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Article

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Comparison of the therapeutic effects of ultrasound-guided platelet-rich plasma injection and dry needling in rotator cuff disease: a randomized controlled trial

Dong-wook Rha[1], Gi-Young Park[2], Yong-Kyun Kim[3], Min Tae Kim[3] and Sang Chul Lee[3]

Abstract

Objective: To compare the effects of platelet-rich plasma injection with those of dry needling on shoulder pain and function in patients with rotator cuff disease.
Design: A single-centre, prospective, randomized, double-blinded, controlled study.
Setting: University rehabilitation hospital.
Participants: Thirty-nine patients with a supraspinatus tendon lesion (tendinosis or a partial tear less than 1.0 cm, but not a complete tear) who met the inclusion criteria recruited between June 2010 and February 2011.
Intervention: Two dry needling procedures in the control group and two platelet-rich plasma injections in the experimental group were applied to the affected shoulder at four-week intervals using ultrasound guidance.
Measurements: The Shoulder Pain and Disability Index, passive range of motion of the shoulder, a physician global rating scale at the six-month follow-up, adverse effects monitoring and an ultrasound measurement were used as outcome measures.
Results: The clinical effect of the platelet-rich plasma injection was superior to the dry needling from six weeks to six months after initial injection ($P < 0.05$). At six months the mean Shoulder Pain and Disability Index was 17.7 ± 3.7 in the platelet-rich plasma group versus 29.5 ± 3.8 in the dry needling group ($P < 0.05$). No severe adverse effects were observed in either group.
Conclusions: Autologous platelet-rich plasma injections lead to a progressive reduction in the pain and disability when compared to dry needling. This benefit is certainly still present at six months after treatment. These findings suggest that treatment with platelet-rich plasma injections is safe and useful for rotator cuff disease.

Keywords

Rotator cuff, platelet-rich plasma, injection, controlled trial.

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Introduction

Rotator cuff pathology is a common orthopaedic disorder and a major cause of shoulder pain. Treatments for rotator cuff lesions without complete tears are mainly conservative.[1] Subacromial injection of anaesthetics or corticosteroids is often used to treat patients with persistent symptoms after rehabilitative therapy and use of oral non-steroidal anti-inflammatory drugs (NSAIDs).[2] Although NSAID treatment and injections of corticosteroids are known to alleviate inflammation and shoulder pain, serious gastrointestinal side-effects after prolonged oral NSAID administration[3] as well as arthropathic changes and increased tendon fragility caused by repeated corticosteroid injections[4] are important concerns.

The pathogenesis of rotator cuff lesions is currently under debate. The rotator cuff is limited in its ability to regenerate due to poor vascularization of the tendon tissue.[5] Interest has increased in providing endogenous growth factors directly to the ligament and tendon injury site. Testing of platelet-rich plasma, the bioactive component of whole blood, is being conducted in various fields of medicine to aid in regeneration of tissue with poor healing potential.[5] Platelet-rich plasma is obtained by centrifuging whole blood and contains a higher platelet concentration than whole blood. It also contains the cellular components of plasma that settle after centrifugation, as well as numerous growth factors.[6–8] Platelet-rich plasma is expected to facilitate healing of these poor vascular structures. Despite this interest and its widespread use, there is a lack of high-level evidence from randomized clinical trials which have assessed the efficacy of platelet-rich plasma in treating ligament and tendon injuries.

Dry needling, also known as percutaneous microtenotomy, involves treating a chronic tendon injury, such as a tendinosis, by attempting to change a chronic, non-healing injury into an acute lesion that may have greater healing potential.[9] The disruption of the tendinosis or scar tissue by needling and consequent bleeding is thought to release tissue growth factors that stimulate a healing response.[9,10] This healing mechanism is the common denominator between needling and platelet-rich plasma. The goal of platelet-rich plasma injected into areas of tendinopathy is also to induce healing via cellular and humoral mediators.[11] Needling effects during platelet-rich plasma injection possibly can induce a healing process via a similar mechanism. Therefore, the present study set out to compare platelet-rich plasma to dry needling.

Given that the suggested therapeutic effects of platelet-rich plasma cover the symptoms of rotator cuff disease, we considered whether platelet-rich plasma might be effective for treating rotator cuff disease. In this study, we conducted a randomized clinical trial to compare the therapeutic effects of platelet-rich plasma injection with those of dry needling on shoulder pain and dysfunction in patients with rotator cuff disease. We hypothesized that platelet-rich plasma injection at the site of a supraspinatus lesion would reduce pain and improve the range of motion of the shoulder significantly more than dry needling.

Methods

Among patients with shoulder pain who visited the outpatient clinic of a university hospital between June 2010 and February 2011, those who met the following criteria were included in this study: (1) had more than six months of shoulder pain, (2) had a pain score measured by the visual analogue scale in the affected shoulder greater than 5 (on a numeric scale of 0–10), (3) had a painful arc and/or an impingement sign, (4) demonstrated no weakness on resisted testing of musculotendinous units of the rotator cuff, (5) were diagnosed with supraspinatus tendon disease, such as a tendinosis or a partial-thickness tear of less than 1.0 cm upon sonographic examination, and (6) no or little response to conservative therapy for at least three months. Exclusion criteria included: (1) presence of other obvious pathology for the rotator cuff pain, such as a fracture or rheumatic diseases, (2) referred pain from the neck, (3) prior surgery to either the shoulder or neck region, (4) a history of NSAID use during the most recent two weeks and/or steroid injection within six weeks, (5) hypersensitivity to lidocaine, (6) presence of an unstable medical condition or a

known uncontrolled systemic disease, and (7) any conditions or situations that might place the patient at significant risk during the study.

The present study was designed as a prospective, randomized, double-blinded, clinical trial that compared platelet-rich plasma injection with dry needling. Patients were randomly grouped into the platelet-rich plasma injection and dry needling groups using a stratified randomization procedure with a permuted block size of four using a computer that balanced ages (<60 or ≥60 years) and sexes (male or female) between the two groups before the trial. For the treatment allocation, sealed envelopes with numbers were used. The flowchart of the study is presented in Figure 1.

Approval from the institutional review board was obtained before conducting the study. Written informed consent was obtained from all participants after they were briefed about the purpose of the study and the examination procedures.

One physiatrist (SCL), who was not blinded, examined all patients who were referred to the clinic for eligibility. This physiatrist, who has more than 7 years of experience in musculoskeletal sonography, also performed the sonographic examinations. B-Mode real-time ultrasound was performed using Accuvix V10 (Samsung Medison Co., Ltd, Seoul, Korea) interfaced with a 5–12 MHz linear array transducer. Rotator cuff tendon abnormalities were described as follows: normal, tendinosis, partial-thickness tear, or full-thickness tear. When a rotator cuff tear was detected on sonographic examination, its type (full- or partial-thickness), location (name of involved tendon; tear in a critical zone or intra-substance) and size were recorded. For the purpose of this study, only patients having supraspinatus tendinosis or a tendon partial-thickness tear of less than 1 cm were included.

Both the participating patients and outcome investigator who evaluated the outcome measures were blinded to the treatment allocation. Twenty-five millilitres of blood was obtained from all patients via venipuncture from the unaffected arm. The collected whole blood was used to make the platelet-rich plasma for the platelet-rich plasma injection group, while blood from the dry needling group was discarded. Syringes for injection were sealed with plaster before injection to blind patients. Since platelet-rich plasma injection was performed using a similar technique with dry needling, patients did not know what group they belonged to. The investigator (DWR) who evaluated the outcome measures was blinded to the group allocation throughout the study, although the investigator (SCL) who performed the platelet-rich plasma injection and dry needling was not blinded. Platelet-rich plasma injections and dry needling were performed in the affected supraspinatus tendon twice at a four-week interval between injections.

Using a sterile technique with a sterile probe cover, real-time ultrasound guidance was provided during the dry needling procedure. A sterile field was set up and maintained throughout the procedure. The lesion was localized under ultrasound and the target area was then adjusted according to the site of maximal tenderness. A 25-gauge needle was used to anaesthetize the supraspinatus tendon with less than 1 mL of 0.5% lidocaine. After anaesthetizing the target, an investigator (SCL) confirmed whether the shoulder pain was reduced. Then, dry needling into the abnormal portion of the tendon was performed. The needle was passed through the lesion of the tendon approximately 40–50 times under ultrasound guidance.

Platelet-rich plasma was prepared using the Prosys PRP Platelet Concentration System (Tozaiholdings Inc., Seoul, Korea). This device comprised a microprocessor-controlled centrifuge and two syringe pumps. Twenty-five millilitres of the patient's blood was obtained and mixed with 3 mL of anticoagulant citrate dextrose formula A. The blood sample was centrifuged at 1600×*g* to separate erythrocytes from the plasma. Then, the plasma was centrifuged again at 2000×*g* to separate the platelet-poor plasma from the platelet-rich plasma. After centrifugation, 3 mL of the platelet-rich plasma was obtained via the disposable kit. Platelet-rich plasma injection was performed using basically the same technique that was used for dry needling. Three millilitres of platelet-rich plasma was infiltrated into the lesion of the supraspinatus tendon under ultrasound guidance. If it was difficult to inject the platelet-rich plasma into the site of the tear directly, the platelet-rich plasma was infiltrated around the lesion.

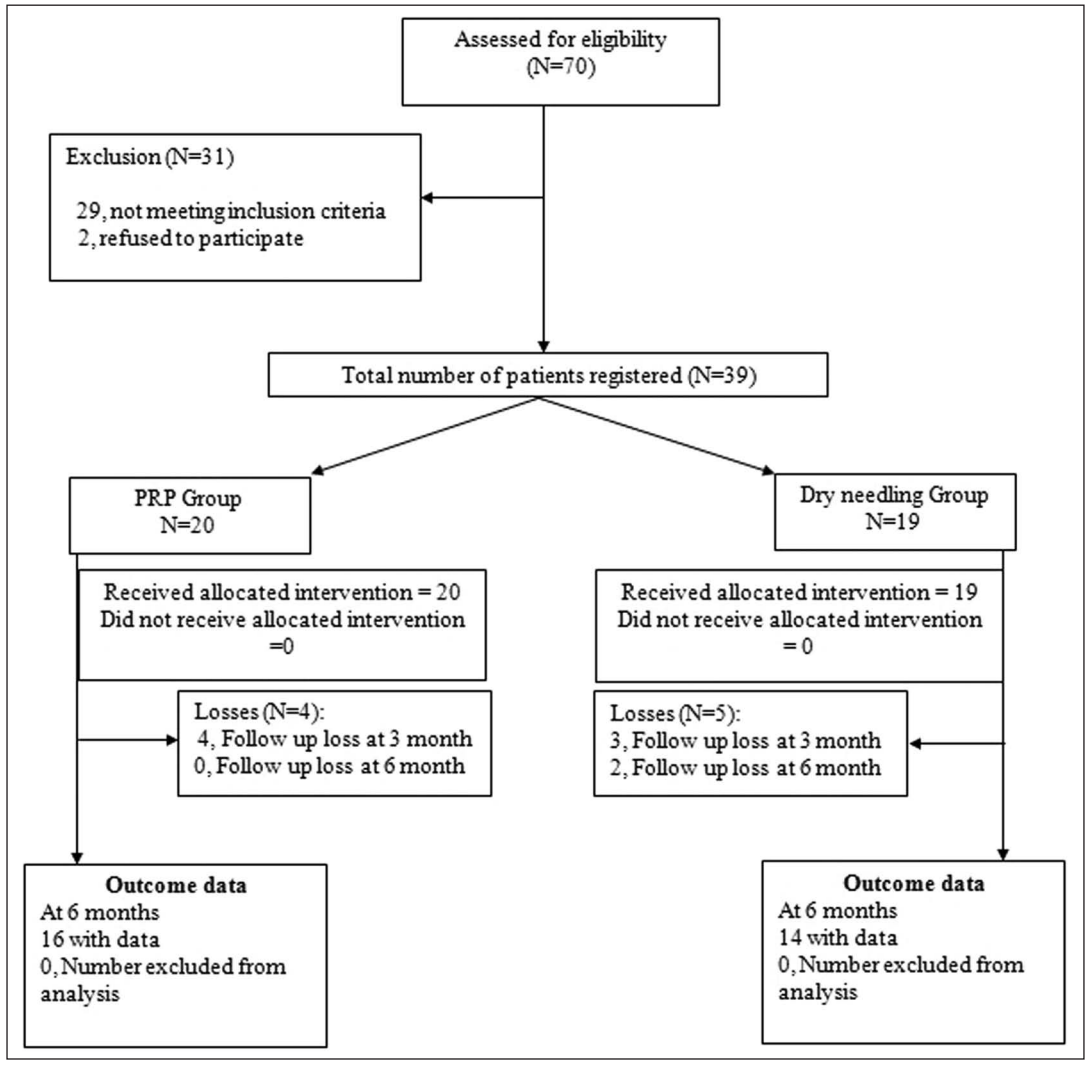

Figure 1. Flowchart of the study.

To control post-injection pain, acetaminophen or hydrocodone was prescribed if needed. A self-exercise protocol was provided to all participants and no other therapy was allowed during the study period except self-exercise and posture correction.

Until the first follow-up appointment at two weeks after the first injection, patients were recommended relative rest and allowed to continue usual activities of daily living. However, overhead activity and rounded shoulder posture were prohibited. Passive range of motion exercise and Codman pendulum exercise[12] for the shoulder were started on the first post-injection day. Active range of motion and light resistive exercises for strengthening the rotator cuff were allowed only if the pain had significantly subsided and movement was possible with less discomfort.

The Shoulder Pain and Disability Index was the main outcome measurement. This is a self-administered instrument developed to measure pain (five

items) and disability (eight items) associated with shoulder complaints.[13] Patients assessed their status using an analogue scale in which a score of 0 was recorded for 'no pain' and a score of 100 was recorded for the 'worst pain imaginable' for the five pain items. A score of 0 was recorded for 'no difficulty' and a score of 100 was recorded for 'difficulty requiring assistance' for the eight disability items. This index has been shown to be sensitive to clinical changes in patients with a pathology of the shoulder.[13] Also, passive range of motion of the shoulder using goniometry (forward flexion, abduction, external rotation and internal rotation) was measured. All motions were measured in the sitting position. Adverse effects were monitored throughout the study. Patients also reported any side-effects and post-injection pain throughout the study.

Outcome measurements were made at baseline (time 0), two weeks after the first injection (time 1), immediately before the second injection (time 2), two weeks after the second injection (time 3), at three- and six-month follow-up visits (times 4 and 5, respectively) by a blinded investigator.

Statistical analysis

After normal distributions were assessed using the Kolmogorov–Smirnov test, a linear mixed model was used to analyse two fixed effects of time and group, as well as the interaction of these. If the interaction was significant, a post-hoc test (using Student's *t*-test or paired *t*-test) was performed to compare parameters between the platelet-rich plasma group and the dry needling group at each time point, as well as between baseline and each time point.

Statistical calculations and analyses were performed with SAS version 9.1.3 (SAS Institute, Inc., 100 SAS Campus Dr, Cary, NC, USA) and statistical significance was accepted for *P*-values less than 0.05.

Results

Thirty-nine patients with rotator cuff disease (age range, 36–79 years) were recruited for this study. Patients were grouped into the platelet-rich plasma injection ($n = 20$) and dry needling ($n = 19$) groups. Of the 39 total patients, 15 patients presented partial-thickness tears (9 articular surface tears, 4 bursal surface tears, and 2 intra-substance tears) and 24 patients presented tendinosis in sonographic findings of the supraspinatus tendon. There was no significant difference between the two groups in terms of age, sex, aetiology and duration of pain (Table 1). Seven of the initial 39 patients (4 from the platelet-rich plasma group and 3 from the dry needling group) were lost to follow-up at three months (after the second injection; time 4). At six months (after the second injection; time 5), two more patients from the dry needling group were lost to follow-up. As a result, 30 of 39 patients completed the six-month follow-up (16 patients in platelet-rich plasma group and 14 patients in the dry needling group).

Figure 2 shows that the reduction of the Shoulder Pain and Disability Index in the platelet-rich plasma group was more significant than that in the dry needling group ($P < 0.05$). Post-hoc analysis revealed that the clinical effect of the platelet-rich plasma injection was superior to the dry needling at times 3, 4 and 5 (Table 2, $P < 0.05$). However, there was no significant difference between the two groups when the total pain score and the total disability score were analysed separately (Table 2).

Table 1. Patient characteristics

	PRP ($n = 20$)	Dry needling ($n = 19$)
Age (years, mean ± SD)	52.2 ± 9.5	53.9 ± 11.6
Sex (male/female)	9/11	8/11
Involved side (right/left)	6/14	6/13
Duration of pain (months, mean ± SD)	9.6 ± 3.6	9.2 ± 3.2

PRP, platelet-rich plasma.

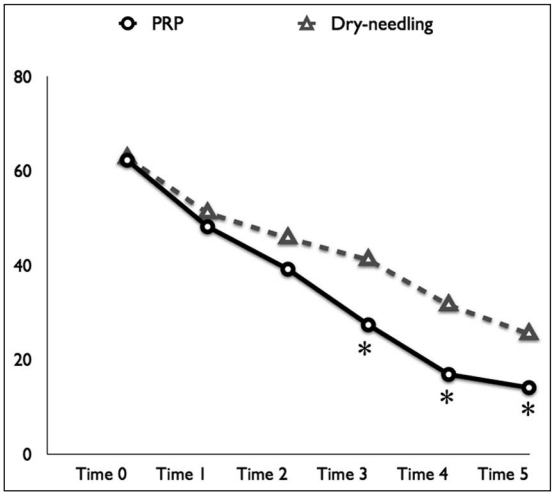

Figure 2. Improvement in Shoulder Pain and Disability Index score after treatment. The reductions in the platelet-rich plasma group were more significant than those in the dry needling group at times 3, 4 and 5 according to the analysis of interactions ($P < 0.05$). Time 0, at baseline; time 1, at two weeks after the first injection; time 2, immediately before the second injection; time 3, at two weeks after the second injection; time 4, at the three-month follow-up; time 5, at the six-month follow-up (*$P < 0.05$, comparison of parameters between the platelet-rich plasma group and the dry needling group at each time point). PRP, platelet-rich plasma.

In the range of motion comparisons, a group difference in internal rotation and flexion of shoulder was observed and they were more improved at times 4 and 5 in the platelet-rich plasma group compared to the dry-needling group. Improvements in external rotation and abduction were not different between the two groups at each time point (Table 2; Figure 3; $P < 0.05$).

All parameters showed a time effect. Both the platelet-rich plasma group and the dry needling group showed a significant reduction in the Shoulder Pain and Disability Index and improvement of range of motion at times 1–5 compared to time 0 (Table 2, $P < 0.05$).

Modest pain was reported after the procedure and persisted for an average of 3.3 days in the platelet-rich plasma group (range 1–10 days) and for an average of 4.1 days in the dry needling group (range 2–10 days). Patients did not report long-term complications related to the procedure or serious adverse events attributable to the treatment.

In the 16 patients in the platelet-rich plasma group who completed the follow-up, six partial-thickness tears (3 articular surface tears, 2 bursal surface tears, and 1 intra-substance tear) and 10 tendinosis of the supraspinatus were observed upon pretreatment sonographic examination. Upon six-month follow-up sonographic examination, two patients with partial-thickness tears (1 articular tear and 1 bursal surface tear) of the supraspinatus improved to tendinosis and two patients with tendinosis improved to normal status. In 14 patients in the dry needling group who completed the follow-up, four partial-thickness tears (3 articular tears and 1 bursal surface tear) and 10 cases of tendinosis of the supraspinatus were observed at baseline study. At six-month follow-up, no partial tears of the supraspinatus improved to tendinosis and one case of tendinosis improved to normal status.

Discussion

Both platelet-rich plasma injection and dry needling demonstrated therapeutic effects on supraspinatus lesions, but platelet-rich plasma injections provided more symptomatic relief and functional improvement than dry needling at six-month follow-up. However, improvement in the range of motion of the shoulder were not different between the platelet-rich plasma and dry needling groups.

The reason for the superiority of platelet-rich plasma to dry needling may be (1) that platelet-rich plasma has stronger therapeutic effects than dry needling despite the fact that the healing mechanism is thought to be similar between them, or that (2) platelet-rich plasma has a different therapeutic mechanism that is synergistic to dry needling. Finnoff et al.[14] suggested that platelet-rich plasma fills the void created by needle tenotomy and stimulates tissue regeneration, thus leading to superior results. In addition, exogenous platelet activation (with bovine thrombin or $CaCl_2$) can be used to control the speed at which growth factors are released

Table 2. Comparison of parameters between the platelet-rich plasma group and the dry needling group at each time point

		Time 0	Time 1	Time 2	Time 3	Time 4	Time 5
SPADI (score)	PRP	62.3 (4.1)	48.2 (4.2)[a]	39.2 (4.3)[a]	27.4 (4.1)[ab]	21.1 (3.9)[ab]	17.7 (3.7)[ab]
	Dry needling	62.8 (4.2)	51.1 (4.3)[a]	45.8 (4.4)[a]	41.2 (4.2)[a]	34.6 (4.0)[a]	29.5 (3.8)[a]
Pain	PRP	24.4 (1.6)	19.0 (1.6)[a]	15.5 (1.7)[a]	10.9 (1.6)[a]	7.6 (1.5)[a]	6.2 (1.4)[a]
	Dry needling	24.6 (1.6)	20.2 (1.6)[a]	18.1 (1.7)[a]	16.4 (1.6)[a]	12.8 (1.5)[a]	10.9 (1.5)[a]
Disability	PRP	38.0 (2.5)	29.3 (2.6)[a]	23.7 (2.6)[a]	16.5 (2.5)[a]	13.5 (2.4)[a]	11.6 (2.3)[a]
	Dry needling	38.3 (2.6)	30.8 (2.6)[a]	27.7 (2.7)[a]	24.8 (2.6)[a]	21.8 (2.5)[a]	18.6 (2.4)[a]
IR (degrees)	PRP	0.0 (0.8)	2.8 (0.8)[a]	3.5 (0.8)[a]	2.8 (0.8)[a]	5.6 (0.9)[ab]	6.3 (0.9)[a]
	Dry needling	0.0 (0.9)	2.4 (0.9)[a]	2.9 (0.9)[a]	2.4 (0.9)[a]	2.5 (0.9)[a]	3.9 (1.0)[a]
ER (degrees)	PRP	0.0 (0.9)	3.3 (0.9)[a]	3.5 (0.9)[a]	2.8 (0.9)[a]	6.3 (1.1)[a]	6.9 (1.1)[a]
	Dry needling	0.0 (1.0)	2.6 (1.0)[a]	2.6 (1.0)[a]	3.2 (1.0)[a]	4.0 (1.1)[a]	4.6 (1.1)[a]
FL (degrees)	PRP	0.0 (0.9)	3.0 (0.9)[a]	2.5 (0.9)[a]	2.5 (0.9)[a]	7.2 (1.0)[ab]	8.4 (1.0)[ab]
	Dry needling	0.0 (0.9)	2.6 (0.9)[a]	2.4 (0.9)[a]	3.2 (0.9)[a]	3.8 (1.0)[a]	4.3 (1.1)[a]
AB (degrees)	PRP	0.0 (1.2)	4.8 (1.2)[a]	4.5 (1.2)[a]	3.5 (1.2)[a]	7.8 (1.4)[a]	9.0 (1.4)[a]
	Dry needling	0.0 (1.3)	3.7 (1.3)[a]	3.4 (1.3)[a]	3.9 (1.3)[a]	5.0 (1.4)[a]	5.4 (1.5)[a]

Values are estimated least square means (standard errors).
PRP, platelet rich plasma; SPADI, Shoulder Pain and Disability Index; Pain, total pain score; Disability, total disability score; IR, improved range of shoulder internal rotation; ER, improved range of shoulder external rotation; FL improved range of shoulder flexion; AB, improved range of shoulder abduction.
Analysed by a mixed model with a post-hoc test.
[a]Adjusted $P < 0.05$, *P*-value was adjusted by Bonferroni correction considering 5 pairwise comparisons from times 1 to 5 versus time 0 at each group.
[b]Adjusted $P < 0.05$, *P*-value was adjusted by Bonferroni correction considering 6 pairwise comparisons between two groups at each time point.

and to solidify the platelet-rich plasma. Solidification of platelet-rich plasma helps it remain at the targeted area long enough to heal the damaged tendon. Because of its coagulative properties, platelet-rich plasma can clot to form a gel-like three-dimensional structure that is able to remain in the injected area without exogenous platelet activation.[15] This allows it to remain long enough at the targeted tendon area after injection even though it is not in a closed area such as intra-articular space. Further study into these issues will be helpful in elucidating the therapeutic mechanism of platelet-rich plasma.

Dry needling also unexpectedly showed good results, however, in some patients with rotator cuff disease. This could be explained by the fact that dry needling may induce bleeding, which in turn releases certain growth factors that stimulate the healing process.[9,10] Although less effective than platelet-rich plasma, dry needling itself might have a therapeutic effect on rotator cuff disease.

The effects of platelet-rich plasma have been evaluated at many joints, including the knee.[16–18] To our knowledge, no literature regarding the therapeutic effects of platelet-rich plasma injection for rotator cuff disease have been published. Our results showed that the function and range of motion of the shoulder continuously improved up to six months after treatment. However, some patients did not show significant reduction in the Shoulder Pain and Disability Index, while other patients reported pain originating from other structures around the shoulder that was newly developed or worsened, although pain originating from the supraspinatus was reduced. Pain originating from other structures, not the supraspinatus tendon, may have complicated the patient's recovery and response to treatment.

We performed sonographic examination to diagnose the tendon pathology, to precisely localize lesions and to guide the needle continuously during the injection. Ultrasound guidance provided pinpoint

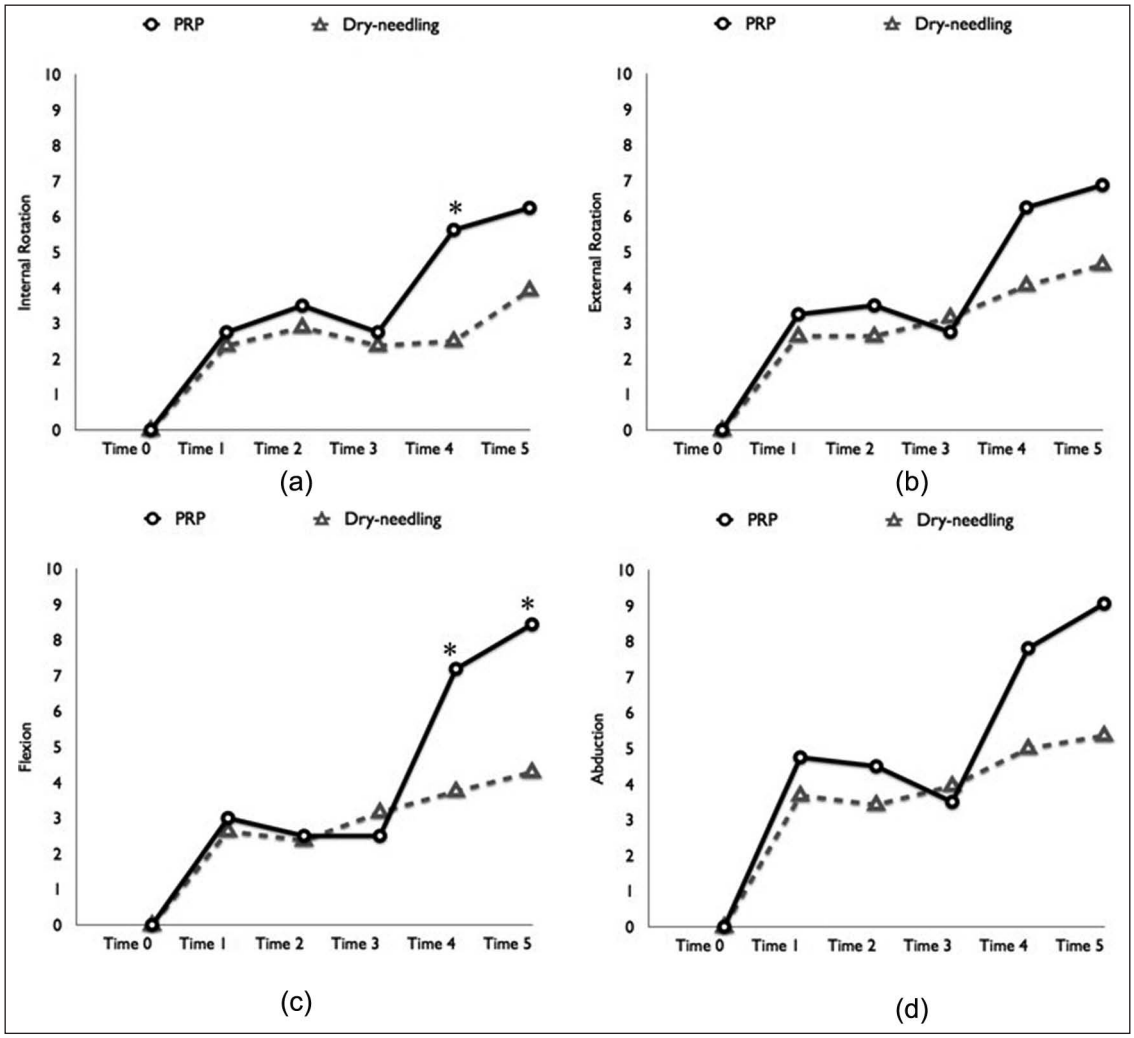

Figure 3. Improvement in the range of motion of the shoulder after treatment. Internal rotation and flexion of the shoulder were more improved at times 4 and 5 in the platelet-rich plasma group than in the dry needling group. (a) Internal rotation; (b) external rotation; (c) flexion; (d) abduction. Time 0, at baseline; time 1, at two weeks after the first injection; time 2, immediately before the second injection; time 3, at two weeks after the second injection; time 4, at the three-month follow-up; time 5, at the six-month follow-up (*$P < 0.05$, comparison of parameters between the platelet-rich plasma group and the dry needling group at each time point). PRP, platelet-rich plasma.

accuracy for platelet-rich plasma injections. However, in cases of tendon tear, we did not intend to inject all of the platelet-rich plasma into the tear itself. First, it was impossible to put all of the platelet-rich plasma into the small tear because 3 mL of platelet-rich plasma was prepared per patient. In these cases the platelet-rich plasma was infiltrated over the damaged tendon and the tear itself. Second, partial rotator cuff tears were present within the substance of the tendon and on the articular surface. In these cases, platelet-rich plasma could not be injected into the tear. Finally, it is reasonable that in addition to tears, the regions around the tear comprise the targeted lesion. In a histopathologic analysis of chronic

tendinopathy, Aström[19] showed that partial ruptures are always surrounded by a non-inflammatory degenerative lesion, indicating that tendon ruptures are not an independent entity but a complication of tendinosis.

On six-month follow-up sonographic examination, two patients with partial-thickness tears (1 articular tear and 1 bursal surface tear) of the supraspinatus improved to tendinosis without tear in the platelet-rich plasma group. We do not know the exact mechanism as to how the platelet-rich plasma was able to resolve the partial-thickness tears. Based on previous studies, we can presume some possibilities. First, platelet-rich plasma discharges more bioactive proteins responsible for attracting macrophages and mesenchymal stem cells than normal blood. These cells are able to not only promote removal of necrotic tissue but also expedite tissue regeneration and healing.[20] Second, tendons contain tendon stem cells, and stimulation of these stem cells with platelet-rich plasma may induce their differentiation into tenocytes that express collagen *in vitro* and increase cell proliferation rates.[21] Previous animal work has shown that in a rat Achilles tendon transection model, regenerated tendons were observed 14 days after platelet-rich plasma treatment.[22] In addition, there is emerging literature on the beneficial effects of platelet-rich plasma for chronic, non-healing tendon injuries including lateral epicondylitis and plantar fasciitis.[20,23,24] However, further studies are required to confirm the effects of platelet-rich plasma on the repair of damaged tendons.

The main limitation of the present study is the small sample size and follow-up loss. A 25% dropout rate is relatively high. A possible reason is that platelet-rich plasma is a new modality with which the patients were not familiar. Another reason might be that platelet-rich plasma injection and dry needling act relatively slowly compared with steroid injection, although they appear to be effective at improving function and pain caused by rotator cuff disease.

In this study, platelet-rich plasma injections and dry needling were performed twice with a four-week interval between injections. It is uncertain whether more than two injections would be more beneficial and whether four weeks is the proper time interval. An additional third injection or more series of injections may be beneficial for the patients who did not show favourable outcomes or only partial therapeutic effects. In addition, several issues of concern still need to be addressed: (1) volume of injection, (2) most effective preparation, (3) buffering/activation, (4) appropriate injury duration for maximal effect, and (5) the most effective rehabilitation protocol after platelet-rich plasma injection.[5] All of these should be determined by further studies.

In conclusion, according to our double-blind, randomized, controlled study, platelet-rich plasma injections provided more significant pain relief and improved arm function, but not range of motion of the shoulder, in patients with supraspinatus tendon lesions (tendinosis or partial tear of less than 1.0 cm, but not a complete tear) when compared to dry needling. These findings suggested that autologous platelet-rich plasma injections could be a safe and useful treatment for tendinosis and partial tears of the rotator cuff. Further studies are required to evaluate the benefits of platelet-rich plasma in massive rotator cuff tears and to confirm the effects of platelet-rich plasma on radiological and histological changes of damaged tendons.

Clinical messages

- Autologous platelet-rich plasma injections lead to a progressive reduction in pain and disability when compared to dry needling, although dry needling itself also shows unexpectedly good results in some patients with rotator cuff disease. This benefit is still present at six months after treatment.
- Autologous platelet-rich plasma injections could be a safe and useful treatment for tendinosis and partial tears of the rotator cuff.

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