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Literature review

The clinical impact of platelet-rich plasma on tendinopathy compared to placebo or dry needling injections: A meta-analysis

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ABSTRACT

Objective: The purpose of this meta-analysis was to compare the impact of platelet-rich plasma with that of placebo or dry needling injections on tendinopathy.
Methods: The databases of PubMed, CENTRAL, Scopus, Web of Science, and trial registries, reference lists, and conference abstract books were searched up to December 2014. Adults with tendinopathy in randomized controlled trials were enrolled. The trials compared effect of platelet-rich plasma with that of placebo or dry needling. We used subgroup analysis linked to the anatomical location of the tendinopathy. The primary outcome was pain intensity at two or three and six months after intervention. The secondary outcome was functional disability at three months after treatment.
Results: Five trials were included. There was a statistically significant difference in favor of the platelet-rich plasma intervention at the second primary outcome time point (SMD −0.48, 95%CIs −0.86 to −0.10, $I^2 = 0\%$, $p = 0.01$) and at the secondary outcome time point (SMD −0.47, 95%CIs −0.85 to −0.09, $I^2 = 0\%$, $p=0.01$).
Conclusions: Platelet-rich plasma did not provide significantly greater clinical benefit versus placebo or dry needling for the treatment of tendinopathy at a six-month follow-up. However, there was a marginal clinical difference in favor of platelet-rich plasma injections on rotator cuff tendinopathy.

1. Introduction

Tendinopathy is a common orthopaedic problem that includes tendinitis, paratenonitis and tendinosis (Khan, Cook, Bonar, Harcourt, & Astrom, 1999). It is characterized by chronic pain, functional deterioration and tendon thickening. Both intrinsic and extrinsic factors have been implicated in the etiology of tendinopathy (Riley, 2004). The histopathology of tendinopathy reveals the absence or minimal presence of inflammatory cells, which has been confirmed by gene array studies (Alfredson, Lorentzon, Bäckman, Bäckman, & Lerner, 2003; Ireland et al., 2001). Tendinopathy is characterized by increased mucoid substance, intratendinous degeneration, and collagen disorganization (Khan et al., 1999). In some cases, a 10- to 20-fold increase in calcium concentration may be detected (Kannus, 2000).

There are a variety of approaches for treating tendinopathy, with traditional methods (i.e., non-steroidal anti-inflammatory drugs and activity modification) still advocated as first-line management (Andres & Murrell, 2008). In cases where conservative treatments fail, surgical consultation is suggested.

In addition to the well-established conservative therapies, many investigational injectable treatments have been developed. Ultrasound- (US) guided dry needling intervention, and US-guided platelet-rich plasma (PRP) injections are two injectable treatments. PRP is defined as the volume of autologous plasma that has a platelet concentration above baseline (Marx, 2001). The dry needling technique, also known as peppering, consists of multiple tendon perforations without injecting any substances.

PRP, placebo and dry needling injections cause bleeding in the tendon, which can increase inflammation and induce the release of

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beneficial growth factors. This stimulates tendon healing (Filardo, Kon, Della Villa, Vincentelli, Fornasari, & Marcacci, 2010; Mishra, Harmon, Woodall, & Vieira, 2012). Consequently, it is thought that the needling of a tendon, with or without injecting any substances, exerts a positive clinical impact on rehabilitation (Dommerholt, 2011; Krey, Borchers, & McCamey, 2015; Nagraba, Tuchalska, Mitek, Stolarczyk, & Deszczyński, 2013). The use of high platelet concentrations in PRP, results in the release of significantly greater amounts of beneficial growth factors than that released by any type of needling. Moreover, the concentration of growth factors increases linearly with increasing platelet number (Eppley, Woodell, & Higgins, 2004; Marx, 2001). Nevertheless, it is evident that PRP with significantly high platelet concentrations does not further increase tendon rehabilitation (Marx, 2001; Rughetti et al., 2008). Considering this, we hypothesized that the clinical effect of PRP on tendinopathy would be greater than that of placebo or dry needling.

The purpose of this meta-analysis was to compare the clinical impact of PRP with that of placebo or dry needling on adults with tendinopathy. The primary outcome measure was pain intensity at two or three and six months after the initial intervention. The secondary outcome was functional disability at three months after the initial treatment.

2. Methods

The review was registered with PROSPERO (CRD42014010003) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed (Liberati et al., 2009).

2.1. Eligibility criteria

Randomized controlled clinical trials (RCTs) that compared the effects of PRP and placebo or dry needling injections on patients with tendinopathy were enrolled. Adults who suffered from tendinopathy for more than six weeks were included in the meta-analysis. Moreover, the diagnosis had to have been confirmed with the use of either Magnetic Resonance Imaging (MRI) or US. In each included study, a randomized group of patients was treated with US-guided PRP intervention and another group with US-guided placebo or dry needling injections. Placebo in the present meta-analysis contained either normal saline or local anesthetic. Furthermore, the minimum length of follow-up in the enrolled trials was six months. Experimental animal studies and full-thickness tendon tears were excluded. The primary outcome measure in this meta-analysis was pain intensity at two or three and six months after the initial intervention. The secondary outcome measure was functional disability at three months after the initial intervention.

2.2. Literature search

A comprehensive literature search was performed using the PubMed, CENTRAL, Web of Science, and Scopus databases, as well as conference abstract books and reference lists of relevant studies without language restrictions up to December 16, 2014. The following clinical trial registries were also searched up to the same date for the identification of completed unpublished studies: ClinicalTrials.gov; Australian New Zealand Clinical Trials Registry (ANZCTR); and the International Standard Randomized Controlled Trial Number (ISRCTN) Register. The search strategy included the use of the terms: “Platelet-Rich Plasma”, “platelet concentrate”, “autologous blood”, “platelet rich transfusion”, “tend*”, “plantar fasciitis”, “patellar”, “jumper's knee”, “golfer's elbow”, “tennis arm”, “epicondyl*”, “Achilles”, “rotator cuff”, “shoulder”. This search was adapted for each database, and the terms that were used were not combined with specific database filters. The corresponding authors of the completed unpublished trials were contacted to request their data.

2.3. Study selection

Two authors (KT and ES) searched for records independently. The titles and abstracts of the retrieved studies were screened. Then, full-text articles were obtained and assessed for eligibility. If an identified study fulfilled the eligibility criteria but contained insufficient data for quantitative synthesis, the corresponding author of the article was contacted twice (with a three-week interval) in order to request additional information. If there was no reply or the data were still insufficient the study was excluded from the quantitative synthesis.

2.4. Data extraction

Information was extracted independently by two reviewers (KT and ES). Details that were abstracted from each enrolled trial included the year of publication, comparators in the control group, and the number and demographics of patients in the included intervention groups. Moreover, Information about the duration of symptoms, intervention characteristics, study outcomes, follow-up and side effects were also extracted. In cases with more than two intervention groups in an included RCT, data were abstracted from the PRP and either the placebo or the dry needling group.

The data that were used in the quantitative synthesis were abstracted from questionnaires that evaluated pain intensity, functional disability, or both. Information from composite questionnaires was used only in cases where pain and function subscores were available. Additional required information was obtained by contacting the corresponding authors. There were few discrepancies during abstracting and these were resolved through consensus.

2.5. Risk of bias assessment

The quality of the included RCTs was independently assessed by two investigators (KT and ES) using the Cochrane collaboration's risk of bias tool (Higgins & Green, 2011). Thus, the following domains were assessed: randomization; concealment of the allocation; masking of patients, study personnel and outcome assessors; incomplete outcome data; selective outcome reporting; and other potential sources of bias.

The risk of selection bias across studies was assessed using both the results of the randomization and that of allocation concealment. In addition, the risk of detection bias (also known as observer bias) was assessed using the results of the blinding of the outcome assessors (Bello, Krogsbøll, Gruber, Zhao, Fischer, & Hróbjartsson, 2014; Higgins & Green, 2011). The decision to use funnel plots for the assessment of publication bias in this meta-analysis was depended on the number of the included studies (Higgins & Green, 2011). Discrepancies between the review authors' opinion about the risk of bias were resolved through discussion.

2.6. Statistical analysis

Review Manager Software (version 5.3) was used in this meta-analysis with random-effects models. Ninety-five percent confidence intervals (CIs) were calculated according to the inverse variance method for all study outcomes. The use of final values was preferred for both primary and secondary outcomes because

the mean values of the imputed correlation coefficients of three of the included studies (Dragoo, Wasterlain, Braun, & Nead, 2014; Kesikburun, Tan, Yilmaz, Yaşar, & Yazicioğlu; 2013, Stenhouse, Sookur, & Watson, 2013) were less than 0.5. Therefore, the precision of the final values analysis was supposed to be greater than that of change from baseline (Higgins & Green, 2011). Mean pain and function scores and their standard deviations were obtained for both PRP and control groups. In cases where the standard deviations were missing, they were imputed according to Cochrane guidelines (Higgins & Green, 2011). A p value of less than 0.05 was judged to be statistically significant. Statistical heterogeneity between the studies was tested using the Q statistics. The extend of heterogeneity was measured using the I-squared statistic. In addition, it was classified as either low (I^2 = 25–49%), moderate (I^2 = 50–74%) or high ($I^2 \geq 75\%$) (Higgins & Thompson, 2002; Higgins, Thompson, Deeks, & Altman, 2003). Moreover, unit-of-analysis issues (i.e., multiple follow-up measurements) were handled according to Cochrane guidelines. Both the primary and secondary outcome analyses were performed on the basis of standardized mean difference (SMD). In addition, an SMD value of 0.2 indicated a small effect, a value of 0.5 a moderate effect, and a value of 0.8 represented a large effect (Cohen, 1988).

Both subgroup and sensitivity analyses in the present meta-analysis were pre-specified, except for two sensitivity analyses that were requested by peer reviewers: one investigated the impact of the inclusion on different comparators in the placebo group, and the second explored the effects of potential sources of methodological diversity (i.e., different baseline characteristics of the participants). The *a priori* defined sensitivity analyses were performed to investigate whether the overall results of the quantitative synthesis were robust enough to the use of imputed SDs or the various intervention characteristics of the included studies (Higgins & Green, 2011). On the other hand, the pre-specified subgroup analysis was performed according to the anatomical location of the tendinopathy.

3. Results

The literature search retrieved 1565 potentially relevant studies. Duplicates were removed and the remaining 1205 studies were screened according to the information provided in their title and abstract. After the exclusion of 1179 records, the remaining 26 articles were eligible for full-text assessment. One of the retrieved trials was not randomized (Mishra & Pavelko, 2006). Two trials presented the results of the same study with different follow-up measurements (de Vos, Weir, Tol, Verhaar, Weinans, & van Schie, 2011; de Jonge et al., 2011). In two RCTs the diagnosis was not confirmed with US or MRI (de Vos et al., 2010; Mishra et al., 2014). One retrieved article was a published protocol (Martin et al., 2013). Four of the identified clinical trials were ongoing (NCT01668953, NCT01789632, NCT01843504, NCT01851044), whereas one has ceased (NCT01152658). Three unpublished clinical trials referred to treatment after arthroscopic surgery (ISRCTN10464365, NCT01029574, and NCT01152658) and one to full-thickness tendon tears (ISRCTN93608625). Moreover, three records in trial registries were duplications of published studies (NCT01945528, NCT00761423 and NCT01111747). One clinical trial was excluded because of an absence of a control group (NCT01200875). Finally, 5 published RCTs were enrolled in the qualitative and quantitative synthesis (Dragoo et al., 2014; Kesikburun et al., 2013; Krogh et al., 2013; Rha, Park, Kim, Kim, & Lee, 2013; Stenhouse et al., 2013). The flow chart of the study selection procedure is presented in Fig. 1.

3.1. Study characteristics

The characteristics of the enrolled studies are shown in Table 1. Five RCTs comprising a total of 190 participants were included in the current meta-analysis. Data were abstracted from 170 patients (87 female, 83 male). All of the enrolled studies were published between 2013 and 2014 and three were funded (Dragoo et al., 2014; Krogh et al., 2013; Rha et al., 2013). The trials were conducted in the United Kingdom (Stenhouse et al., 2013), South Korea (Rha et al., 2013), Denmark (Krogh et al., 2013), the United States of America (Dragoo et al., 2014) and Turkey (Kesikburun et al., 2013). The mean age of participants in PRP and control group ranged from 28 to 52.2 and 40–53.9 years respectively. There was a balance between the number of males and females in three of the enrolled trials (Krogh et al., 2013; Rha et al., 2013; Stenhouse et al., 2013) (Table 1).

The PRP was prepared using the buffy coat method (DeLong, Russell, & Mazzocca, 2012) in 80% of the included studies, and the platelets used were not activated in any of the included RCTs. The number of tendon fenestrations varied from 5 to 50 per intervention and the diameter of the syringes used ranged from 21 to 25 gauge. None of the enrolled participants had either been injected with corticosteroids six weeks before the intervention or reported any serious adverse effects after the treatment. The intervention characteristics of the RCTs are presented in Table 2.

3.2. Risk of bias assessment

The results of the quality assessment are shown in Table 3. Random sequence generation was applied in all of the included studies of the present meta-analysis and the allocation was concealed in four trials (Dragoo et al., 2014; Kesikburun et al., 2013; Krogh et al., 2013; Rha et al., 2013). The study protocols were available in two studies (Dragoo et al., 2014; Krogh et al., 2013), the outcomes of which were pre-specified. Successful blinding of the outcome assessor was reported in all the included RCTs in this meta-analysis. A significant imbalance was encountered on the baseline characteristics of the participants of an included trial (Dragoo et al., 2014). The risk of selection bias across studies was low, with most of the included data coming from studies with a low risk of bias. Funnel plots were not used in the present meta-analysis because of the small number of the enrolled trials (Higgins & Green, 2011). Furthermore, there was low risk of detection bias in this review because all of the included outcome assessors were blinded. A quantification synthesis of the risk of bias assessment is presented in Fig. 2.

3.3. Synthesis of the results

The results for both primary and secondary outcomes are displayed in the forest plots (Figs. 3–5). Pooled analysis showed that there was a statistically significant difference in favor of the PRP intervention group at the second primary outcome time point (SMD, −0.48; 95%CIs, −0.86 to −0.1; I^2 = 0%; p = 0.01) (Fig. 4). Moreover, there was a statistically significant difference in favor of the PRP group at the secondary outcome time point (SMD, −0.47; 95%CIs, −0.85 to −0.09; I^2 = 0%; p = 0.01) (Fig. 5).

3.4. Subgroup and sensitivity analyses

Of all the included RCTs, two were classified as lateral epicondylopathy (Krogh et al., 2013; Stenhouse et al., 2013); two into the rotator cuff tendinopathy (Kesikburun et al., 2013; Rha et al., 2013) and one into the patellar tendinopathy subgroup (Dragoo et al., 2014). In the rotator cuff tendinopathy subgroup, the analysis demonstrated that there was a statistically significant

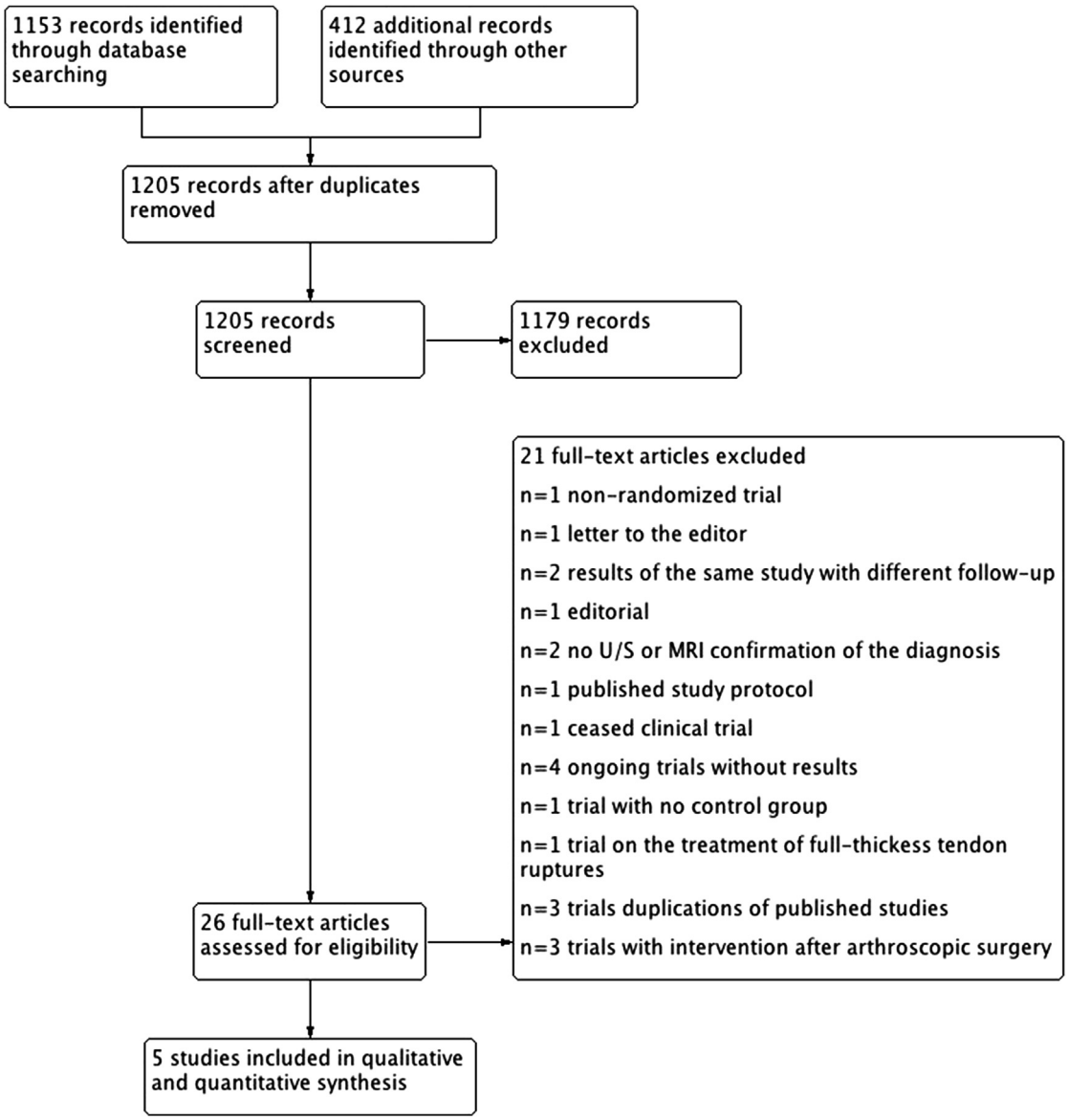

Fig. 1. Flow chart of the study selection procedure. MRI = Magnetic Resonance Imaging; US = Ultrasound; ACL = Anterior Cruciate Ligament.

difference in favor of the PRP intervention group at both the first and the second primary outcome time points (SMD, −0.57; 95% CIs, −1.04 to −0.10; $I^2 = 0\%$; $p = 0.02$; and SMD, −0.66; 95% CIs, −1.15 to −0.17; $I^2 = 0\%$; $p = 0.008$, respectively) (Figs. 3 and 4). Pooled results showed a statistically significant difference in favor of the PRP intervention for the same subgroup at the secondary outcome time point (SMD, −0.61; 95%CIs, −1.09 to −0.14; $I^2 = 0\%$; $p = 0.01$) (Fig. 5). There were no statistically significant differences between the intervention groups when data from the other subgroups were included in the analyses. On the other hand, sensitivity analyses indicated that heterogeneity was low in all cases.

4. Discussion

Five RCTs comparing the impact of PRP with that of placebo or dry needling on tendinopathy were identified. There was no significant statistical heterogeneity in the overall results of the present quantitative synthesis. Therefore, there was no significant variability in the intervention effects that were evaluated in the included RCTs (Higgins & Green, 2011). At the first primary outcome time point and at the secondary outcome time point, pooled analysis indicated statistically significant differences in favor of the PRP intervention group. However, PRP injections did not provide significant additional clinical relief over placebo or dry needling for treatment of tendinopathy at a six-month follow-up.

Regarding the rotator cuff subgroup, pooled results showed statistically significant difference in favor of the PRP intervention for both the primary and secondary outcome. In the latter subgroup, the analysis indicated that there was a marginal clinical superiority of PRP injections over placebo or dry needling. In the other subgroups of this meta-analysis, there were no significant differences between the intervention groups.

In the current meta-analysis, the risk of selective outcome reporting was expected to be minimized, because the outcomes that were assessed included not only pain intensity, but also functional disability. The quality assessment of the trials was performed using the Cochrane risk of bias tool. Moreover, 80% of the

Table 1
Study characteristics of the included trials.

Study (year)	Condition treated	Participants in the included groups, n	Control group	Duration of symptoms (months)	Participant's mean age, years (SD)		Females, n (%)	Follow-up (weeks)	Outcome measures
					PRP	Control			
Krogh et al., 2013	L.E.	40	Saline or corticosteroid injection	At least 3.8	47.6 (7.1)	44.7 (7.9)	22 (55)	48	PRTEE, US changes in color Doppler signal and tendon thickness
Stenhouse et al., 2013	L.E.	28	Saline injections	At least 6	47.6 (6.12)	53.2 (9.87)	15 (54)	24	VAS, Nirschl Score
Rha et al., 2013	Rotator cuff tendinopathy	39	Dry needling injections	At least 6	52.2 (9.5)	53.9 (11.6)	22 (56)	24	SPADI, US, passive range of motion of the shoulder using goniometry
Kesikburun et al., 2013	Rotator cuff tendinopathy	40	Saline injection	At least 2	45.5 (11.8)	51.4 (10)	27 (68)	48	WORC, SPADI, VAS with the Neer test, passive range of motion of the shoulder using goniometry
Dragoo et al., 2014	Patellar tendinopathy	23	Dry needling injections	At least 1.5	28 (8)	40 (14)	1 (4)	≥26	VISA-P, VAS, Tegner activity scale (Tegner & Lysholm, 1985), Lysholm scale (Lysholm & Gillquist, 1982), SF-12

L.E. = Lateral Epicondylopathy; US = Ultrasound; SF-12 = 12 Item Short Form Health Survey; PRTEE = Patient-Rated Tennis Elbow Evaluation; VISA-P = Victorian Institute of Sports Assessment–Patella; WORC = Western Ontario Rotator Cuff Index; SPADI = Shoulder and Pain Disability Index; VAS = Visual Analogue Scale.

Table 2
Intervention characteristics of the included studies.

Study	PRP kit	Buffering	Syringe specification	Volume of injected PRP	Procedure technique	Injection protocol	Post-intervention rehabilitation exercises
Krogh et al., 2013	GPS® II	The PRP was buffered using 8.4% sodium bicarbonate	21 G	Approximately 3–3.5 ml	Five to seven tendon perforations through one skin portal	Single injection	Prescription of a standard L.E. rehabilitation program (Fredberg, 2011)
Stenhouse et al., 2013	Arthrex ACP™	No	23 G	2 ml	Approximately forty to fifty tendon perforations through one skin portal	Two injections with a four-week interval between them	Not mentioned
Rha et al., 2013	Prosys®	No	25 G	3 ml	Approximately forty to fifty tendon perforations	Two injections with a four-week interval between them	Prescription of a self-exercise rehabilitation program
Kesikburun et al., 2013	GPS® III	No	22 G	5 ml	Injection of the fluid into five sites through one skin portal	Single injection	Three weeks under supervision of a PT, and further three weeks on a home-based protocol
Dragoo et al., 2014	GPS® III	The PRP was buffered using 8.4% sodium bicarbonate	22 G	Approximately 6 ml	Ten tendon perforations	Single injection	Five-phase protocol: two times per week on a PT, and standardized rehabilitation exercises at home

PRP = Platelet-Rich Plasma; L.E. = Lateral Epicondylopathy; G = Gauge; ACP = Autologous Conditioned Plasma; GPS® = Gravitational Platelet Separation system; PT = Physical Therapist.

included RCTs (Dragoo et al., 2014; Kesikburun et al., 2013; Krogh et al., 2013; Stenhouse et al., 2013) were sorted into the first level of evidence-based medicine (EBM) (Phillips et al., 2009). Although the latter classification does not necessarily entail high reporting quality (Poolman, Struijs, Krips, Sierevelt, Lutz, & Bhandari, 2006), the low risk of detection bias in this meta-analysis supports the consistency of these data (Jadad et al., 1996).

In the present quantitative synthesis, we attempted to maintain low levels of clinical diversity (Higgins & Green, 2011) by applying stringent inclusion criteria and including only the comparators of

Table 3
Risk of bias assessment of the enrolled studies.

Study	Random sequence generation	Allocation concealment	Blinding of participants	Blinding of personnel	Blinding of outcome assessors	Incomplete outcome data	Selective reporting	Other potential sources of bias
Krogh et al., 2013	Low risk	Low risk	Low risk	High risk	Low risk	Low risk	Low risk	Low risk
Stenhouse et al., 2013	Low risk	High risk	High risk	High risk	Low risk	Low risk	Unclear risk	Low risk
Rha et al., 2013	Low risk	Low risk	Low risk	High risk	Low risk	High risk	Unclear risk	Low risk
Kesikburun et al., 2013	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Unclear risk	Low risk
Dragoo et al., 2014	Low risk	Low risk	Low risk	High risk	Low risk	High risk	Low risk	High risk

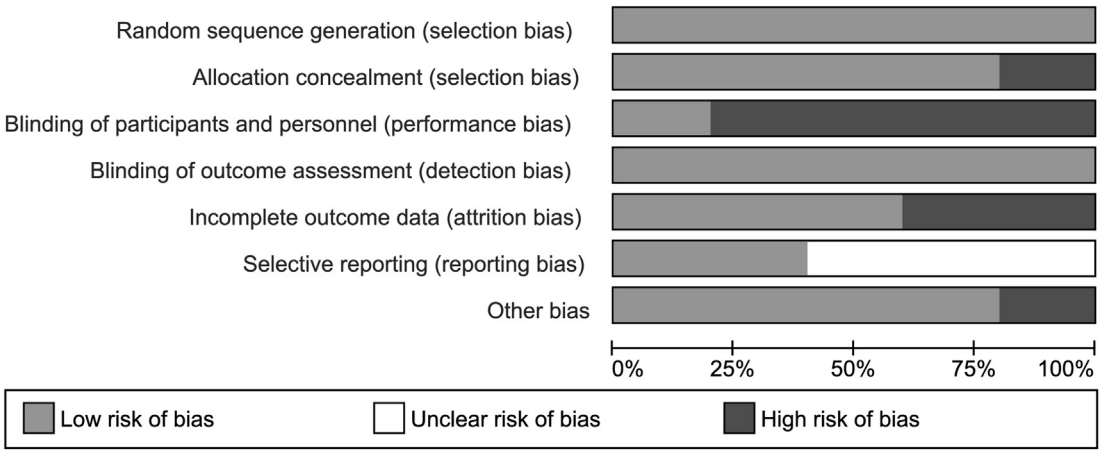

Fig. 2. Quantification synthesis of the risk of bias assessment.

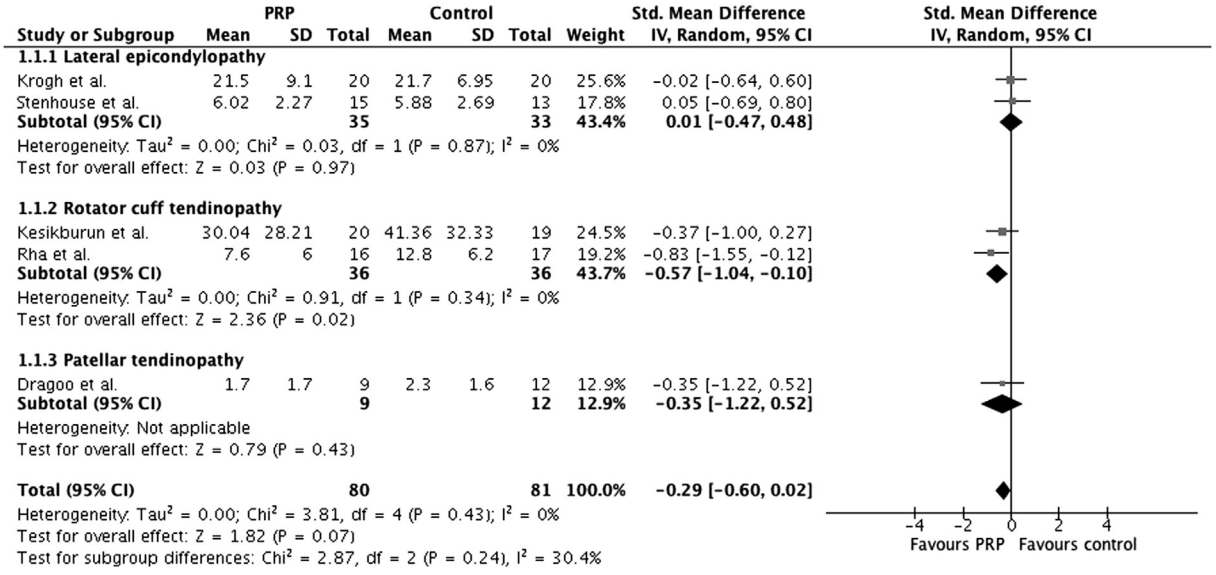

Fig. 3. Forest plot of standardized mean differences showing no statistically significant difference in pain intensity levels between PRP and control groups at two or three months. Vertical line demonstrates no difference between the two intervention groups. PRP = Platelet-Rich Plasma; SD = Standard Deviation, IV = Inverse Variance.

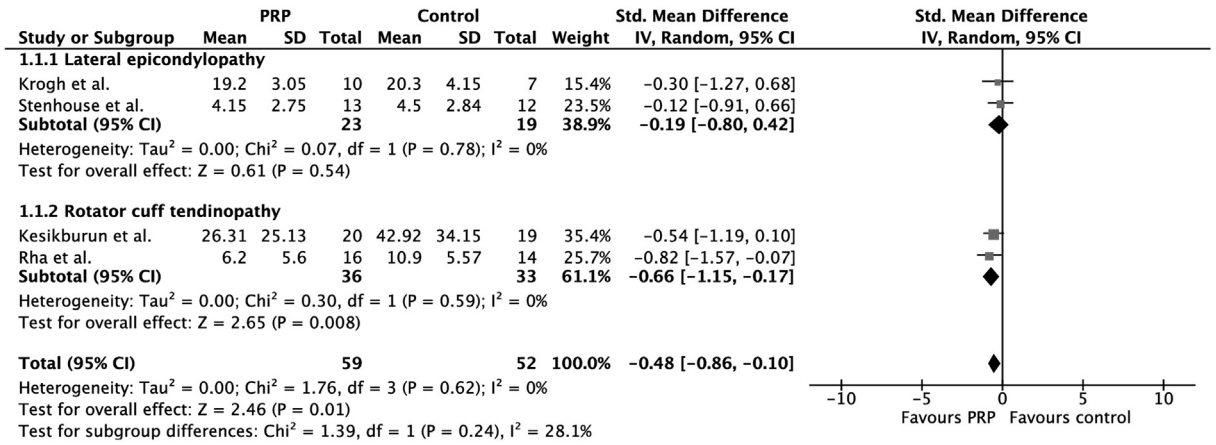

Fig. 4. Forest plot of standardized mean differences showing a statistically significant difference in pain intensity levels in favor of PRP at six months. Vertical line demonstrates no difference between the two intervention groups. PRP = Platelet-Rich Plasma; SD = Standard Deviation, IV = Inverse Variance.

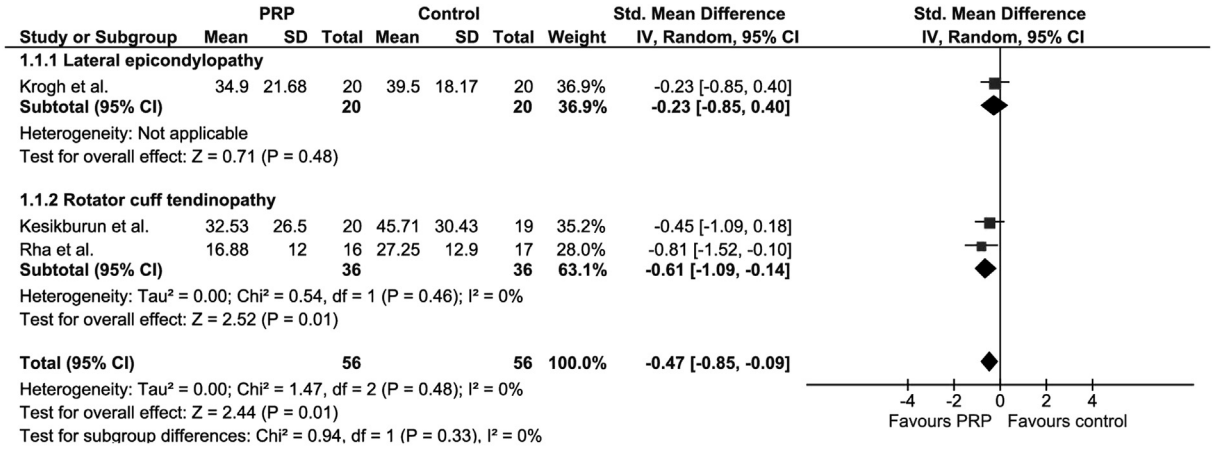

Fig. 5. Forest plot of standardized mean differences showing a statistically significant difference in functional disability levels in favor of PRP at three months. Vertical line demonstrates no difference between the two intervention groups. PRP = Platelet-Rich Plasma; SD = Standard Deviation; IV = Inverse Variance.

placebo and dry needling in the control group. Furthermore, subgroup analysis was undertaken and all study outcomes were assessed at specific time points. Moreover, only patients whose diagnosis was confirmed with MRI or US were considered. Consequently, the tendinopathy was reliably detected in all cases (Shahabpour, Kichouh, Laridon, Gielen, & De Mey, 2008; Warden, Kiss, Malara, Ooi, Cook, & Crossley, 2007). It is important that a meta-analysis include studies that are not significantly clinically diverse. Differently, the quantitative synthesis may be meaningless (Higgins & Green, 2011). It should be noted that statistical heterogeneity emanates from clinical heterogeneity, methodological diversity, or both. In the current review, low levels of statistical heterogeneity were demonstrated in all cases. Thus, the intervention effect was not significantly affected by the factors that varied across the included RCTs.

At present, there is a lack of high quality trials in the literature on the treatment effectiveness of PRP injections. There is also a paucity of evidence about the impact of the following potential sources of clinical diversity on tendon rehabilitation: the volume of the injection; platelet activation; number of centrifugation steps during PRP preparation; buffering of the PRP; disease duration before the intervention; and post-injection rehabilitation protocol. It should be noted that extreme baseline imbalance was encountered between the genders of the participants in an included study of this meta-analysis (Dragoo et al., 2014). This significant imbalance can be attributed to the greater incidence of patellar tendinopathy on males compared to females (Ferretti, 1986).

In this review, the control group contained either placebo or dry needling injections. For this reason, a sensitivity analysis was undertaken. The results of the latter analysis indicated that the intervention effect was not significantly affected by this potential source of clinical heterogeneity. A longer follow-up measurement would provide useful information to clinicians regarding the management of tendinopathy. However, there was not sufficient data for quantitative synthesis allowing safe conclusions to be created.

The outcomes of the present study were assessed by questionnaires and were measured in a variety of ways. For this reason, the results of the enrolled RCTs were standardized before they were combined. In addition, the authors of the present meta-analysis assessed the outcomes at different clinically important time points. Therefore, there was sufficient homogeneity in terms of the outcomes of the present meta-analysis (Higgins & Green, 2011).

As for the lateral epicondylopathy subgroup, the Patient-Rated Tennis Elbow Evaluation (PRTEE) and Visual Analogue Scale (VAS) questionnaires were used in the quantitative synthesis. Research findings show that the correlations between these questionnaires are satisfactory and that the PRTEE questionnaire is a reliable and sensitive instrument (Rompe, Overend, & MacDermid, 2007). As for the rotator cuff subgroup, pain and function subscales of the SPADI questionnaire were used in the present meta-analysis. The latter questionnaire is considered to be a valid and responsive instrument (Staples, Forbes, Green, & Buchbinder, 2010).

5. Conclusions

In conclusion, PRP injections did not provide significantly greater clinical relief compared to placebo or dry needling for the treatment of tendinopathy at a six-month follow-up. However, there was a marginal clinical advantage in patients who suffered from rotator cuff tendinopathy. The latter marginal clinical superiority should be further investigated in large-scale RCTs. Future research should determine the impact of potential sources of clinical diversity on the rehabilitation of tendinopathy (that is the duration of symptoms before the intervention, activation of the platelets, buffering of the PRP, centrifugation method, volume of the injected PRP, number of injections and post-intervention rehabilitation protocol).

Conflict of interests

None declared.

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