

Original Article

The effects of extracorporeal shock wave therapy on frozen shoulder patients' pain and functions

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Abstract. [Purpose] The present study was conducted to examine the effects of extracorporeal shock wave therapy on frozen shoulder patients' pain and functions. [Subjects] In the present study, 30 frozen shoulder patients were divided into two groups: an extracorporeal shock wave therapy group of 15 patients and a conservative physical therapy group of 15 patients. [Methods] Two times per week for six weeks, the extracorporeal shock wave therapy group underwent extracorporeal shock wave therapy, and the conservative physical therapy group underwent general physical therapy. Visual analog scales were used to measure frozen shoulder patients' pain, and patient-specific functional scales were used to evaluate the degree of functional disorders. [Results] In intra-group comparisons, the two groups showed significant decreases in terms of visual analog scales and patient-specific functional scales, although the extracorporeal shock wave therapy group showed significantly lower scores than the conservative physical therapy group. [Conclusion] Extracorporeal shock wave therapy is considered an effective intervention for improving frozen shoulder patients' pain and functions.

Key words: Extracorporeal shock wave therapy, Pain, Function

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INTRODUCTION

Frozen shoulder is a disease that causes joint synovial membranes to thicken and adhere to articular surfaces, leading to gradually intensifying pain and gradual decreases in joints' range of motion. Although frozen shoulder does not cause neurogenic muscle weakness such as cervical radiculopathy per se, it results in flexion and reduced external rotation of the shoulder joint due to pain, reduces flexibility and elasticity, and makes performing everyday activities difficult due to the chronic inflammation and joint fibrosis that accompany it¹⁾. Among the factors that induce frozen shoulder, continued immobility is the most commonly known. Other factors include age, diabetes, thyroid diseases, humeral lesions, and personality disorders²⁾. No accurate cause has been determined, although it has been reported that aging leads to insufficient blood supply to tendons and articular capsules, which results in reduced nutrition supply to articular capsule and tendon tissues and causes tissue degeneration, local

necrosis appears in the degenerated tendons and articular capsules, and the necrotized areas are calcified so that they can be easily ruptured or lacerated by even minor injuries³⁾. Although there are a number of frozen shoulder treatment methods, including thermotherapy, psychotherapy, electric percutaneous nerve treatment, ultrasound therapy, manual therapy, and taping therapy, one non-surgical treatment method that has been receiving attention recently is extracorporeal shock wave therapy (ESWT). ESWT is a treatment method that applies extracorporeal shock waves to lesions to aid revascularization and stimulate or reactivate the healing of bones and connective tissues such as tendons, thereby relieving pain and improving functions⁴⁾. Although ESWT is commonly used to treat musculoskeletal diseases such as calcific tenosynovitis and plantar aponeurosis⁵⁾, studies on its application for treating frozen shoulder are rare. The present study was conducted to examine the effects of ESWT on frozen shoulder patients' pain and functions.

SUBJECTS AND METHODS

The present study was conducted with 30 of the patients who visited the outpatient clinic of S Orthopedic Hospital in Daegu, Korea. All the patients were diagnosed with frozen shoulder by a doctor who used clinical findings and medical equipment, such as an X-ray machine. Patients with structural problems, recent dislocations or subluxations, or

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Table 1. Comparison of VAS and PSFS for each group

	Group	Pre	Post
VAS (mm)	CPTG**	7.3±1.1	5.7±0.9
	ESWTG**	7.3±1.0	3.9±1.2††
PSFS (point)	CPTG**	7.7±0.8	6.1±1.2
	ESWTG**	7.7±0.8	3.8±0.9††

VAS: visual analog scale, PSFS: Patient-specific functional scale, CPTG: conservative physical therapy group, ESWTG: extracorporeal shock wave therapy group, *paired t-test, †independent sample t-tests, **††p < 0.01

rheumatic disease as well as those who underwent surgery were excluded. All patients were taking NSAIDs once a day. The study subjects were divided into a conservative physical therapy group (CPTG, n=15), with a mean age of 52.8±5.6 years, a mean height of 163.9±7.6 cm, and a mean weight of 61.2±11.7 kg, and an extracorporeal shock wave therapy group (ESWTG, n=15), with a mean age of 54.2±5.7 years, a mean height of 162.6±7.7 cm, and a mean weight of 64.3±10.1 kg. The intention of the present study and the entire experimental process were sufficiently explained, and voluntary agreement was obtained from all participants before the experiment was conducted. In addition, ethical approval for the study was granted by Youngdong University's institutional review board.

For the ESWTG, a VITERA (Comed, Korea) was used for ESWT. The patients received 1,000 shock waves at 2.5 Hz, with the energy adjusted from 0.01–0.16 mJ/mm², depending on the degree to which the patients endured pain. To accurately deliver the shock wave energy to targeted regions, targeted regions were determined through physical examinations and the setting of the shock wave therapy equipment according to the results before implementing the therapy. Physical therapist was operated ESWT. The CPTG was treated with a hot pack (20 minutes) and an ultrasound (5 minutes), which are thermotherapies, and interference current therapy (100 bps, 15 minutes), which is an electrotherapy. ESWTG and CPTG did not have other physical therapy. All subjects were treated two times per week for six weeks.

Visual analog scales (VASs) were used to evaluate pain, and patient-specific functional scales (PSFSs) were used to evaluate functions. PSFSs are questionnaires designed to evaluate patients' functions by examining the activities that the patient finds hardest to perform and determining the degree of difficulty of performing these activities. PSFSs were used before and after treatment, and the results were compared to examine changes in the functions of the patients.⁶⁾

For statistical processing, paired sample T-tests were used for intra-group comparisons, and independent sample t-tests were used for inter-group comparisons to examine the changes in frozen shoulder patients' functions and evaluations of pain. In the present study, the data were statistically processed using SPSS/PC Ver. 13.0, and the significance level α was set to 0.05.

RESULTS

In intra-group comparisons of VAS and PSFS, both the CPTG and the ESWTG showed significant decreases in both VAS and PSFS. In intergroup comparisons of VAS and PSFS, the ESWTG showed significantly lower scores than the CPTG (Table 1).

DISCUSSION

Frozen shoulder causes severe pain, restricts joints' range of motion, and disturbs sleep when the pain is severe, all of which disrupt patients' daily lives. Recently, ESWT was presented as a new way to treat frozen shoulder.

Moon et al.⁷⁾ reported that when Maitland and Kaltenborn mobilization techniques were used to treat frozen shoulder patients, the patients' pain decreased and their internal and external rotation ranges increased. Similarly, Park et al.⁸⁾ reported that intensive mobilization techniques and steroid injection controlled inflammation, expanded joint spaces, and improved joints' range of motion. Rompe et al.⁹⁾ noted that when one-time shock wave therapy was used to treat calcific tendonitis of the shoulder, 60% of patients recovered to normal states, and 72% of patients improved to a point at which they only felt intermittent discomfort on the Constant-Murley scale. Lee⁴⁾ revealed that the use of ESWT to treat lateral epicondylitis relieved pain, significantly improved simple elbow test scores, and led to satisfactory results for 83% of patients. Cho et al.¹⁰⁾ related that when lateral epicondylitis patients were treated by ESWT, the patients' pain significantly decreased and muscle strength significantly increased. Likewise, Na¹¹⁾ reported that when ESWT was used to treat chronic low back pain, patients' pain significantly decreased. Lastly, Lee et al.¹²⁾ discovered that chronic low back pain patients who were treated with an exercise program and ESWT experienced reduced pain and improved dynamic balancing, compared to those who were treated with an exercise program and conservative physical therapy.

In the present study, in intra-group comparisons of VAS and PSFS, both the CPTG and the ESWTG showed significant decreases in both VAS and PSFS. In intergroup comparisons of VAS and PSFS, the ESWTG received significantly lower scores than the CPTG. Given these results, ESWT is considered to be effective for pain relief. It uses fine, repetitive stimuli produced by a sound wave that can be spread through soft tissues without energy dissipation¹³⁾. In doing this, it causes changes in cells' metabolism and

the permeability of endothelial cell tissues, leading to pain relief⁴⁾, and has positive effects on soft tissues.

Frozen shoulder patients have trouble performing common activities due to pain or physical functional disorders, and they experience many restrictions each day. The patients showed significant decreases in their functional disorder evaluation indexes because their ability to perform everyday activities was improved due to improved physical functions and pain relief.

The diverse effects of ESWT should be investigated, and the author hopes that the results of the present study will be utilized as reference data at clinics when selecting treatment for frozen shoulder patients.

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