adduction significantly increased. [Conclusion] In our opinion, the SMWAMs are a very useful method for correcting spinal malalignment, and for stimulating the joint mechanoreceptors without the risks of manipulation. SMWAM is a valuable therapy method that can complement the demerits of mobilization.

Key words: Spinal mobilization with arm movement (SMWAM), Muscle strengthening, Manual therapy

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INTRODUCTION

Physical therapy is the treatment of pain and functional disorders caused by diseases or injuries, using physical manipulation and exercise. Physical therapy can be divided into two areas: one is therapy using equipment, and the other is manual therapy, using the bare hands of a therapist to perform examinations and treatment¹⁾. In physical therapy, more interest is generally given to manual therapy approaches performed by the hands of the therapist, which do not rely on equipment modality.

Manipulation is effective for correction of disc protrusions of the spine, correction of dysfunction of facet joints, mobilization of closed vertebrae body joints, decrease of compression of nerve roots, normalization of reflexes, and the release of muscle tension²⁾. Martínez-Segura et al.³⁾ performed a study of 25 men and 45 women who had been experiencing cervical pain in order to compare the effects of manipulation and spinal mobilization. They reported that cervical pain was reduced more quickly by manipulation than by spinal mobilization, and that the range of joint motion increased. Hence, manipulation is more effective than

spinal mobilization for reducing cervical pain and increasing range of joint motion. However, Gotlib and Thiel⁴⁾ asserted that cervical manipulation can cause neurologic complications and other cervical injuries. However, Byfield⁵⁾ noted that manipulation is still being used because its benefits outweigh its risks.

Recently, the demand for a new manual technique which addresses the defects and promotes the advantages of spinal mobilization and manipulation has been increasing. In response to this demand, Mulligan⁶⁾ developed “Spinal Mobilization with Arm Movements (SMWAMs)”. This technique is based on the knowledge that when the shoulder girdle moves, the muscles attached to the scapula, cervical vertebrae, and upper thorax cause simultaneous spine movement. This technique combines the advantages and characteristics of spinal mobilization and manipulation to maximize the treatment effect, and it has been demonstrated to be a manual therapy technique which mitigates the defects of both types of treatment⁷⁾. This technique can be easily performed, and one of its advantages is that, if the basic principles are followed faithfully, the treatment can be done safely and effectively.

Generally, spinal mobilization and manipulation are used to relieve pain in the spine⁸⁾. However, some recent studies have shown that spinal mobilization and manipulation have prompt treatment effects on the extremities⁹⁾. Therefore, the purpose of this study was to examine the immediate effects of SMWAMs on the strengthening of the shoulder muscles.

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Table 1. Change of shoulder muscle strength after SMWAMs

Motion	Exercise	Mean ± SD	Mean rank	Rank sum
Flexion*	Pre	22.35±3.44	6.50	13.00
	Post	23.70±2.94	6.50	65.00
Extension*	Pre	21.69±2.73	6.50	13.00
	Post	22.45±2.63	6.50	65.00
Abduction	Pre	19.84±2.62	5.00	25.00
	Post	20.74±2.82	7.57	53.00
Adduction*	Pre	22.10±3.52	2.67	8.00
	Post	23.90±2.42	7.78	70.00

Mean ± SD, *: p<0.05

SUBJECTS AND METHODS

The purpose of this study was to examine the effects of spinal mobilization with arm movements (SMWAMs) on shoulder muscle strengthening. Therefore a pre-post experimental design was used. The subjects of this study were 12 healthy male students who were studying at S University, Busan City. They had no musculoskeletal disease, or upper congenital malformation, and had no history of surgery or neurological disease. All candidates were informed of the purpose of the study and its significance before they voluntarily agreed to participate in the experiment. This study complied with the ethical standards of the Declaration of Helsinki, and written informed consent was received from each participant. The average age of the subjects was 22.4±0.6, their average height was 174.3±1.4 cm, and their average weight was 69.3±2.7 kg.

Before the SMWAMs were performed, the shoulder muscle strength of each participant was measured 3 times. After the SMWAMs, the shoulder muscular strength was measured again 3 times each. A portable strength meter (Manual Muscle System, Lafayette Instruments, USA) that was used for strength measurement which displays the muscle strength value accurately and objectively. It is portable and inexpensive, and can be easily used in clinics^{10, 11)}. Strength measurements were recorded in kilograms (kg). Strength measurement was performed according to Viznik¹²⁾. Each subject sat in an upright position on an adjustable table with both feet touching the ground. In the sitting position, the maximum muscular strength of shoulder flexion, extension, abduction, and adduction were measured. To avoid trunk compensation during the measurement, trunk movement was limited. The average value of three measurements was used. The strength measurements were performed by a physical therapist who had more than 8 years of clinical career experience.

After the preliminary examination, SMWAMs were performed on the 4th cervical vertebra (C4). For the stimulation of the 5th cervical nerve, the spinous process of C4 was pushed to the left and held. Then, the arm was abducted to the point where the spinous process could be felt, and the range of abduction was examined. The abduction movement was repeated 10 times, and the gliding of C4 was held until the arm had returned to the starting position. During the treatment, the head and trunk were held in the correct

posture. The SMWAMs were carried out by a physical therapist with more than eight years of clinical experience, who was certified as an orthopedic professional manual physical therapist by the Korean Academy of Orthopedic Manual Therapy.

To determine whether or not SMWAMs improve muscle strength, Wilcoxon's Signed Rank test was performed, because the Shapiro-Wilk's test showed the data were not normally distributed¹³⁾. The analysis was performed with the statistical analysis program SPSS WIN (ver.21) and a significance level of $\alpha=0.05$.

RESULTS

After the performance of SMWAMs, the muscular strength of the shoulder flexion increased significantly from 22.4 kg to 23.7 kg ($p<0.05$), the muscular strength of the shoulder extension increased significantly from 21.7 kg to 22.5 kg ($p<0.05$), and the muscular strength of shoulder adduction increased significantly from 22.1 kg to 23.9 kg ($p<0.05$).

The muscular strength of the shoulder abduction was increased from 19.84 kg to 20.74 kg, but the difference was not significant (Table 1).

DISCUSSION

Manual therapy is known to be an effective method for reducing pain, increasing range of motion, and posture correction¹⁴⁾. In many cases, manual therapy is performed on the spine to cure spinal problems. However, Schneider¹⁵⁾ noted that limited movement of the shoulder is not only caused by joint problems, but also by pain resulting from cervical nerve compression. Cyriax and Cyriax¹⁶⁾ stated that the reference pain that causes limited movement of the shoulder joint can originate in the neck. They further stated that there is an interrelationship of shoulder joint motion and cervical motion. McClithie et al.¹⁷⁾ reported that performing mobilization of the C5 spinous process resulted in a reduction in arm pain. When mobilization of the neck is performed, it releases the impingement of the ganglion, improving shoulder joint movement that is hampered by a neurologic problem. Wang and Meadows⁹⁾ also reported that the abductor muscle strength of the shoulder joint improved after performing mobilization of the C5–6 joint. Therefore,

this study was performed to examine if SMWAMs treatment of the cervical spine, would affect the shoulder joint.

Generally, the surrounding shoulder muscles are related to the C5 spinal nerve. In normal movement of the shoulder joint, the C5 nerve root undergoes glenohumeral joint abduction and 4 mm of glide in the distal direction at the intervertebral foramen¹⁸. Therefore, if the C4 were restricted, upper extremity movement also would be limited. Consequently, in this study, we selected the C4 segment as the treatment application site. Pikura¹⁹ performed a study of the effects of spinal manipulation on immediate pain decrease and range of motion. He stated that there was an immediate in pain as well as an improvement in decrease range of motion after one treatment. Further, Kanlayaphotporn et al.²⁰ also stated in their study, that after one application of mobilization, 30 people in the experimental group experienced an immediate decrease in pain and an increase in range of cervical motion.

To confirm these previous reports, this study also designed an experiment to investigate whether or not a single application of SMWAM would have immediate effects. We observed significant changes in shoulder flexor, extensor and adductor strength after just one application of SMWAMs. Therefore, we conclude that SMWAMs can improve upper extremity dysfunction. These results are very similar to those reported by McClithie et al.¹⁷ who described how mobilization can correct vertebral joint malalignment and improve alignment of impinged nerves. They also speculated that mechanoreceptors at the joints are stimulated decreasing the pain in the upper extremity. Wang and Meadows⁹ also reported that mobilization can correct joint malalignment and increase the muscular strength of the upper extremity. Likewise, this study also showed that cervical mobilization was effective at increasing the muscular strength of the shoulder. Based on these results, we consider that SMWAM is a very useful method for correcting spinal malalignment and stimulating joint mechanoreceptors without the risks of manipulation. It is a valuable therapy method that eliminates the demerits of mobilization.

Wang and Meadows⁹ reported that the changes in shoulder abductor strength were sustained for 10–20 minutes after the application of mobilization. Hegedus et al.²¹ reviewed several articles about mobilization and concluded that the neurologic changes induced by mobilization do not exceed 5 minutes. In the present study, we only investigated the immediate effects of SMWAMs and did not examine the time course of the effects of treatment. We recommend further studies to investigate the time course of the effects of treatment, and in addition, we recommend further studies to research the effects of the SMWAM technique as it is performed on the patients.

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