



Comparison of subacromial corticosteroid injection and physical therapy in patients with subacromial impingement syndrome: A prospective, randomized trial

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Abstract

The aim of this randomized trial was to evaluate the efficacy of subacromial corticosteroid injection and physical therapy (PT) in patients with subacromial impingement syndrome (SIS). Forty patients who diagnosed as SIS were included in this study and were randomly assigned to the PT and injection groups. Pain during rest, sleep and motion were evaluated by visual analog scale (VAS). Disability was determined by Costant-Murley score. Physical and social functions were evaluated with Short Form-36 (SF-36). Active range of motion (ROM) was measured by goniometer. Patients were evaluated at baseline, 3rd and 8th weeks of the therapy. PT continued for 3 weeks with ultrasound and interferential current combined to local heat and exercise. For patients in the injection group, a single steroid injection of 40 mg triamcinolone acetonide into the subacromial space was combined with exercise. After eight weeks, significant improvements at pain, SF-36 and Costant-Murley scores were observed in both groups ($p < 0.001$). Improvement rates of pain during sleep and motion were significantly higher in PT group than the injection group after 8 weeks ($p < 0.01$). Significant improvements were determined at ROM in both groups ($p < 0.001$). No statistically significant differences were found between two groups in terms of Costant-Murley and ROM scores. Results of the PT group were significantly better in terms of physical and social function, and pain subscores of SF-36 ($p < 0.05$). Our results suggest that both PT and corticosteroid injection have beneficial effects on shoulder mobility and pain relief in SIS. PT should be an alternative and effective treatment method to corticosteroid injection in SIS.

Keywords: corticosteroid injection, interferential current, subacromial impingement syndrome, ultrasound

1. Introduction

Shoulder impingement syndrome is commonly referred to as painful arc syndrome, subacromial impingement syndrome (SIS), supraspinatus syndrome. SIS and rotator cuff tendinitis are considered to be the most common cause of shoulder pain and disability. SIS is a clinical syndrome that indicates pain and pathology related with the encroachment of the subacromial tissues as a result of the narrowing of the subacromial space (1).

The cause of SIS is considered to be multifactorial with both extrinsic and intrinsic factors involved in its pathogenesis. Extrinsic factors such as acromial shape and subacromial spurs, often associated with acromioclavicular joint arthritis, have been described. Intrinsic factors such as rotator cuff dysfunction (RCD) leading to superior head migration, and scapular dyskinesis leading to scapular malposition, also contribute and can be reversed with physical therapy. These injured tissues incite a local inflammatory

response, which leads to tissue edema and pain (1, 2).

Many treatment modalities have been employed in attempts to relieve pain and restore function of the affected shoulder. Nonoperative treatment options for SIS include rest, ice, physical therapy (PT), electromagnetic radiation, corticosteroid injections, and systemic nonsteroidal anti-inflammatory drugs (NSAIDs) (3).

There is still little knowledge about the efficacy of most conservative treatment options for SIS. The injection of corticosteroids into the subacromial space is a procedure commonly performed for impingement. However, there is no consensus about whether subacromial injection is superior to other conservative treatment options. Corticosteroids have been reported to be associated with tendon rupture, subcutaneous atrophy, and articular cartilage changes. Due to the potentially serious side effects, frequent use of corticosteroid injections is avoided (4).

There are limited number of studies evaluated the effect of PT intervention in patients with SIS. Although ultrasound (US) is the frequently used as a PT method for soft tissue disorders, there are limited and conflicting data regarding the effectiveness of US therapy in SIS (3,5). In the present study, we aimed to compare the efficacy of subacromial corticosteroid injection and ultrasound in the treatment of SIS.

2. Materials and methods

The study was planned as a prospective, randomized, clinical trial with an 8-week follow-up period. It consisted of 40 consecutive patients, who were suffering from shoulder pain and diagnosed as SIS, with physical examination and Magnetic Resonance Imaging (MRI) at Ondokuz Mayıs University, Medical Faculty, Department of Physical Medicine and Rehabilitation Clinic. Exclusion criteria were as follows; instability of shoulder, infection, decompensated heart failure, cardiac pace-maker, status angina, asthma, seizure, neurological deficiency, shoulder and neck surgery, history of PT and corticosteroid injection at last six months, pregnancy, positive drop arm test, rupture of RC, adhesive capsulitis (AC), rheumatologic diseases, cervical radiculopathy, hemorrhagic diathesis and diabetes mellitus. The study was approved by the local ethics committee and all patients gave their written informed consent.

All participants were questioned about demographic and clinical characteristics. In physical examination Neer, Hawkins, Painful arc, Drop arm, Supraspinatus tests were evaluated. Active ROM degrees were measured by a goniometer, at supine position by the same physician blinded to the treatment of patients. Rotations were measured while shoulder was at 90° abduction. Degrees of abduction, flexion, internal rotation, and external rotation were recorded.

Pain at rest, motion and sleep periods were evaluated with 10cm (0= no pain, 10= severe pain) visual analog scale (VAS).

Shoulder functions were evaluated with Constant-Murley Shoulder Score. It is an easy, cheap, and reliable scale which has been used for the results of surgery, conservative treatment and traumatic shoulders since 1980s. There are 100 points including 15 points for pain, 20 points for daily activities, 40 points for active ROM and 25 points for strength (6).

Daily living activities were evaluated with Short Form-36 (SF-36), which was found reliable and valid in Turkish population (7). Forty patients were randomly assigned into two groups. In PT group (n=20), hot pack for 20 minutes, US for seven minutes (1.5 Watt/cm², constant mode, 1MHz) and interferential current (IC) for 20 minutes (100 Hz) were applied to the patients, five times per week for three weeks.

In injection group, subacromial injection was performed by the same physician with 40 mg/1ml triamcinolone

acetionide. For every patient, a single injection was applied with lateral approach, by 5cc-21-gauge injector, in sterile conditions, to the subacromial space after marking the lateral side of acromion.

Passive ROM, stretching and pendulum exercises were started in both groups. After gaining full ROM, isometric-isotonic strenghtening exercises for RC and scapula stabilizer muscles were started with dumbbell and therabands. In PT group, exercises were applied in hospital twice per day with 10 repetitions while they were performed at home with the same conditions in injection group. All patients were allowed to use 275 mg Naproxen Sodium, twice per day at the first three weeks of the therapy. All subjects were evaluated by the same physician at the baseline, at the end of 3th week and 8th week.

2.1. Statistical analysis

Statistical analyses were performed using SPSS software, version 15.0. For continuous variables Mean ± Standard Deviation (Mean±SD), and for frequencies percents (%) were reported. All variables were analyzed for normally distribution by Shapiro Wilk test. In group comparisons Paired t-test and Wilcoxon test were used. Mann Whitney u test and t-test were used for intergroup comparisons. In group comparisons, Mc Nemar Chi square test was used for the countable variables, and in intergroup comparisons Chi square test was used. P<0.05 was accepted significant for all statistical measurements.

3. Results

Forty patients-23 female (57.5%) and 17 male (42.5%)-were included in the study. Ages ranged from 29 to 63. There were no differences between groups in terms of age, gender and duration of the pain (p>0.05). The demographic characteristics of the patients are shown in Table 1.

Table 1. Demographic characteristics

		Injection Group Means±SD	Physical Therapy Group Means±SD	P
Age (years)		50.10 ±7.91	48.25 ± 9.80	0.745
Complaint Period (months)		10.95 ±6.64	9.55 ±10.10	0.287
		Number (%)	Number (%)	
Gender	Female	11(55)	12 (60)	0.749
	Male	9(45)	8 (40)	
Education	Primary school	14(70)	8 (40)	0.191
	Secondary school	1 (5)	2 (10)	
	High school	3(15)	3 (15)	
	College	2(10)	7 (35)	
Occupation	Housewife	9(45)	8 (40)	0.082
	Laborer	6(30)	2 (10)	
	Retired	4(20)	3 (15)	
	Officer	1 (5)	7 (35)	

p<0.05; significant, SD; standard deviation

Right side affected patients were 13 (65%) in injection group and 12 (60%) in PT group. Dominant hand of most patients was right; 17 (85%) in injection group and 18 (90%) in PT group, respectively. There were no differences between the groups for dominant hands and affected sides ($p>0.05$).

In injection group, Neer test which was positive in 90% of the patients at the baseline decreased to 35% and 15% at the end of 3rd week and 8th week. In PT group Neer test which was positive in all patients at the baseline decreased to 35% and 5% at the end of 3rd week and 8th week. Hawkins tests were positive in all patients in both groups at the baseline. In injection group they decreased to 65% and 40% at the end of 3rd week and 8th week. In PT group, these rates were 60% and 15% respectively.

The mean ROM measurements improved significantly in both groups at the 3rd and 8th weeks ($p<0.001$ for each). All measurements were better in PT group than injection group, but there were no significant differences between groups for active ROM at the end of 3rd week and 8th week ($p>0.05$) (Table 2).

Table 2. Comparison of range of motion

		Injection Group	Physical Therapy Group	p
		Means±SD	Means±SD	
Flexion	Baseline	126.5±39.1	126.5±35.13	0.978
	3 th week	146.5±31.83	163.0±19.76	0.108
	8 th week	159.0±28.26	171.5±20.84	0.091
Abduction	Baseline	122.75±42.41	120.0±37.55	0.838
	3 th week	149.50±27.99	163.75±14.9	0.145
	8 th week	160.50±24.59	170.5±20.89	0.123
Internal Rotation	Baseline	55.25±13.71	51.75±12.69	0.397
	3 th week	64.00±12.31	67.75±8.02	0.333
	8 th week	70.25±9.79	75.50±8.87	0.303
External Rotation	Baseline	64.50±15.03	61.00±17.13	0.527
	3 th week	75.75±13.50	80.75±9.21	0.285
	8 th week	80.25±13.42	86.00±0.94	0.060

$p<0.05$; significant, SD; standard deviation

At 3rd week, both treatment methods appeared to have similar efficacy on pain and disability. Both treatment options were similarly effective in improving the mean VAS activity pain and Constant-Murley scores. At the end of an 8-week follow-up period, the activity pain and Constant-Murley scores were significantly improved in both of the groups without significant difference between two treatment methods. There was a significant difference between the two groups with regard to the night pain and activity pain scores at 8th week. After 8 weeks, VAS pain scores at motion and at sleep were significantly better in PT group than the injection group (Table 3).

When we compared both groups for SF-36, physical function, social function, emotional role function and pain subscores in PT group were significantly better than the injection group at the end of 8th week ($p<0.05$ each other) (Table 4.) There were no differences for general health,

change in health, mental health and fitness/fatigue scores in SF-36 ($p>0.05$). In both groups all SF-36 scores except for emotional role function in injection group improved significantly at the end of 3rd week and 8th week ($p<0.05$).

Table 3. Comparison of VAS pain and Constant-Murley scores

		Injection Group	Physical Therapy Group	p
		Means ± SD	Means ± SD	
VAS rest	Baseline	4.55 ± 1.50	5.10 ± 2.42	0.394
	3 th week	1.35 ± 1.53	0.95 ± 1.05	0.341
	8 th week	1.40 ± 1.53	0.85 ± 1.26	0.224
VAS motion	Baseline	8.20 ± 1.73	8.30 ± 1.75	0.814
	3 th week	4.15 ± 1.84	3.50 ± 1.31	0.378
	8 th week	3.70 ± 1.89	2.00 ± 1.65	0.006*
VAS sleep	Baseline	5.90 ± 2.84	6.25 ± 3.16	0.663
	3 th week	2.10 ± 1.94	1.45 ± 1.73	0.260
	8 th week	2.00 ± 2.10	0.55 ± 1.14	0.006*
Constant-Murley	Baseline	41.10±13.4	39.50±11.9	0.626
	3 th week	57.70±10.3	62.20±7.47	0.616
	8 th week	62.95±10.9	66.40±9.47	0.186

$p<0.05$; significant, SD; standard deviation, VAS; Visual analog scale

Table 4: Comparison of Short Form-36 subscores

		Injection Group	Physical Therapy Group	P Value
		Means±SD	Means±SD	
Physical function	Baseline	48,80±16,64	59,00±22,74	0,106
	3 th week	66,50±16,06	75,75±15,83	0,085
	8 th week	69,50 ± 16,21	81,75 ± 17,18	0,011*
Social function	Baseline	41,00 ± 17,98	48,40 ± 21,23	0,394
	3 th week	59,95 ± 16,53	69,85 ± 13,94	0,067
	8 th week	65,40 ± 21,87	78,70 ± 15,32	0,019*
Physical role function	Baseline	23,75 ± 18,97	28,75± 30,64	0,897
	3 th week	47,50 ± 31,30	69,15± 26,11	0,025*
	8 th week	65,00 ± 32,84	81,25 ± 29,10	0,066
Emotional role function	Baseline	54,65 ± 31,10	49,65± 33,23	0,681
	3 th week	68,10± 33,40	74,75± 30,48	0,532
	8 th week	69,75 ± 32,38	88,20± 24,96	0,039*
Pain	Baseline	34,65 ± 16,46	35,75± 20,77	0,989
	3 th week	63,25± 15,91	72,65± 14,10	0,117
	8 th week	68,80± 21,15	81,65± 15,61	0,040*

$P<0,05$ Significant SD: Standard Deviation

4. Discussion

The aims of the conservative treatment in SIS are to improve the shoulder functions, to provide full ROM and to obtain a painless shoulder by reducing the inflammatory response (8). There is not a standard conservative treatment for SIS. Corticosteroid injection is a very common treatment method for SIS. However, there is not a consensus on its effects and initial treatment is controversial for some authors (9).

Therefore, alternative methods are needed. Local and deep heat therapies and analgesic currents are the most commonly used physical therapy methods for SIS. In our study we compared the effectiveness of corticosteroid injection with the effectiveness of PT, including local heat, US and IC.

US is one of the most common investigated PT methods which may have the potential to induce biophysical effects within the soft tissue. It is assumed to have thermal effects on the target tissue resulting in an increase in blood flow, cell metabolism and tissue regeneration, and also reducing inflammation, edema and pain (10). There are several studies which have reported US as an effective or ineffective therapy at soft tissue pathologies of shoulder (11-12). Ainsworth et al have compared the effectiveness of US and sham US on 221 patients with shoulder pain. After 6 weeks, they have found no differences between the groups for VAS pain (12). But in their study, diagnoses of the patients have not been indicated and the US was applied to all patients with constant dose and same period. In another study, Yildirim et al have compared four minutes or eight minutes US therapy for SIS treatment. They found that all four- or eight-minutes US therapy have beneficial effects in treatment of SIS but eight minutes of ultrasound treatment was shown to be more effective than four minutes of ultrasound treatment (13).

Bicer et al. have compared the PT including US, Infrared and TENS with corticosteroid injection in shoulder pain. They have applied unique subacromial injection with methylprednisolone. At the end of the study, they have found no significant differences between the groups at VAS pain. But, in their study, there were patients diagnosed as tendinitis, bursitis and adhesive capsulitis as well as SIS (14). In our study we found that US therapy is effective as corticosteroid injection. We recruited only the patients who were diagnosed SIS. There was not any frozen shoulder as Ainsworth and colleagues's study that possibly US therapy is not effective on in. In addition, we applied US seven minutes longer like Yildirim et al. but Ainsworth applied average four minutes per patient (13).

Our results indicate that US is effective on reduction of pain and improvement of function which are the main problem for a patient diagnosed SIS. Ultrasound therapy may have the potential to induce biophysical effects within the soft tissue. Ultrasound is assumed to have thermal effects on the target tissue resulting in an increase in blood flow, cell metabolism and tissue regeneration, and also reducing inflammation, edema and pain.

Corticosteroid injection is a very common and effective therapy on SIS. Tan et al. have compared conventional PT and corticosteroid injection as in our study. They have applied US, IC, hot-pack, exercise to PT group and corticosteroid injection with exercise to another group. As distinct from our study, they have found that VAS pain during motion and rest at first week and VAS pain during motion at 3rd week in

injection group were significantly less than the PT group. However, they have not found differences between the groups for the pain scores at the 6th week (15). The early and significant improvement at pain can be explained with the anesthetic added to the corticosteroid injection treatment. Because, combination of corticosteroid and local anesthetics reduces the pain. Additionally, in their study, Constant-Murley scores were significantly better in injection group at the end of the first week but, there were no differences between the groups at the end of 6th week.

Levendoglu et al have compared corticosteroid injection treatment at SIS, with 15 sessions-PT program including US, TENS and hot-pack. Similar to our study, they have found significant improvements at all parameters in both groups at the end of the study. Contrary to our study, they have observed better significant improvements in injection group at VAS pain during rest and active motion at 15th day, first month and 3rd month of the study (16). We can explain these differences with the local anesthetic added to the injection treatment and receiving physical therapy without hospitalization of the patients in the PT group. In our study VAS pain during active motion and sleep was better in PT group than the injection group at the end of 3rd week and 8th week, and we believe that it was due to hospitalization and being avoided from inappropriate activities and the emotional stress of the daily living as well as the exercise therapies with physiotherapists. In several studies it has been showed that corticosteroid injection is effective on reducing inflammatory response (16, 17) However, some side effects after injection including pain, tendon tears, blushing and infection have been reported (18). In our study there were no side effects and we found significant improvements at VAS pain, ROM and Constant-Murley scores at the end of 3rd and 8th weeks, when compared with the baseline.

There are limited studies in literature which compare the effectiveness of analgesic currents. In PT modalities, analgesic currents like IC and Transcutaneous Electrical Nerve Stimulation (TENS) are important for pain relief. IC is often used for acute and chronic pain of superficial and deep tissues (19). As well as the analgesic effect, it is used for anti-inflammatory effect at joint sprains, for osteogenic effect at delayed fracture improvements and for sympatholytic effect at Complex Regional Pain Syndrome (20, 21). Although the effect mechanism of IC is not clear, there are various suggested hypotheses, one of which is Melzack-Wall theory; increasing release of endogenous opiates, local vasodilatation and sympathetic blockade (22). There are studies which have showed that IC was as effective as TENS at the treatment of superficial and deep tissues pain. Ay et al. compared TENS with IC in patients with shoulder pain. In both groups US, hot-pack and exercise therapies were added to the treatment. At the end of the study, they observed significant improvement at pain scores and ROM in both groups, but they found no significant differences between two groups

(23). Facci LM et al also compared effects of TENS and IC in their study and found any statistical difference between two methods for reducing VAS score (24). Another supporting result was found in the study of Ucurum SG et al. They applied TENS or IC for their patients all of whom were diagnosed as SIS similar to our study. There was similar result in terms of pain and SF 36 physical component scores at fourth week and third month assessments (25). In our study, the main complaint was pain. Therefore, we combined US and local heat therapy with IC in PT group. We found that IC might have a beneficial effect on pain relief and improvement at daily living activities in PT group. Our results suggest that US combined with local heat, and IC, and exercise program has benefit effect similar local injection treatment on shoulder mobility, pain and disability in SIS.

Our study has some limitations, one of which is that subject number was fewer and follow up period was short. That's why, studies with large numbers of subjects and long follow up periods are needed to confirm these results.

Our results showed that both PT and subacromial corticosteroid injection treatments for SIS have similar effects on pain relief, providing ROM, shoulder functions and daily living activities. PT demonstrated comparable efficacy versus local injection treatment with similar clinical response. However, PT is more effective in long-term pain relief.

Conflict of interest

There is no conflict of interest to declare.

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