Clinical Effect Analysis of Radial Extracorporeal Shock Wave Therapy with Compound Ultrasonic Treatment for Frozen Shoulder

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Abstract: Objective: To evaluate the effect of radial extracorporeal shock wave and compound ultrasonic treatment in patients with frozen shoulder. To evaluate the effect of Radial Extracoporeal Shock Wave Therapy (RESWT) and compound ultrasonic therapy in frozen shoulder patients. **Methods**: 68 patients with frozen shoulder treated in our hospital from January 2020 to January 2021 were divided into two groups according to the random number table method. 30 patients in the control group and 30 patients in the observation group were given compound ultrasonic treatment in the control group and radial extracorporeal shock wave treatment in the observation group. The VAS pain score, average temperature difference, ROM score and incidence of adverse reactions of the two groups were compared. **Results:** The VAS pain scores (3.12 ± 1.23) and (2.20 ± 1.55) in the observation group at the end of treatment and 8 weeks after treatment were lower than those (5.82 ± 1.56) and (4.26 ± 1.59) in the control group ($P < 0.05$). The average temperature difference at the end of treatment and 8 weeks after treatment in the observation group (0.25 ± 0.04) ºC, (0.21 ± 0.06) ºC was lower than that in the control group (0.79 ± 0.24) ºC, (0.65 ± 0.52) ºC, ($P < 0.05$). At the end of treatment and 8 weeks after treatment, the ROM scores of the observation group (28.63 ± 5.99) and (32.63 ± 9.85) were higher than those of the control group (25.12 ± 6.15) and (26.52 ± 7.51) ($P < 0.05$). The incidence of adverse reactions in the observation group (0.00%) was lower than that in the control group (16.67%), ($P < 0.05$). **Conclusions:** In the treatment of frozen shoulder patients, radial extracorporeal shock wave with compound ultrasonic therapy can better relieve the pain of patients, reduce adverse reactions, and improve the range of motion of shoulder joint, which is of great value in the field of clinical rehabilitation.

Keywords: Extracoporeal shock wave therapy; Compound ultrasonic therapy; Frozen shoulder; Pain; Skin temperature; Adversre reaction

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1. Introduction

Compound ultrasonic is a combination therapy of physical factors, which mainly applies Transcutaneous Electrical Nerve Stimulation (TENS) and focused ultrasound to delay the degeneration of articular cartilage and relieve joint pain [1]. Patients with frozen shoulder will suffer from pain and limited joint movement. If not treated in time, joint dysfunction and muscle atrophy will occur, seriously affecting the daily living activities of patients [2-4]. Acupuncture, medium frequency electrotherapy, drug therapy and extracorporeal shock wave therapy are commonly used in clinical treatment for frozen shoulder pain, and massage or manipulation is used for joint movement limitation. There are few studies on the treatment of frozen shoulder by compound ultrasonic therapy, especially the study of compound ultrasonic therapy with extracorporeal shock wave therapy has not been reported. In order to evaluate the effect of radial extracorporeal shock wave and compound ultrasonic therapy on frozen shoulder patients, 68 patients with frozen shoulder were selected for clinical efficacy analysis.

2. Information and Methods

2.1 Baseline Data

68 patients with frozen shoulder were included in our hospital. The patients were enrolled from October 2018 to June 2021. They were randomly divided into control group (ultrasonic treatment) and observation group (radial extracorporeal shock wave treatment), 34 cases/group. In the control group, there were 18 females and 16 males; the average age was (49.63 ± 3.22) years; the duration of the disease ranged from 4 months to 16 months, with an average duration of (9.65 ± 1.56) months. In the observation group, there were 22 females and 12 males; the average age was (49.88 ± 3.15) years; the course of disease ranged from 4 months to 15 months, and the average course of disease was (9.48 ± 1.43) months. There was no significant difference between the two groups ($P > 0.05$).

Inclusion criteria: (1) The patient presented varying degrees of shoulder pain and limited shoulder joint movement. X-ray examination showed thickening of the axillary recess wall more than 5 mm, which was diagnosed as frozen shoulder; (2) Patients volunteered to participate in the study and signed informed consent; (3) This study was approved by the ethics committee.

Exclusion criteria: (1) Mental disorder; (2) Patients with severe cardiovascular and cerebrovascular diseases; (3) Patients with neuropathy; (4) Pregnant and lactating women.

2.2 Method

In the control group, radial extracorporeal shock wave therapy was performed [5]. The patient was in the sitting or lateral decubitus position, the affected shoulder was exposed and abducted, and coupling agent was applied to the pain point, supraspinatus outlet, and the anterior and posterior joint capsule of the shoulder. The impact dose was 12 Hz, the air pressure was 2 bar, and the impact times were 2000 times for each part. The handle pressure could be appropriately increased according to the patient's tolerance. The patient was treated once every 5 days, 5 times as a course of treatment, and the treatment lasted for 3 courses. Nerve disfigurements and important blood vessels are avoided during treatment.

In the observation group, divergent extracorporeal shock wave was used for treatment and combined ultrasonic arthritis treatment instrument was used for treatment. The frequency parameter was set at 0.6 mhz, the output power was 0.6 W, the output waveform was pulse-modulated sine wave, the focal plane distance of the treatment head was 25 mm, and the treatment depth was 15-50 mm. The pulse width and output frequency of transcutaneous neuromuscular electrical stimulation (TENS) were set as 200 μs, and the alternating output density waves of 50 Hz/100 Hz were set as 25 mA to 40 mA, and the output current and depth were adjusted in time according to patients' performance and tolerance during treatment [6,7]. The treatment site was the anterior and posterior joint capsule and other pain points of the shoulder joint, and the treatment frequency was 20 minutes twice a day.

2.3 Observation Indicators

The scores of the two groups were calculated: (1) VAS pain score, 0 was painless and 10 was extreme pain. (2) The average temperature difference was recorded by infrared thermal imaging equipment. (3) Improvement of ROM score in shoulder abduction and pronation. (4) The incidence of adverse reactions was calculated, including skin redness, pain, swelling, numbness and palpitation.

2.4 Statistical Treatment

Statistical software SPSS23.0 was used to process the data of two groups of frozen shoulder patients. VAS pain score, skin temperature difference and ROM score were expressed by (Mean ± Standard Deviation). T-test was used for independent sample test. The incidence of adverse reactions was expressed in (%), and the difference was tested by chi square. If it has statistical significance, then ($P < 0.05$).

3. Results

3.1 Calculate the VAS Pain Score of the Two Groups

There was no significant difference in VAS pain score between the observation group and the control group before treatment ($P > 0.05$). VAS pain scores at the end of treatment and 12 weeks after treatment in the observation group were lower than those in the control group ($P < 0.05$). See Table 1.

Table 1. VAS pain scores of the two groups were calculated{$\bar{x} \pm s$, min}

group	Before treatment	At the end of treatment	12 weeks after treatment
Observation group (n = 34)	6.52±1.65	3.12±1.23	2.20±1.55
Control group (n = 34)	6.63±1.59	5.82±1.56	4.26±1.59
T value	0.2629	7.4442	5.0813
P value	0.7935	0.0000	0.0000

3.2 Calculate the Average Temperature Difference between the Two Groups

There was no significant difference in the average temperature difference between the observation group and

the control group before treatment (P > 0.05). The average temperature difference at the end of treatment and 12 weeks after treatment in the observation group was lower than that in the control group (P < 0.05). See Table 2.

Table 2. calculate the average temperature difference between the two groups{$\bar{x} \pm s$, ℃}

group	Before treatment	At the end of treatment	12 weeks after treatment
Observation group (n = 34)	1.15±0.53	0.25±0.04	0.21±0.06
Control group (n = 34)	1.19±0.55	0.79±0.24	0.65±0.52
T value	0.2868	12.1560	4.6040
P value	0.7753	0.0000	0.0000

3.3 Calculate the ROM Score in Shoulder Abduction and Pronations of the Two Groups

There was no significant difference in ROM score in shoulder abduction and pronation between the observation group and the control group before treatment (P > 0.05). The ROM scores of the observation group at the end of treatment and 12 weeks after treatment were higher than those of the control group (P < 0.05). See Table 3.

Table 3. ROM scores of the two groups were calculated{$\bar{x} \pm s$, min}

group	Before treatment	At the end of treatment	12 weeks after treatment
Observation group (n = 34)	66.56±23.52	100.65±13.65	165.65±15.52
Control group (n = 34)	66.46±24.05	82.65±11.56	155.05±13.23
T value	0.0173	5.8676	3.0307
P value	0.9862	0.0000	0.0035

3.4 Calculate the Incidence of Adverse Reactions in the two Groups

The incidence of adverse reactions in the observation group was lower than that in the control group (P < 0.05). See Table 4.

4. Discussion

At present, physical factors commonly used in clinical treatment of frozen shoulder in China include intermediate frequency, low frequency, interference electricity, polarized light, magnetic vibration heat, microwave, short wave, ultra-short wave, ultrasonic and radial extracorporeal shock wave [8,9]. Ultrasonic mainly relies on ultrasound to penetrate human muscles and repair articular cartilage, but it has little obvious effect on immediate relieve the pain [10,11]. Radial extracorporeal shock wave is one of the effective physical factor therapies in the treatment of pain. Its main mechanism is to stimulate local blood vessels, accelerate the circulation speed in this area, and provide a better internal environment for tendon cell regeneration and functional repair. And in shock wave treatment can make the body C neural activation, the activation of C nerve can be within the organization or in the spinal cord to secrete a kind of substance P, after activating this nerve, nerve fibers in a period of time can't C production of substance P and substance P reduce neurogenic inflammatory conditions can be effectively controlled, so as to alleviate the pain of patients with locally. Neurogenic inflammatory response can effectively help tissue repair. In this process, tissues will also secrete growth factors and related substances to activate nerve fibers and promote their repair, so as to achieve the therapeutic effect of tissue repair and analgesic effect. In this process, a certain energy gradient and torsional tension can occur between different tissues during the shock wave transmission phase, which can cause the adhesive tissue to release, thus relieving the trapped microvessels and nerve bundles. In this process, the impact of shock wave will cause damage to surrounding tissues and lead to inflammatory reaction, which will improve the permeability of capillaries, release relevant inflammatory mediators and substances, accelerate the healing of the body and reduce the occurrence of symptoms [12-15].

Table 4. calculate the incidence of adverse reactions {n (%)}

group	Red skin	pain	swelling	Numbness	palpitation	incidence rate
Observation group (n = 34)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Control group (n = 34)	1 (3.33)	1 (3.33)	1 (3.33)	1 (3.33)	1 (3.33)	5 (16.67)
χ^2 value	-	-	-	-	-	5.4545
P value	-	-	-	-	-	0.0195

The results of this study showed that VAS pain score of the observation group was lower than that of the control group at the end of the intervention and 12w after the intervention. The average temperature difference of the observation group was lower than that of the control group. In ROM Angle improvement, the observation group showed advantages compared with the control group. The incidence of AR in the observation group was lower than that in the control group, $P < 0.05$. It is suggested that the treatment of frozen shoulder with radial extracorporeal shock wave combined with compound ultrasonic therapy can better reduce pain, improve local temperature changes, improve the range of motion of shoulder joint abduction and internal rotation, and reduce the incidence of adverse reactions.

5. Conclusions

To sum up, the treatment of frozen shoulder with radial extracorporeal shock wave can achieve certain results, but the combination of radial extracorporeal shock wave combined with compound ultrasonic therapy can better relieve the pain of patients, reduce adverse reactions, and improve the range of motion of shoulder joint, which is worthy of reference and promotion in clinical treatment.

The other also has shortcomings, this study did not explore the patients choose possible differences between surgery and conservative treatment, and combined with musculoskeletal ultrasound and the methods of electric figure around the shoulder joint in patients with frozen shoulder agonist and antagonist muscle activation of the corresponding detection and analysis, the correlation and feature remains to be further research.

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