



Original Article

The effects of extracorporeal shock wave therapy on pain and range of motion in patients with adhesive capsulitis

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Abstract. [Purpose] This study examined the effects of extracorporeal shock wave therapy on pain and range of motion in patients with adhesive capsulitis. [Subjects and Methods] Thirty patients with adhesive capsulitis were divided into an experimental group (n=15) that would be treated with extracorporeal shock wave therapy and a control group (n=15) that would be treated only with conservative physical therapy. Both groups were treated three times a week over a four-week period. [Results] An intra-group comparison before and after the treatment showed that both groups experienced a decline in pain and an increase in their range of motion that were statistically significant. An inter-group comparison after the treatment showed that the experimental group had a lower level of pain and a higher range of motion than the control group that were statistically significant. [Conclusion] Extracorporeal shock wave therapy may be an effective intervention for reducing pain and improving the range of motion in patients with adhesive capsulitis.

Key words: Extracorporeal shock wave therapy, Pain, Range of motion

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INTRODUCTION

Adhesive capsulitis creates a great deal of discomfort in a patient's daily life caused by degenerative changes¹⁾ occurring in the rotator cuff, synovial membrane, articular capsule, biceps brachii, and the surrounding tissues. Adhesive capsulitis refers to the occurrence of pain and a gradual decline in the range of motion (ROM) due to slow increases in synovial hypertrophy and the adhesion between the synovial membrane and articular surface. The disease is characterized by a bending of the shoulder joint and a decline in external rotation. It leads to the loss of flexibility and difficulties with the activities of daily living (ADLs) due to chronic inflammation accompanied by intra-articular fibrosis²⁾. While the methods for treating adhesive capsulitis include thermotherapy, cryotherapy, electrotherapy, exercise therapy, and manual therapy³⁾, extracorporeal shock wave therapy (ESWT) has recently drawn great attention as a non-surgical treatment method⁴⁾. This therapy assists revascularization through the application of extracorporeal shock waves to the lesion, and reduces pain and improves function in the shoulder by stimulating or reactivating the healing process of connective tissues, including tendons and bones⁵⁾. While it is currently used for musculoskeletal diseases, such as calcific tendinitis and plantar fasciitis⁶⁾, few studies have focused on its

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Table 1. Comparison of the VAS and ROM within each group

Group		Pre	Post
VAS (cm)	CG	7.9 ± 0.9	6.3 ± 0.9**
	EG	8.0 ± 0.9	2.9 ± 1.0**;††
FROM (degree)	CG	108.4 ± 23.4	112.0 ± 24.3**
	EG	88.3 ± 30.4	147.7 ± 27.1**;††
ERROM (degree)	CG	50.0 ± 15.5	52.2 ± 15.6**
	EG	45.7 ± 10.9	81.3 ± 5.4**;††

VAS: visual analog scale; FROM: flexion ROM; ERROM: external rotation ROM; CG: control group; EG: experimental group; **pair t-test, $p < 0.01$; ††independent sample t-tests, $p < 0.01$

therapeutic effects on adhesive capsulitis. Therefore, the aim of this study is to investigate the effects of ESWT on pain and ROM in patients with adhesive capsulitis.

SUBJECTS AND METHODS

The subjects were 30 patients, aged 50 to 70, who had been diagnosed by their physicians with adhesive capsulitis based on clinical findings and data obtained from such medical devices as x-ray units. The subjects were chosen from among the outpatients at S Orthopedic Clinic in Daegu Metropolitan City. Patients who had neurological diseases, dislocation, subluxation, rheumatism, or had received surgery were excluded. On average, the control group ($n=15$) members were 59.0 ± 4.4 years of age, 163.3 ± 6.6 cm in height, and 61.5 ± 10.0 kg in weight; the experimental group ($n=15$) members were 58.4 ± 4.0 years of age, 163.5 ± 8.1 cm in height, and 65.1 ± 9.6 kg in weight. The study was conducted after its entire process was fully explained to the subjects and their approval was gained. In addition, ethical approval for the study was granted by the U1 University institutional review board.

The control group was treated with a range of conservative physical therapies, including hot packs (20 minutes), ultrasound (5 minutes), and interference current therapy (100 bps, 15 minutes). The experimental group received conservative physical therapy, then was additionally treated with a magnetic ESWT unit (REGENWAVE, HNT Med, Korea). Waves of 4 Hz were applied 1,000 times using a focus-type head and while adjusting the intensity of the energy according to the patients' degree of tolerance to the pain resulting from the treatment. Prior to the treatment, the patient received a physical examination to determine the target region for the accurate delivery of the shock wave energy. All the subjects were treated three times a week over a four-week period.

The visual analogue scale (VAS) was used to evaluate the degree of pain; the shoulder ROM was measured using a goniometer while the patients were in the supine position. To increase consistency, a single rater measured all the subjects' order of bending and external rotation.

For the statistical processing of the data describing the changes in pain and ROM in the patients with adhesive capsulitis, the paired t-test was performed for the intra-group comparison and the independent t-test was performed for the inter-group comparison. The SPSS/PC Version 13.0 software package was used for statistical processing and the statistical significance level was set at $\alpha=0.05$.

RESULTS

The intra-group comparison showed that both groups experienced statistically significant declines in their degree of pain as measured by the VAS score and statistically significant increases in their flexion ROM (FROM) and external rotation ROM (ERROM). The inter-group comparison after the treatment showed that the experimental group recorded statistically significant lower VAS scores and higher FROM and ERROM than the control group (Table 1).

DISCUSSION

Loew et al.²⁾ reported that a three-month follow-up of 20 patients treated with shock waves showed that 70% of the patients experienced notably reduced pain. Rompe et al.⁷⁾ stated that 60% out of the 40 patients with calcific tendinitis of the shoulder fully recovered after a single ESWT. Moreover, Noh et al.⁸⁾ reported that the application of ESWT in patients diagnosed with calcific tendinitis of the shoulder resulted in clinical improvements. In the present study, the experimental group also exhibited a statistically significant decline in their VAS scores. This may have resulted because the fine and repetitive stimulations of shock waves, a type of sound wave that can be transmitted through soft tissues without the loss of energy, generated the effect of suppressing the nociceptors⁹⁾.

Avancini-Dobrović et al.¹⁰⁾ conducted a study in which extracorporeal shock waves were applied to 30 patients with calcific tendinitis of the shoulder and observed the treatment's statistically significant effects on bending, spreading, and

lateral rotation of the shoulder joint. Chen et al.¹¹⁾ noted that after the application of extracorporeal shock waves, the measurement of the ROM in 40 patients with adhesive capsulitis showed statistically significant improvements. In the present study, the experimental group treated with ESWT also exhibited statistically significant improvements in their ROM. This result may have occurred because the therapy reduced pain by causing changes in the metabolism of cells and the penetrability of endothelial tissues¹²⁾. In addition, the ESWT may have stabilized the tissues by stimulating and reactivating the healing process of the tendons and their surrounding tissues by creating new muscle fibers through facilitating the secretion of angiogenic substances around the affected region and increasing blood flow to the region¹³⁾. However, this study involved only a small number of subjects who had visited our hospital over a four-week period. The researcher failed to follow up the degree of recovery of the treated patients beyond four weeks. Therefore, further follow-up research is needed to evaluate the long-term treatment of the subjects

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