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Are intra-articular corticosteroid injections better than conventional TENS in treatment of rotator cuff tendinitis in the short run? A randomized study

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Aim. **Rotator cuff problems are common causes of pain and restriction of movement in shoulder. The aim of this study to compare the effect of intra-articular injection of corticosteroid and conventional transcutaneous electrical nerve stimulator (TENS) treatment in treatment of rotator cuff tendinitis.**

Methods. **Subjects were randomly allocated into Group 1 (intra-articular injection of corticosteroid) and Group 2 (conventional transcutaneous electrical nerve stimulation-TENS). Outcome measurements were performed using the Visual Analogue Scale (VAS) for pain, range of motion (ROM), the Shoulder Disability Questionnaire (SDQ), the Short Form-36 (SF-36), and Beck Depression Scale (BDS) questionnaires and paracetamol consumption.**

Results. **In both groups, significant improvement was observed in all weeks in VAS, ROM and SDQ scores (P<0.05). Improvement was detected in most of the SF36 scores at the end of the treatment in both groups (P<0.05), while no significant change was observed in BDI score (P>0.05). In both treatment groups, paracetamol consumption decreased in time (P<0.05). When the groups were compared, a significant difference was found between the groups in favor of Group 1 in terms of VAS-at night and VAS-at rest in weeks 1, 4 and 12, and VAS-during movement in week 1 and 12 (P<0.05). The comparison of two groups revealed a significant difference in favor of Group 1 in weeks 1 in the passive abduction and the active and passive IR ROM measurements (P<0.05). There was also a significant difference in favor of Group 1 observed in weeks 1 in SDQ scores (P<0.05).**

Conclusion. **Intra-articular injection of corticosteroid and conventional TENS are efficient in the treatment of rotator cuff tendinitis. When two treatments are compared, it may be concluded that intra-articular steroid injection was more effective especially in the first weeks regarding pain, ROM and disability. Otherwise, use of TENS allow to patients to increase activity level, improve function and quality of life like that in our study. TENS, as it is cheaper, non-invasive, more easily performed and efficient, may be preferable for the treatment of shoulder pain. Further studies are needed to include these results in the prospective treatment guidelines.**

KEY WORDS: Injections, intra-articular - Transcutaneous electric nerve stimulation - Rotator cuff.

Inflammation and degenerative changes in the rotator cuff and adjacent structures are the predominant causes of shoulder pain.[1] The most common symptoms in rotator cuff tendinitis are pain related to movement, muscular weakness and reduced mobility in the shoulder [1]. The most common methods currently applied to alleviate the symptoms of rotator cuff pathologies include the analgesics and non-

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steroidal anti-inflammatory drugs (NSAIDs), injection of corticosteroids, physical therapy-rehabilitation methods, and surgical approaches.[1-3] But, there is very little evidence on the effectiveness of these methods in treatment of rotator cuff tendinitis.[3-6]

Despite extensive research, there are no definitive guidelines with regard to appropriate duration of non-operative management, including the number and frequency of corticosteroid injections, primarily because each patient has different expectations and responses to treatment. Furthermore, published clinical trials have not provided individual patient characteristics or uniform outcome measures. These factors make it challenging to perform meta-analyses of the clinical efficacy of corticosteroid injections in patients with clinically significant rotator cuff injuries.[7] Although corticosteroids will not reverse pathologic changes within the rotator cuff, properly placed injections can reduce inflammation within the bursa and the rotator cuff tendons, thus reducing pain and allowing patients to participate in appropriate physical therapy to regain their daily living activities.[7-9] The precise mechanism of local corticosteroid injections is not well understood. Possible therapeutic mechanism include anti-inflammatory effects, relaxation of reflex muscle spasm, influence of local tissue metabolism, pain relief, mechanical improvement, and placebo effect.[10] Although corticosteroid injections are commonly applied in clinical practice, there are still question marks in the minds of clinicians regarding the application technique, efficacy and side effects.

Physiotherapy encompasses a broad range of interventions. This group of interventions are often the first line of management for rotator cuff tendinitis in the clinical practice. The aim is to relieve pain, promote healing, reduce muscle spasms, increase joint range and strengthen weakened muscles and ultimately to prevent and treat functional impairment.[5] Physiotherapy interventions include manual physical therapy, laser, ultrasound, bipolar interferential current, transcutaneous electrical nerve stimulation (TENS), and pulsed electromagnetic field therapy. TENS uses analgesic currents and while its mechanism of action is not completely understood it is thought that it serves to release endogenous opiates in specific areas of the central nervous system.[5, 11] TENS is used more frequently compared to other physical therapy methods; it has already been used in respectable evidence-based studies involving the treatment of other musculoskeletal diseases. It is a more acceptable physical therapy method in the literature. However, it has been reported that there are no sufficient data on the efficacy of TENS application not only in rotator cuff tendinitis, but also in shoulder pain.[12]

Several trials compared injection to physiotherapy in the literature for shoulder pain.[5] These comprised two trials comparing intra-articular corticosteroid injection with a combined physiotherapy intervention,[13, 14] two trials comparing intra-articular and subacromial corticosteroid injection to electrotherapy and exercises,[15, 16] and three comparing injections to mobilisation and manipulation.[15, 17, 18]

Despite different methods are being used in the treatment of rotator cuff tendinitis there is no concencus neither about which of these treatments in more effective nor whether they have a superiority over each other or not. The studies on shoulder pain treatment [2, 8, 9] also mention the lack of studies carried out by using head-to-head comparison. Currently there exists no accepted gold standard or any treatment with proven efficacy for shoulder pain and rotator cuff tendinitis. This is mainly because there are not adequate studies of good quality that are executed head-to-head with suitable design and enough number of patients. Nevertheless, in clinical practice, especially physical therapy methods and intraarticular injections are used very often.

Therefore, our study aimed to compare intra-articular corticosteroid injection and conventional TENS treatment in patients with rotator cuff tendinitis.

Materials and methods

Study population

Forty patients who have been suffering shoulder pain for at least 3 months and who have rotator cuff pathology detected by shoulder ultrasonography were included in the study. Study population consisted of 18 to 80 years old patients who had applied to the Physical Medicine and Rehabilitation and Pain Outpatient Clinics of Ege University Medical School. Patients were excluded if they had inflammatory arthritis (rheumatoid arthritis, ankylosing spondylitis, etc.), active synovitis in the joints, a history of shoulder surgery, a history of nerve blocks to the shoulder, intra-articular injection within the last 3 months, trauma or physical therapy within the last 6 months**,** patients with rotator cuff total rupture, very severe pain (Visual Analogue Scale [VAS]≥9), shoulder insta-

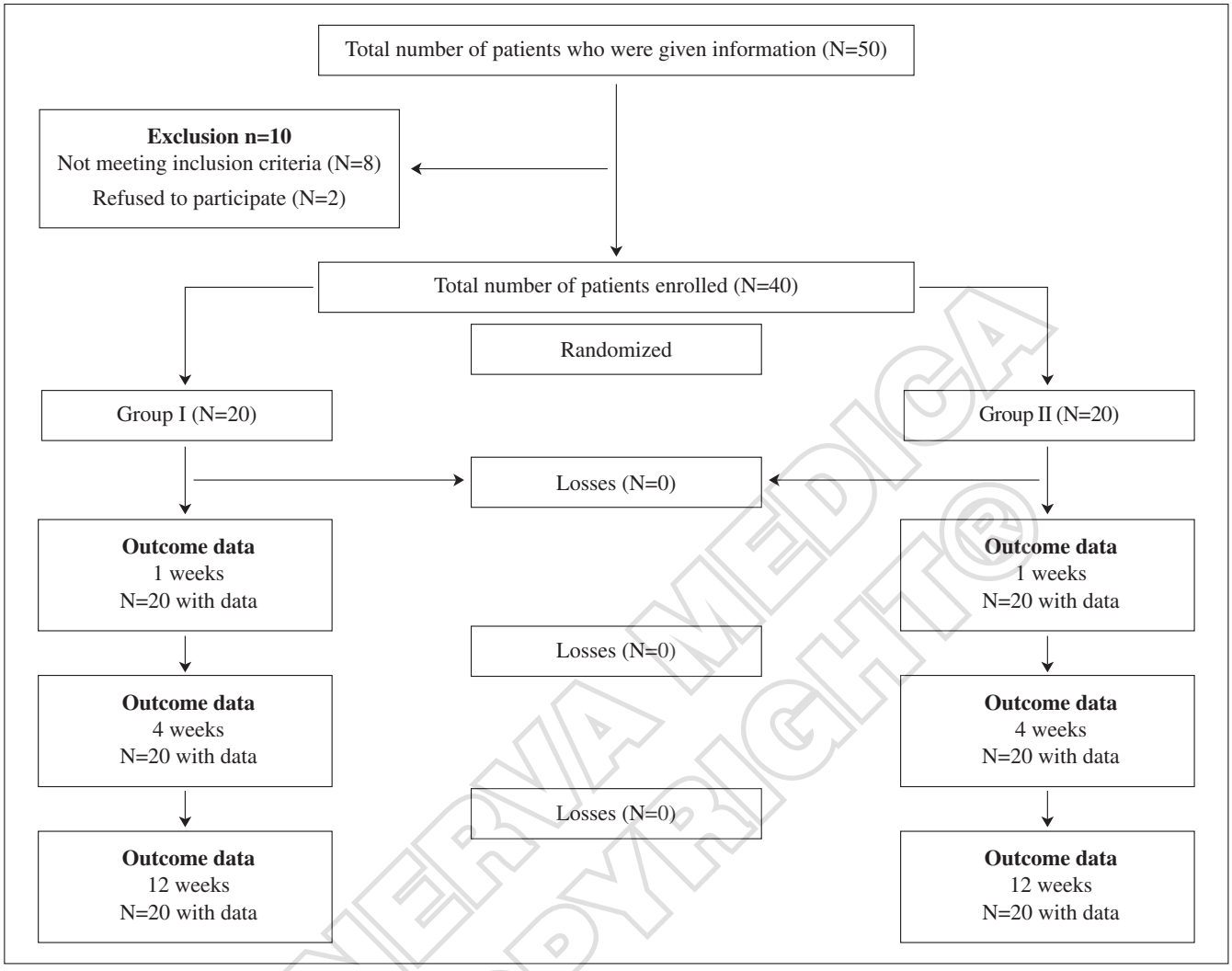

Figure 1.—Flow diagram of the study.

bility, positive drop arm test, presence of calcific tendinitis, advanced osteoarthritis, referred pain in the shoulder, neurological impairment (stroke, Parkinson's disease, paresis), severe cardio-vascular disease (acute myocardial infarction, congestive heart failure, uncontrolled hypertension), unstable chronic or terminal illness (diabetes mellitus, malignancies), bleeding problems, major depression, severe cognitive impairment, presence of pace-maker or severe musculoskeletal impairment (since the patient's arrival in the hospital would cause problems along with the adaptation difficulty concerning the given exercises and would affect pain and life quality scores).

Patients did not receive any additional treatments for the duration of the study. The patients were asked to stop taking NSAIDs before the study, and were reminded to avoid their use during the course of the study. The patients were allowed to use only paracetamol and the amount of paracetamol taken by the patients was recorded in the subsequent visits in first 4 weeks. Depending on the patient's needs, maximum 4 gram (1 tablet 500 mg. paracetamol) of paracetamol a day is allowed to be used.

Fifty patients were selected initially for this study. Eight patients did not fulfil the criteria and therefore were excluded from the study. Two patients did not

accept to be included in the study. Forty patients were randomized to the intra-articular injection of corticosteroid treatment (Group 1, N=20) or the conventional TENS treatment (Group 2, N=20) by using double randomization from the random number table.

Interventions

INTRA-ARTICULAR CORTICOSTEROID INJECTION TECHNIQUE

In order to provide standardization, all applications were performed by a single physician specialized in the field. The injection procedure was standardized. In order to perform the surgical procedure under sterile conditions, the intra-articular injection procedure was performed in the operating room. Each patient was placed in a supine position, and the skin overlying the operation area was prepared and draped. Fluoroscopy was adjusted to show the shoulder joint in antero-lateral position. Acromioclavicular joint entry point was marked and local anesthetic was applied to the skin (0.5 cc prilocaine). A 22 G spinal needle was inserted into the acromioclavicular joint. The injection was placed through the subacromial space and it was observed to penetrate into glenohumeral joint. Entry into the joint was proved by giving 0.5 cc contrast substance. The prepared mixture was injected as 3.5 cc to glenohumeral joint, 2.5 cc to subacromial space and 1 cc to acromioclavicular joint. This prepared mixture consisted of 0.5 cc triamcinolone (40 mg/ml) (Kenacort-A), 3.5 cc bupivacaine (5 mg/ml) (Marcaine), 3 cc serum physiologic.

TENS

TENS on the anterior and posterior aspects of the joint for 30 minutes for 5 times per week for 15 sessions, with a mean frequency of 100 Hz, 15 mA amplitüd, 150 µsn.

In both groups, exercises for increasing the range of motion, strengthening exercises, Codman exercises, pulley exercises, and finger ladder exercises were recommended. For each of the exercises, participants were provided with simple, step-by-step written instructions with illustrations.

Measurements

The following assessments were performed for all the subjects before and after the procedure by the same physician who was blinded to the treatment protocols:

Pain: maximum and mean pain severity during movement, at night and at rest in the last two weeks were assessed by a blind-testing physician using the 10 cm. standard VAS.

Range of Motion (ROM): range of motion of the shoulder was examined by the same physiotherapist using an goniometer according to a standardized protocol.

Shoulder Disability Questionnaire (SDQ): the shoulder disability questionnaire (SDQ) is a validated pain related disability questionnaire including 16 items that describe common conditions that may induce symptoms in patients with disorders of the shoulder. All items refer to the preceding 24 h. Options are "yes", "no" and "not applicable". The "not applicable" category should be used when the condition referred to has not occurred during the preceding 24 h. A final score is calculated dividing the number of "yes" scored items by the total number of items applicable. And then multiplying the score by 100, which results in a final score that ranges between 0 (no disability) and 100 (all applicable items scored "yes"). The higher the score, the greater the impairment [19].

Short Form 36 (SF 36): on this widely used index, there are 36 questions for evaluating the quality of life. It is essential that a score be obtained for the designated life areas, such as physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, and mental health [20]. Pre-treatment scores and the scores obtained only after week 12 were evaluated in terms of the significance of results.

Beck Depression Inventory (BDI): BDI is a 21-item test presented in multiple choice format which purports to measure presence and degree of depression. Responses are made on a four point, minimally-anchored scale, ranging from 0 to 3, with 3 representing the most severe symptoms.[21] Pretreatment scores and the scores obtained only after week 12 were evaluated in terms of the significance of results.

Follow-up measurements

The patients were evaluated for pain relief, ROM, functional disability, and complications. All of the measurements were repeated after 1, 4 and 12 weeks by the same blinded physician who had made the initial assessments. The patients and the blinded physician also assessed the effectiveness of treatment separately as 0=Ineffective, 1=Minor effects, 2=Moderately effective, 3=Good results, 4=Very good results.

TABLE I.—*Demographic characteristics of the patients.**

	Group 1 (N.=20)	Group 2 8N.=20)
Age (Mean±SD)	60.8±12.5	57.60±9.92
Female/male (N)	15/5	14/6
Shoulder problem (N)		
Right side	12	11
Left side	8	9
Symptom duration (month) (Mean±SD)	8.9±5.1	8.6±4.5

P>0.05, SD: Standard deviation.

The protocol was approved by the local Research and Ethics committee of the medical unit where the study was performed, and all participants signed an informed consent before enrollment.

Statistical analysis

The results were analyzed using the Statistical Package for Social Sciences (SPSS) version 14.0 software for Windows. Descriptive statistics were used to characterize the sample. Preliminary inferences using two independent student t-tests for numeric variables and Chi-square for categorical variables were made. Normal distribution was assessed by Shapiro-Wilk test in the repeated measurement. Where variances were homogeneous distribution the groups were performed repeated measures ANOVA. Bonferoni Test was used as the Post Hoc method. Variables presenting no homogeneous distribution were analyzed with Fredman test and Wilcoxon test for intra-group analysis and Mann Whitney-U test was used to compare the the two groups. Statistical significance level was set at P<0.05.

Results

There was no significant difference between the groups demographically (Table I) (P>0.05).

In Group 1, statistically significant improvements were found in VAS, ROM (active and passive), and SDQ scores in weeks 1, 4 and 12 compared to the pre-treatment period (P<0.05) (Table II). Compared to pre-treatment values, statistically significant improvements were found in most of SF36 sub-scores (except general health, vitality, and emotional role scores) (P<0.05) while no significant improvement was noted in BDI score (P>0.05) (Table III). Paracetamol consumption decreased significantly in Group 1 in weeks 3 and 4 (P<0.05) (Table IV).

In Group 2, statistically significant improvements were found in VAS, ROM (active and passive), and SDQ scores in weeks 1, 4 and 12 compared to the pre-treatment period (P<0.05) (Table II). Compared to

TABLE II.—*VAS, ROM and SDQ scores before and 1, 4, and 12 weeks after procedure.*

	Group 1 (N.=20)				Group 2 (N.=20)			
	Pre-treatment	1. week	4. week	12. week	Pre-treatment	1. week	4. week	12. week
VAS (Mean±SD)								
At Night	5.9±1.9	2.1±2.0*	1.7±1.2*	1.2±0.9*	5.8±1.4	4.2±1.8*	2.7±1.6*	2.0±0.9*
At Rest	3.7±1.3	1.5±1.0*	0.6±0.4*	0.2±0.4*	3.6±1.7	2.3±1.2*	1.8±1.5*	1.0±0.7*
During Movement	7.1±1.4	3.5±1.4*	1.9±1.2*	1.2±0.7*	7.5±1.2	4.5±1.0*	2.6±1.6*	2.1±1.3*
ROM (Mean±SD)								
Active.Flex	130.3±18.7	152.5±21.6*	162.7±14.7*	170.5±9.1*	129.8±15.6	144.9±17.6*	160.0±11.9*	165.3±8.8*
Passive Flex	152.2±15.3	166.8±13.6*	174.7±9.1*	178.5±3.9*	150.2±15.5	161.0±10.3*	171.8±4.3*	173.3±3.4*
Active Abd	115.5±26.2	143.5±22.9*	163.7±16.1*	170.0±13.3*	110.2±28.1	124.3±23.2*	149.8±14.6*	159.3±11.8*
Passive Abd	136.5±23.0	161.3±22.4*	174.1±12.3*	177.5±7.0*	146.8±21.4	153.8±15.9*	172.8±9.2*	177.3±6.0*
Active ER	47.4±20.1	59.3±20.9*	68.3±10.8*	69.9±8.9*	48.0±18.1	56.8±15.7*	64.5±9.9*	70.3±8.7*
Passive ER	60.5±17.6	70.5±18.5*	77.0±8.4*	79.8±5.9*	62.8±14.7	67.5±13.4*	74.3±6.4*	77.3±5.2*
Active IR	45.0±19.8	59.0±14.8*	66.7±14.2*	68.6±7.9*	39.4±14.2	48.3±13.3*	63.0±11.3*	68.4±11.8*
Passive IR	57.9±20.0	69.8±12.5*	76.7±8.4*	77.8±4.6*	55.0±14.8	60.8±11.5*	72.8±6.0*	77.0±4.4*
SDQ (Mean±SD)	80.7±12.9	37.9±22.6*	22.1±15.9*	13.7±11.5*	82.3±9.9	67.6±15.9*	42.5±14.7*	28.5±13.2*

*P<0.01, SD: Standard deviation, VAS: Visual Analogue Scale, ROM: Range of Motion, Flex: Flexion, Abd: Abduction, ER: External rotation, IR: Internal rotation, SDQ: Shoulder Disability Questionnaire.

TABLE III.—*SF36 and BDS scores before and 12 weeks after procedure.*

	Group 1 (N.=20)		Group 1 (N.=20)	
	Pre-treatment	Post-treatment	Pre-treatment	Post treatment
SF36 (Mean±SD)				
Physical functioning	54.1±16.9	68.5±17.4*	60.5±12.0	74.4±16.9*
Physical role	8.9±12.7	51.2±36.7*	13.8±20.6	63.8±15.1*
Bodily pain	26.3±12.2	68.6±16.6*	28.6±13.1	61.3±18.0*
General health	44.9±21.2	50.0±19.2	50.3±13.1	58.6±17.1*
Vitality	50.7±10.9	51.5±12.1	52.6±13.2	54.3±12.6
Social functioning	45.0±24.8	68.1±25.8*	48.5±21.6	73.3±14.0*
Emotional role	53.2±25.1	58.2±21.2	52.5±23.6	53.8±18.5
Mental health	51.6±13.7	56.1±13.9*	51.8±16.7	55.1±16.3*
BDI (Mean±SD)	4.6±2.9	4.0±3.8	3.8±2.8	4.3±2.9

*P<0.05, SD: Standard deviation, SF36: Short Form 36, BDI: Beck Depression Inventory.

pre-treatment values, statistically significant improvements were found in most of SF36 sub-scores (except vitality, and emotional role scores) (P<0.05) while no significant improvement was noted in BDI score (P>0.05) (Table III). Paracetamol consumption decreased significantly in Group 1 in weeks 3 and 4 (P<0.05) (Table IV).

When the groups were compared, a significant difference was found between the groups in favor of Group 1 in terms of VAS-at night and VAS-at rest in weeks 1, 4 and 12, and VAS-during movement in weeks 1 and 12 (P<0.05). There was no statistically significant difference between the two groups regarding the improvement of active and passive flexion, active abduction, active and passive ER and IR (P>0.05).

TABLE IV.—*Paracetamol consumption in first 4 weeks (gram/week).*

	1. week	2. week	3. week	4. week
Group 1 (N.=20)	4.40±4.64	3.65±4.04	2.67±3.02*	2.00±2.38*
Group 2 (N.=20)	6.65±3.22	6.10±4.24	4.82±3.43*	4.35±3.26*

*P<0.05.

The comparison of two groups revealed a significant difference in favor of Group 1 in week 1 in the increase of passive abduction, active and passive IR ROM measurements (P<0.05). There was also significant difference in favor of Group 1 observed in week 1 in SDQ scores (P<0.05) (Table II). No statistically significant difference was found between two groups in terms of SF36 sub-scores (except bodily pain) and BDI sub-scores (P>0.05) (Table III). Paracetamol consumption was observed to be lower in Group 1 in weeks 3 and 4 (P<0.05) (Table IV).

In weeks 1 and 4 for physician satisfaction rate, and in week 1 for patient satisfaction rate was observed to be significantly higher in Group 1 (Table V, VI) (P<0.05).

No significant adverse event was reported in either of the two groups (P>0.05).

Discussion

At the end of our study, improvement was observed in terms of pain, ROM, functionality and quality of life in both intra-articular corticosteroid injection treat-

TABLE V.—*Doctor satisfaction.*

	0 Infective	1 Minor efects	2 Moderately effective	3 Good results	4 Very good results
1. week (N.%)					
Group 1*	0 (0%)	3 (15%)	1 (5%)	11 (55%)	5 (25%)
Group 2	0 (0%)	11 (55%)	7 (35%)	2 (10%)	0 (0%)
4. week (N.%)					
Group 1	0 (0%)	0 (0%)	3 (15%)	14 (70%)	3 (15%)
Group 2	0 (0%)	0 (0%)	9 (45%)	10 (50%)	1 (5%)
12. week (N.%)					
Group 1*	0 (0%)	1 (5%)	1 (5%)	9 (45%)	9 (45%)
Group 2	0 (0%)	0 (0%)	6 (30%)	13 (65%)	1 (5%)

*P<0.05

TABLE VI.—*Patient satisfaction.*

	0 Infective	1 Minor efects	2 Moderately effective	3 Good results	4 Very good results
1. week (N.%)					
Group 1 *	1 (5%)	2 (10%)	3 (15%)	10 (50%)	4 (20%)
Group 2	0 (0%)	10 (50%)	6 (30%)	4 (20%)	0 (0%)
4. week (N.%)					
Group 1	0 (0%)	2 (10%)	3 (15%)	10 (50%)	5 (25%)
Group 2	0 (0%)	1 (5%)	7 (35%)	11 (55%)	1 (5%)
12. week (N.%)					
Group 1	0 (0%)	1 (5%)	2 (10%)	9 (45%)	8 (40%)
Group 2	0 (0%)	0 (0%)	7 (35%)	11 (55%)	2 (10%)

*P<0.05

ment and conventional TENS treatment groups in patients with rotator cuff tendinitis. While there was no difference between the two treatment groups in terms of quality of life and psychological state, improvement rate was higher in intra-articular corticosteroid group in terms of pain, ROM and SDQ scores.

Previous randomized trials and systemic reviews have reported contradictory results on the effectiveness of corticosteroid injections for shoulder disease.[7, 8, 9, 22-29] The methodological quality varied and only one treatment had definitive evidence for efficacy for non-specific patients, namely injection of corticosteroids. The trust in corticosteroids, injected in the subacromial bursa, was supported by definitive evidence for short-term efficacy.[12] There are still no available answers to questions regarding the type of steroid to be used (methyl prednisone or triamcinalone), dose, dose frequency, dose intervals, place of application and the duration of efficacy in intra-articular corticosteroid application.[7-9] Prospective and randomized trials evaluating corticosteroid injections in patients with rotator cuff disease are limited. Koester *et al.*,[30] reported little reproducible evidence to support the use of corticosteroid injections to relieve pain, increase ROM, or improve function in patients with rotator cuff disease. In the study by Emery *et al.*,[31] improvement was observed in pain in weeks 1 and 4 by steroid and local anesthetic application, while this improvement did not continue in week 12 when compared to the control group. Similarly, improvement did not continue in week 12 also in the study carried out by Shanahan *et al.*[32] In our study, an improvement lasting till week 12 was observed in all VAS and SDQ scores. Even two studies with the longest follow-up of 12 weeks demonstrated either no improvement or a gradual deterioration in the range of motion with time.[32, 33] In literature, short-term effect of corticosteroid injection has been criticized.[7-9] As a matter of fact, when two treatment groups are compared, the higher rate of improvement in the steroid treatment groups especially in the first weeks may be associated with this condition. The continuation of the positive effect on pain up to week 12 and the improvement obtained in ROM may be explained by the application of corticosteroid injection in 3 different areas in intra-articular injection. Besides, the applications accompanied by fluoroscopy, the type of steroid used and the appropriate combination of local anesthetic substance (lidocaine use in most studies) [8, 9] may also have been useful. Therefore, future studies, which evaluate all these effective variables separately, may clarify our hypotheses. In addition, studies wit longer follow-up periods may provide information about the effect duration.

Few trials have compared the results of physiotherapy with intra-articular injections for rotator cuff disease, however most have used differing physiotherapy modalities and injection sites making it not clinically sensible to combine the results of these trials in a meta-analysis. One study with multiple outcomes assessed at many time points [13] has demonstrated intra-articular corticosteroid injection to be significantly more beneficial than a combination physiotherapy approach (mobilisation, exercise and electrotherapy) with respect to improvement inmain complaint at 3weeks, 7weeks and 13weeks, but not beyond. This benefit was maintained when combined

with a second study assessing short term pain and demonstrating no significant difference between groups.[14] These findings are supported by another trial comparing intraarticular and subacromial corticosteroid injection to exercises and electrotherapy [15] and demonstrating significant benefit of injection over physiotherapy in the short term, however in the longer term there was no difference between groups. After these studies, there is some evidence that for rotator cuff disease, corticosteroid injections are superior to physiotherapy (4 trials).[13-15, 17] In the study by Hay *et al*.,[34] no difference was detected between injection and physiotherapy groups in terms of pain, ROM and disability scores in the 6 month-period.

The review of studies comparing different physiotherapy methods revealed that the effect of ultrasound was not significantly different to bipolar interferential current in the short or long term,[35] however one trial showed significantly greater improvement with ultrasound than TENS. This was not supported by the results of the other trials.[5] Johansson *et al*.[12] reported that there is no available evidence for efficacy of TENS for patients with subacromial pain. In our study, it was observed that the improvement in pain, ROM and disability scores continued until week 12. Although these findings demonstrate that physiotherapy is important for rotator cuff tendinitis treatment, available data do not allow making specific recommendations. Currently, there is no treatment algorithm established for rotator cuff lesion. However, concomitant use of these treatments in clinical practice will increase the treatment success by all means.

However, chronic shoulder pain is expected to affect patients' quality of life and psychological state, since its treatment requires a long and challenging process affecting daily life activities. People with shoulder pain have been shown to score substantially less than normal values on the SF-36 (a standardised measure of general health) for physical function, social function, physical role function, emotional role function and pain.[36, 37] In our study, it was observed that SF36 scores were negative in pre-treatment period and there was a significant improvement in most of the sub-scores following the treatment in both groups. However, no difference was found between two groups. Improvement was observed also in depression scores, but this improvement was not statistically significant. In today's medicine, which considers the quality of life as one of the most important parameters indicating the treatment success, it will be useful to include these variables in the study protocol in future studies.

In both treatment groups, paracetamol consumption decreased in time. This decrease was found to be more in intra-articular corticosteroid group compared to TENS group. This may be explained by the significant effect of intra-articular corticosteroid injection on pain.

Patient and physician satisfaction was observed to be high in both groups. Probably due to the difference in pain scores, patient and physician satisfaction was found to be higher in Group 1. It should be taken into consideration that invasive application would be more effective. The absence of drop-outs in the follow-up period may be associated with the fact that the study achieved the desired objectives, such as the close follow-up of patients and providing the functionality regarding pain – ROM.

These processes could have been performed using US guided technique. In fact, a study that compares fluoroscopy with ultrasonography guided approach can be planned for future studies. The applications both by fluoroscopy and US are approaches that require considerable experience. When personal experience is taken into account, we think that the application with fluoroscopic guide is easier. Yet, the disadvantage of radiation should not be forgotten. Whereas in ultrasonography guided approach, experience of the executor comes into prominence. However, since we have used fluoroscopic approach in our clinic, we have preferred this application. As the executor was very experienced, we did not face any adverse effect problems. We think that experience is important in these kinds of applications.

The strong aspects of our study are that it is the first study to compare the efficacy conventional TENS treatment and intra-articular corticosteroid injection in patients with rotator cuff tendinitis, it is a randomized study, and the patients were evaluated through multiple dimensions (quality of life and depression). The reason for us to select only the patients with rotator cuff pathologies is that planning the study in a more specific patient group would provide more specific results; and would also prevent confusion in the literature. The exclusion of placebo or control group due to ethical reasons and practical difficulties may be considered as the limitations of this study. It will be useful to evaluate also the cost-effectiveness in future studies.

In conclusion, conventional TENS and intra-articu-

lar injection of corticosteroid are efficient applications in terms of pain, ROM, disability and quality of life in the treatment of rotator cuff tendinitis. It may be stated that intra-articular steroid injection is more effective on pain, ROM and disability especially in the first weeks. As intra-articular injection of corticosteroid is an invasive treatment approach, it may certainly not be the first option in treatment. However, it may be considered as an option in patients who do not respond to conservative treatment. Use of TENS allow to patients to increase activity level, improve function and quality of life like that in our study. Conventional TENS, as it is cheaper, non-invasive, more easily performed and efficient, may be preferable for the treatment of shoulder pain. In clinical practice, these results can be a guide for us in terms of treatment method and proper patient selection. We are of the opinion that new studies are needed to include these results in future treatment guidelines.

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