



Original Article

Effects of manual therapy on shoulder pain in office workers

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Abstract. [Purpose] The purpose of this study was to determine the effects of manual therapy on shoulder pain in office workers. [Subjects and Methods] Subjects included 38 office workers who were randomly divided into two groups: a manual therapy group of 19 subjects and a shoulder stabilization exercise group of 19 subjects. All subjects underwent evaluation of the pressure pain threshold in the splenius capitis and upper, middle, and lower trapezius muscles on both sides. The manual therapy used in the study was designed to include soft-tissue mobilization, prone thoracic mobilization, prone selected thoracic mobilization, cervical mobilization, and thoracic manipulation. Both groups underwent training of two 40-minute sessions per week for 6 weeks. [Results] After the intervention, both groups showed significantly increased pressure pain thresholds in the splenius capitis and upper, middle, and lower trapezius muscles on both sides. The manual therapy group showed greater improvements than did the shoulder stabilization exercise group in the splenius capitis on both sides, left upper trapezius, middle trapezius on both sides, and right lower trapezius. [Conclusion] The results of this study suggest that manual therapy for shoulder pain is feasible and suitable for office workers and may be useful in clinical rehabilitation.

Key words: Manual therapy, Shoulder pain, Office worker

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INTRODUCTION

Industrialization has led to a rapid increase in the use of information technology (IT) devices. Approximately 90% of white-collar workers use IT devices for more than 4 hours per day¹⁾. Long-term use of computers can cause stability muscle (spine erector) dysfunction and increase trapezius muscle activation, which in turn generates cervical and axillary disorders²⁾, causing shoulder and cervical pain and a decreased pain threshold³⁻⁵⁾.

For normal alignment and movement, the cervical spine and head cooperatively use a combination of flexors (60%) and extensors (40%)⁶⁾. Flexion of the spine for extended periods, such as while using IT devices, weakens the flexors and the serratus anterior, rhomboid, middle trapezius, and lower trapezius muscles because of inhibition. On the other hand, the trapezius, levator scapulae, suboccipital, sternocleidomastoid, and pectoral muscles shorten because of facilitation⁷⁾. Shortened muscles move faster than antagonists, causing upward rotation, protrusion, scapular elevation, and forward head postures⁷⁾.

Hyperactivity of the upper trapezius muscle results in decreased control of the lower trapezius and serratus anterior muscles and is a cause of shoulder pain⁸⁾. Instability of the scapular muscle and abnormal motion are the primary causes of impact syndrome. To prevent this syndrome, recovery of scapular stability and mobility is important⁸⁾. Maintaining a fixed posture long-term can cause cervical and shoulder pain, which is treated with therapeutic exercise, manual therapy, biofeedback, stabilization exercise, electrotherapy, and heat therapy⁹⁾. Stabilization exercise is effective for cervical and shoulder pain¹⁰⁾. Manual therapy is usually applied for cervical pain, low back pain^{11, 12)}, and myofascial pain syndrome¹³⁾, but some researchers have applied it for SCI¹⁴⁾. This therapy alters the neurobiological condition and length of the connective

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tissue, including autonomic and motor nerves¹⁵). In addition, by activating the neural structure, it controls pain and lengthens connective tissues, thereby increasing range of motion. Muscles and connective tissues affect joint form and movement, determine the kinetics of fibrocartilage tissue, and cause limited arthrokinematics by inducing resistance of the ligament, articular capsule, and fascia to the tension and shear force¹⁶). Manual therapy can lengthen connective tissues, thereby increasing movement and controlling pain. The purpose of this study was to determine the analgesic effects of soft-tissue mobilization, thoracic and cervical mobilization, and thoracic manipulation in office workers with shoulder and cervical pain.

SUBJECTS AND METHODS

Subjects included in this study were 38 office workers (19 males and 19 females) who were diagnosed with cervical and shoulder pain and were receiving physical therapy at Seoul H Hospital. The selection criteria were: office workers aged 30–40 years who had shoulder pain (visual analog scale score of >5) and who used IT devices for >8 hours per day. The exclusion criteria were chest pain, dizziness, blood pressure of >160/110 mmHg, and the inability to perform the exercise postures needed, such as the push-up posture. In order to decrease bias, the subjects were randomly divided into a shoulder stabilization exercise group (19 subjects) and a manual therapy group (19 subjects). The general characteristics of the subjects in the experimental group were as follows: 19 office workers (6 males and 13 females), mean age of 36.16 ± 5.53 years, mean height of 168.00 ± 8.10 cm, and mean weight of 57.79 ± 11.34 kg. Meanwhile, the general characteristics of the subjects in the manual therapy group were as follows: 19 office workers (6 males and 13 females), mean age of 35.79 ± 4.10 years, mean height of 167.16 ± 7.33 cm, and mean weight of 60.16 ± 14.23 kg. No significant differences were found between the groups for general characteristics.

The pressure pain threshold (PPT) in the splenius capitis, upper trapezius, middle trapezius, and lower trapezius muscles was measured on both sides for all subjects. Manual therapy and stabilization exercises for the shoulder were performed in two 40-minute sessions per week for 6 weeks. The present study was approved by Sahmyook University Institutional Review Board (SYUIRB2015-014) and the objective of the study and its requirements were explained to the subjects, and all participants provided written parental consent; thus, the rights of human subjects were protected.

For manual therapy, soft-tissue mobilization was applied for 3 minutes on the upper trapezius, levator scapulae, suboccipital, sternocleidomastoid, pectoral, cervical deep flexor, serratus anterior, rhomboid, and middle and upper trapezius muscles. Prone thoracic mobilization, prone selected thoracic mobilization, cervical mobilization, and thoracic manipulation were also applied.

Stabilization exercises for the shoulder joint were designed to correct abnormal scapular location¹⁷), such as by stretching shortened muscles, including the upper trapezius, levator scapulae, suboccipital, sternocleidomastoid, and pectoral muscles. Modified exercise programs developed by Verstegen and Williams¹⁰) and Arolta et al.¹⁸) were used to enhance and increase the stability of the deep cervical flexor, serratus anterior, middle and lower trapezius, and rhomboid muscles. The detailed procedure of the exercise program is as follows:

Stage 1: Stretching of the upper trapezius, levator scapulae, suboccipital, sternocleidomastoid, and pectoral muscles and isometric contraction of the deep cervical muscles were performed. The following postures were used: knee push-up, prone row, modified prone cobra, cow posture, cat posture, cat postures for thoracic mobilization, dead bug, and flank. Each exercise was performed for 10 seconds per session in 10 sets.

Stage 2: Deep cervical flexor isometric contraction exercises, supine row, flank, Y exercise, supine pull, modified cobra posture, thoracic mobilization, and the dead bug posture on a foam roller were performed, each for 10 seconds per session in 10 sets.

The PPT was used to assess the patients' shoulder joint pain using the Wagner Force Ten Digital Force Gauge (Model: FPX 25, 2010) in the splenius capitis and upper, middle, and lower trapezius muscles while the subject was in the neutral prone position. Trigger points were located in the bottom of the mastoid (splenius capitis), the middle of the spinous process of the C7 vertebra and the acromion process (upper trapezius), between the scapular spinae and spinous process at the same level (middle trapezius), and the middle of the inferior angle of the scapula and the spinous process at the same level (lower trapezius). The PPT meter was placed vertically on the skin's surface, and the subjects were instructed to use a vocal signal when the pressure became painful. PPT was measured in kg/cm². The pressure pain meter quantifies pain according to an accurate trigger point for pain and the pressure sensitivity of the muscle. Therefore, the pressure point is put into good use in the management of myofascial pain syndrome¹⁹). The reported intra-rater reliability for PPT was $r=0.85$, and the inter-rater reliability for PPT was $r=0.85$ ²⁰). In this study, we used the mean value of three measurements taken at 30-second intervals.

SPSS 18.0 was used for statistical analyses. The Shapiro-Wilk test was used to determine the patients' general characteristics and subject-related variables. The paired t-test was used to compare pre- and post-test results within each group, and the independent t-test was used to compare the two groups before and after training. P values < 0.05 were considered significant.

RESULTS

Changes in shoulder pain after the interventions are shown in Table 1. Regarding the changes after exercise, the PPT on the right side in the manual therapy group was 5.98 kg/cm² before training and 9.69 kg/cm² after training, showing a

Table 1. Within- and between-group comparisons of shoulder pain (n=38)

Parameters (kg/cm ²)	Values				Change values	
	MTG (n=19)		SSEG (n=19)		MTG (n=19)	SSEG (n=19)
	Before	After	Before	After	Before-after	Before-after
Rt SC	5.98 (2.53)	9.69 (2.60)*	6.14 (2.86)	9.19 (2.62)*	3.71 (0.75)†	3.05 (0.69)
Lt SC	3.07 (0.60)	6.20 (2.80)*	6.39 (2.64)	9.46 (2.60)*	3.69 (0.88)†	3.89 (2.81)
Rt UT	8.12 (4.17)	11.41 (3.76)*	8.42 (3.99)	11.40 (3.92)*	3.29 (0.73)	2.98 (0.67)
Lt UT	8.13 (4.42)	11.55 (3.81)*	9.00 (4.01)	11.70 (3.95)*	3.42 (0.95)†	2.70 (0.79)
Rt MT	8.18 (3.58)	11.96 (3.56)*	10.18 (3.24)	13.07 (3.30)*	3.77 (0.62)†	2.89 (1.01)
Lt MT	8.22 (3.64)	12.06 (3.54)*	10.23 (3.00)	13.19 (3.18)*	3.84 (0.70)†	2.95 (1.05)
Rt LT	8.93 (3.15)	12.76 (3.23)*	9.63 (2.75)	12.70 (2.69)*	3.84 (0.55)‡	3.07 (0.69)
Lt LT	9.27 (3.28)	12.75 (3.24)*	9.77 (2.68)	13.00 (2.58)*	3.47 (0.89)	3.23 (0.78)

Values are expressed as mean (SD). *p<0.001: significant difference within each group; †p<0.05, ‡p<0.001: significant difference between the groups; MTG: manual therapy group; SSEG: scapular stability exercise group; SC: splenius capitis; UT: upper trapezius; MT: middle trapezius; LT: lower trapezius; Rt: right; Lt: left

statistically significant increase of 3.71 kg/cm² (p<0.001). In the scapular stabilization exercise group, the PPT on the right side was 6.14 kg/cm² before training and 9.19 kg/cm² after training, showing a statistically significant increase of 3.05 kg/cm² (p<0.001).

In the manual therapy group, the PPT on the left side was 3.07 kg/cm² before training and 6.20 kg/cm² after training, indicating a statistically significant increase of 3.69 kg/cm² (p<0.001). The PPT in the splenius capitis in the scapular stabilization exercise group was 6.39 kg/cm² before training and 9.46 kg/cm² after training, indicating a statistically significant increase of 3.89 kg/cm² (p<0.001). Significant increases were also observed in the upper, middle, and lower trapezius muscles on both sides in both groups.

The manual therapy group showed greater improvement than did the scapular stabilization exercise group with respect to the PPT in the splenius capitis muscle on both sides, left upper trapezius muscle, middle trapezius muscle on both sides, and the right lower trapezius muscle.

DISCUSSION

Cervical pain is deeply related to cervical and shoulder posture²¹. If scapular stability is poor, the upper trapezius muscle is activated to compensate, which increases scapular elevation. Therefore, stress in the upper trapezius muscle at the cervical level is increased⁷, and muscle activation of the upper trapezius muscle is increased, which in turn increases pain in the cervical spine and shoulder²².

This study focused on the effects of manual therapy and shoulder stabilization exercise on cervical pain in office workers. Both shoulder stabilization exercise and manual therapy considerably increased PPT in the left and right splenius capitis and upper, lower, and middle trapezius muscles (p<0.05) compared to that before the intervention. The left and right splenius capitis, left upper trapezius, left and right middle trapezius, and right lower trapezius muscles showed significant changes. The shoulder stabilization exercises stretched the upper trapezius, levator scapulae, suboccipital, sternocleidomastoid, and pectoralis major and minor muscles, which are shortened by active muscle training in the process of strengthening the deep cervical flexor, serratus anterior, and middle and lower trapezius muscles. Rhomboid shoulder joint stabilization increases, reducing muscle pain. Moreover, active muscle contraction is suspected to increase muscle activation and thereby sustains sensitivity to pain. This result was also reported in a previous study by Liuch et al.²³ that used both passive and active shoulder stabilization exercise. They evaluated pain using a numerical rating scale and the PPT. Active shoulder exercise decreased the numerical rating scale score from 6.9 to 3.7. On the other hand, passive shoulder exercise slightly decreased the score from 6.9 to 5.9. Active stabilization exercise increased the PPT from 8.7 to 10.1 kg/cm² (p<0.05). Cho et al.¹⁷ studied the effect of shoulder stabilization exercises in middle-aged women and found that they increased the women's ranges of motion and muscle strength.

Recently, Baker et al.²⁴ applied typical massage and soft-tissue massage as manual therapy in women aged 25–45 years who complained of cervical pain lasting 3–6 months and evaluated PPT in the sternocleidomastoid on both sides. The typical massage considerably increased the PPT in the right sternocleidomastoid from 14.72 to 15.73 kg/cm² and in the left sternocleidomastoid from 14.44 to 15.81 kg/cm². Soft-tissue massage largely increased the threshold in the right sternocleidomastoid from 13.16 to 13.76 kg/cm² and in the left sternocleidomastoid from 13.52 to 14.64 kg/cm². Thus, that study reported a considerable difference between the two groups, similar to the results in our study.

As previously noted, manual therapy in our study was performed in two 40-minute sessions per week for 6 weeks. The program consisted of soft-tissue mobilization, prone thoracic mobilization, prone selected thoracic mobilization, cervical mo-

bilization, and thoracic manipulation. This manual therapy program is thought to be effective for tissue healing by increasing blood flow. Passively performed manual therapy is considered to decrease sensitivity to pain by applying pressure on muscles and decreasing muscle activity. Therefore, applying manual therapy induces a neurobiological phenomenon and changes the lengths of connective tissues, including autonomic and motor neurons¹⁵). Continuous manual therapy provides an analgesic effect resulting from neural structure activation and increased range of motion from connective tissue lengthening¹⁶).

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