



Original Article

The clinical effect of hydraulic distension plus manual therapy on patients with frozen shoulder

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Abstract. [Purpose] This study aimed to develop a clinical protocol for the treatment of frozen shoulder using applied hydraulic distension plus manual therapy. [Subjects and Methods] Patients were randomly assigned to 2 groups: 60 patients in group A were treated with hydraulic distension plus manual therapy, and 61 in group B were treated with hydraulic distension alone. Treatment effects were assessed using the Visual Analog Scale (VAS) (pain and satisfaction), and active range of motion of the shoulder (forward flexion, internal and external rotation) before treatments and at 2, 6, 12, 24 weeks, and 1 year after the last injections. [Results] Patients in group A achieved faster pain relief and better satisfaction than patients in group B during the 6 weeks after treatment. However, no significant difference in VAS was observed between the groups at final follow-up. AROM of the shoulder was improved at final follow-up in both groups. [Conclusion] Hydraulic distension plus manual therapy provided faster pain relief, a higher level of patient satisfaction, and an earlier improvement in AROM of the shoulder than hydraulic distension alone in patients with frozen shoulder.

Key words: Hydraulic distension, Manual therapy, Frozen shoulder

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INTRODUCTION

The main symptoms of a frozen shoulder are pain and stiffness in the glenohumeral joint¹⁾. It has been reported that 40% of frozen shoulder patients without proper treatment suffered from persistent pain and limited range of motion, and 11% showed permanent shoulder dysfunction^{2, 3)}.

The primary therapeutic approaches to frozen shoulder include conservative treatments such as physical therapy, nonsteroidal anti-inflammatory medication, and intra- or subacromial steroid injection^{4, 5)}. However, the use of invasive approaches such as hydraulic distension and manual therapy by a physical therapist is considered when the patient does not want long-term conservative treatment or does not show signs of recovery despite treatment for a period of time^{6, 7)}. However, there is a lack of evidence for the effect of conservative treatment, and invasive methods are controversial⁸⁾.

Therefore, the purpose of this study was to analyze the clinical results and efficacy of hydraulic distension plus manual therapy on patients with a frozen shoulder and to develop a useful clinical protocol.

SUBJECTS AND METHODS

The study was approved by KONIBP (Korea National Institute for Bioethics Policy) and all the participants provided written informed consent. A total of 140 patients with frozen shoulders were registered as the subjects for this prospective randomized study, which was conducted from April 2013 to January 2015. The inclusion criteria were as follows: age 19 to 70 years, symptoms lasting more than 3 months, pain and limitation in range of motion in at least 2 directions (less than 120°

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Table 1. General characteristics

Characteristic	Group A	Group B
Number of patients	60	61
Gender (male/female)	25/35	20/41
Age (yrs)	52.1 ± 6.4 ^a	53.9 ± 5.9 ^a
Duration (mo)	6.7 ± 2.3	6.3 ± 2.1
Side (dom/nondom)	45/15	46/15

^aMean ± SD.

dom: dominant; nondom: nondominant

Table 2. VAS score for each treatment group over time

VAS	Group	Before	2 wk	6 wk	12 wk	6 mon	1 year
Pain*	A	6.8 ± 1.0 ^a	2.4 ± 1.2 [†]	2.0 ± 0.8 [†]	1.8 ± 0.5 [†]	1.8 ± 0.8	1.6 ± 0.9
	B	6.6 ± 1.2	4.9 ± 0.7	4.2 ± 0.7	2.7 ± 0.9	1.9 ± 0.9	1.7 ± 0.7
Satisfaction*	A	1.8 ± 1.1	6.9 ± 0.9 [†]	7.1 ± 1.0 [†]	7.3 ± 0.9	7.6 ± 0.9	7.6 ± 1.1
	B	1.7 ± 0.7	4.5 ± 1.1	4.8 ± 1.1	6.9 ± 0.9	7.5 ± 0.9	7.5 ± 1.0

^aMean ± SD.

*Significantly different from baseline (p<0.05)

[†]Significantly different between the groups (p<0.05)

of forward flexion and less than 50% of normal internal and external rotation on the normal side), and no special abnormal findings on radiographic study⁵). Those with a diagnosis other than frozen shoulder, such as osteoarthritis, cervical disorders, or history of shoulder injury, were excluded.

Of 140 subjects, 11 were excluded before the test. In addition, 6 patients met the exclusion criteria and 2 were absent from the experiment. Therefore, 121 patients with frozen shoulder were divided into 2 groups according to a randomized controlled statistical program processed by another researcher.

Table 1 shows the general characteristics of the subjects. The 60 patients in group A received 30 minutes of manual therapy by a physical therapist 3 times a day, for 4 weeks after hydraulic distension. Manual therapy based on the Kaltborn-Evjenth concept was applied, based on the patient's symptom duration, because there is no official guideline for manual therapy for frozen shoulder. The patients then performed home rehabilitation exercise. The 61 patients in group B performed home rehabilitation exercise after hydraulic distension. Both groups were provided with a home-based exercise program guidebook before exercise.

Pain index and satisfaction level were evaluated with the Visual Analog Scale (VAS) in each measurement period. For the range of motion (ROM), the active ranges of forward flexion, external rotation, and internal rotation were measured 3 times with a goniometer bending iron (29–5900, Pakistan) using a standardized method, and the mean value was calculated¹².

For the statistical analysis, demographic characteristics of the subject were analyzed with the χ^2 test and independent t-test. A repeated measures analysis of variance (ANOVA) was used to examine the differences between the measuring periods. This study used an independent t-test to analyze the differences between the groups in each period. Statistical analysis was performed using PASW Statistics Version 18.0 Windows (SPSS Inc., Chicago, IL, USA). The statistical significance level was set to $\alpha=0.05$.

RESULTS

Both groups showed similarities in average ages, symptom duration, gender distribution, and dominant shoulder. There was no statistically significant difference in general characteristics (Table 1).

The pain index decreased more rapidly in group A and the difference between the groups was maintained until 12 weeks after treatment (p<0.05). However, the difference between the groups at 1 year after treatment was not significant. The satisfaction level increased more rapidly in group A and the difference between the groups was maintained until 6 weeks after treatment (p<0.05). However, the difference between the groups at 1 year after treatment was not significant (Table 2).

The range of forward flexion increased more rapidly in group A and the difference between the groups was maintained until 6 weeks after treatment (p<0.05). However, the difference between the groups at 1 year after treatment was not significant. The ranges of external rotation and internal rotation also increased more rapidly in group A, and the differences between the groups were maintained until 6 weeks after treatment (p<0.05). However, the differences in the ranges of external rotation and internal rotation between the groups at 1 year after treatment were not significant (Table 3).

Table 3. Range of motion for each treatment group over time

ROM	Group	Before	2 wk	6 wk	12 wk	6 mon	1 year
FF*	A	96.3 ± 17.5 ^a	132.6 ± 17.2 [†]	144.5 ± 15.0 [†]	154.6 ± 13.2	161.5 ± 12.1	169.0 ± 10.1
	B	97.4 ± 13.6	123.2 ± 11.7	133.6 ± 19.0	153.4 ± 12.1	160.9 ± 11.8	168.2 ± 9.1
ER*	A	16.7 ± 5.6	45.8 ± 10.6 [†]	47.7 ± 8.2 [†]	54.5 ± 9.0	57.7 ± 8.7	66.8 ± 11.3
	B	19.0 ± 7.0	27.8 ± 7.0	31.7 ± 7.0	51.2 ± 10.1	54.2 ± 7.7	62.5 ± 8.2
IR*	A	11.5 ± 1.3	15.5 ± 1.8 [†]	16.0 ± 1.6 [†]	16.9 ± 1.4	17.9 ± 2.2	19.0 ± 1.7
	B	11.4 ± 1.0	13.1 ± 1.8	14.0 ± 2.1	16.5 ± 1.3	17.5 ± 2.0	18.5 ± 1.6

^aMean ± SD.

FF: forward flexion; ER: external rotation; IR: internal rotation

*Significantly different from baseline (p<0.05)

[†]Significantly different between the groups (p<0.05)

DISCUSSION

This study analyzed the effect of hydraulic distension plus manual therapy in patients with frozen shoulder by comparing the differences between hydraulic distension plus manual therapy and hydraulic distension alone. From 6 weeks to 12 weeks after treatment, the hydraulic distension plus manual therapy group showed a more rapid decrease in pain, increase in patient satisfaction, and improvement in range of motion than the other group. In addition, both groups showed significant increases in the pain index, satisfaction level, and range of motion after treatment at each time period. However, both groups showed similar results at 1 year after treatment.

A study by Russell et al.⁴⁾ showed that 75 patients with frozen shoulder who underwent manual therapy including a home-based exercise program had a satisfactory result. Harmon and Hearty⁹⁾ reported that suprascapular nerve block without manual therapy was effective for temporary relief of pain in patients with frozen shoulder, but did not improve the range of motion. Clinical results for various conservative treatments have been reported, but most showed a short-term treatment effect of less than 6 months. However, patients with frozen shoulder received conventional conservative treatment and were observed for 1 year, with positive treatment results. There are few studies related to frozen shoulder treatment that included hydraulic distension with manual therapy and compared them prospectively. This study produced results similar to those of previous studies, that is, rapid onset of treatment effects and maintenance until 6 weeks after hydraulic distension plus manual therapy of the pain index, satisfaction level, and range of motion¹⁰⁾. These results occurred because hydraulic distension performed with manual therapy induced increased joint volume in a short time, permitting sufficient joint movement¹¹⁾.

Limitations of this study included the low accuracy of the diagnosis of frozen shoulder and different individual symptom durations among subjects. This study was based on physical examination, medical history, and imaging diagnosis, but it was very hard to differentiate frozen shoulder from other shoulder diseases. However, the results of this study seem significant due to the long-term (1 year) observation.

Hydraulic distension plus manual therapy decreased shoulder pain and improved shoulder function. Specifically, pain, satisfaction, and range of motion showed quick improvement from 6 weeks to 12 weeks after treatment. The treatment results of this study can be used for frozen shoulders. Various manual therapies for a frozen shoulder should be performed to analyze persistence of clinical efficacy in further studies.

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