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ORIGINAL

Efficacy of Platelet-Rich Plasma in the Treatment of Rotator Cuff Injuries

Eficacia del plasma rico en plaquetas en el tratamiento de las lesiones del manguito rotador

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ABSTRACT

Introduction: rotator cuff injuries are a common cause of shoulder pain and functional limitation. Recently, platelet-rich plasma (PRP) has been proposed as a regenerative therapy to potentially accelerate tendon healing and improve outcomes.
Method: we performed a review of studies published between 2010 and 2024 examining the effectiveness of PRP in patients with rotator cuff tendinopathies or partial tears. Clinical trials, observational studies, and meta-analyses were included, focusing on pain reduction (Visual Analogue Scale) and functional improvement (Constant-Murley, Quick DASH).
Results: most studies reported a significant decrease in pain and an improvement in shoulder function after PRP application, especially in patients who did not respond to conventional treatments. No severe adverse effects were identified, although the efficacy varied depending on the concentration of platelets and injection protocols.
Conclusion: PRP appears to be a promising option for enhancing tendon healing and reducing pain in rotator cuff injuries. However, the lack of standardized protocols calls for further research to establish definitive guidelines and confirm its long-term benefits and safety.

Keywords: Platelet-Rich Plasma; Rotator Cuff Injuries; Tendinopathy; Regenerative Therapy; Pain Management.

RESUMEN

Introducción: las lesiones del manguito rotador representan una de las principales causas de dolor y limitación funcional en el hombro. El plasma rico en plaquetas (PRP) ha surgido como una alternativa regenerativa para acelerar la recuperación tendinosa.
Método: se realizó una revisión de estudios publicados entre 2010 y 2024 que evaluaron la efectividad del PRP en pacientes con tendinopatía o desgarros parciales del manguito rotador. Se incluyeron ensayos clínicos, estudios observacionales y metaanálisis, analizando variables de dolor (Escala Visual Analógica) y función (Constant-Murley, Quick DASH).
Resultados: la mayoría de los estudios mostraron mejoría significativa en la reducción del dolor y la funcionalidad del hombro tras la aplicación de PRP, especialmente en aquellos pacientes que no respondieron a terapias convencionales. No se reportaron eventos adversos graves, aunque se observaron diferencias en resultados según la concentración de plaquetas y el protocolo de inyección.
Conclusión: el PRP aparece como una opción prometedora para el tratamiento de lesiones del manguito rotador, al favorecer la cicatrización y disminuir el dolor. Sin embargo, la falta de protocolos estandarizados exige mayor uniformidad en futuros ensayos que consoliden su eficacia.

Palabras clave: Plasma Rico en Plaquetas; Manguito Rotador; Tendinopatía; Terapia Regenerativa; Dolor.

INTRODUCTION

The shoulder is one of the most complex anatomical structures in the human body and comprises the humerus, scapula, and clavicle. Its glenohumeral joint is the most mobile in the body. It is reinforced by a series of muscles and tendons that comprise the rotator cuff (supraspinatus, infraspinatus, teres minor, and subscapularis). These muscles have a dual function, stabilizing the head of the humerus in the glenoid cavity of the scapula, and are responsible for the range of movements performed in multiple planes, such as abduction, internal rotation, and external rotation of the arm. In addition, ligamentous structures and bursae help reduce friction by providing support and preventing excessive displacement that could damage the tendinous tissue.

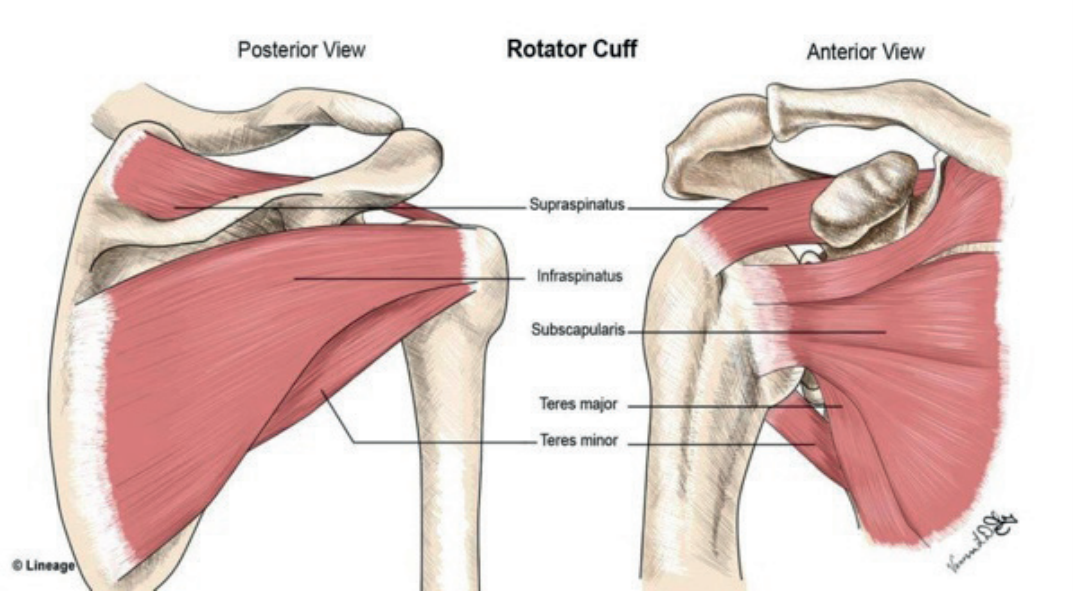

Figure 1. Anatomic structure of the shoulder

Due to its complex anatomy and the demands placed on it, rotator cuff injuries are one of the most common causes of shoulder pain and disability. These injuries range from mild tendinopathies to complete tears. Despite the variety of conventional treatments, the likelihood of achieving long-term relief or full functional recovery is rare.

Platelet-rich plasma (PRP) is presented as a regenerative therapy because the growth factors released by platelets are believed to accelerate the tissue healing process. PRP is a concentrated source of bioactive agents extracted from the patient's blood or from a donor. It is obtained by centrifugation and results in a high concentration of platelets in a small volume of plasma.

Scientific evidence on the effectiveness of PRP remains contradictory, although some studies report significant improvements in pain reduction and functional recovery. Other findings show no significant differences compared to standard therapies.[1] The diversity of results highlights the need for further analysis of PRP's role in treating rotator cuff injuries, specifically in terms of dosage, application protocol, and type of injury.

Is platelet-rich plasma treatment more effective than conventional therapies in improving shoulder function and reducing pain in patients with rotator cuff injuries?

Objective

To compare the impact of platelet-rich plasma (PRP) versus conventional therapies in treating rotator cuff injuries, evaluating its effectiveness in reducing pain and improving shoulder function.

METHOD

This study used a systematic review and meta-analysis design, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Randomized controlled trials (RCTs), prospective observational studies, and retrospective descriptive studies evaluating the efficacy of platelet-rich plasma

(PRP) in rotator cuff injuries were included. The objective was to compare the effectiveness of PRP versus conventional treatments or placebo in pain reduction and functional improvement.

The review population consisted of patients with rotator cuff injuries described in the literature, mostly tendinopathies or partial tears.

Inclusion criteria:

- Studies published between 2010 and 2024.
- Participants diagnosed with rotator cuff injury (tendinopathies, partial tears) who had not responded to conventional treatments.
- Controlled clinical trials (RCTs), observational studies, and clinical trials evaluating the use of PRP in Spanish and English.
- Adult patients.
- Patients without osteoarticular diseases or other diseases that alter shoulder function.
- Patients without previous shoulder injuries.

Exclusion criteria:

- Studies without sufficient data on PRP intervention.
- Narrative reviews or isolated clinical cases that did not allow quantitative results to be extracted.
- Studies combining multiple therapies without clearly isolating the effect of PRP.
- Pediatric patients.
- Patients with previous diseases.

The articles are from hospitals, sports clinics, and worldwide orthopedic and rehabilitation research centers.

The selection focused on studies where PRP was administered under ultrasound guidance or conventionally.

Studies were included where the primary intervention was platelet-rich plasma (PRP) obtained by simple or double centrifugation and applied to the injured area.

Intervention variables considered:

- The number of PRP injections.
- The platelet concentration in the preparation.
- The use or non-use of ultrasound guidance in the application.
- The follow-up time after the intervention.

As a comparative treatment (control group), studies could use placebo, corticosteroid injections, physical therapy, or conventional strategies (anti-inflammatory drugs, rest, etc.).

The data collected were analyzed using statistical software (SPSS, R, or Stata, depending on the availability reported in each study). For the systematic review, the methodological quality of the included trials was assessed using the Jadad scale or PRISMA tools, evaluating the risk of errors in each study.

In cases that provided compatible quantitative data, a meta-analysis was performed to estimate the overall effect of PRP compared to comparative therapies. Mean differences and/or risk ratios (according to continuous or categorical variables) were calculated, with their respective 95 % confidence intervals. In addition, a heterogeneity analysis (I^2) was performed, and when high clinical or methodological variability was detected, random effects models were applied.

The operational definitions included:

- Pain: Assessed, according to each study, using the Visual Analog Scale (VAS).
- Shoulder function: Measured using Constant-Murley, Quick DASH, or WORC scales.
- Clinical improvement: Defined as a significant reduction in pain and/or increase in functionality score after PRP application compared to control.

RESULTS

Several studies (controlled clinical trials, observational studies, and systematic reviews) were identified that evaluated the efficacy of PRP in rotator cuff injuries, especially tendinopathies and partial tears.

Results in pain reduction

Pasin et al. Three modalities (PRP, corticosteroid injection, and physical therapy) were compared in 90 patients with subacromial impingement syndrome (SAIS). At eight weeks, the group receiving PRP showed greater pain reduction in the visual analog scale (VAS) than the other groups

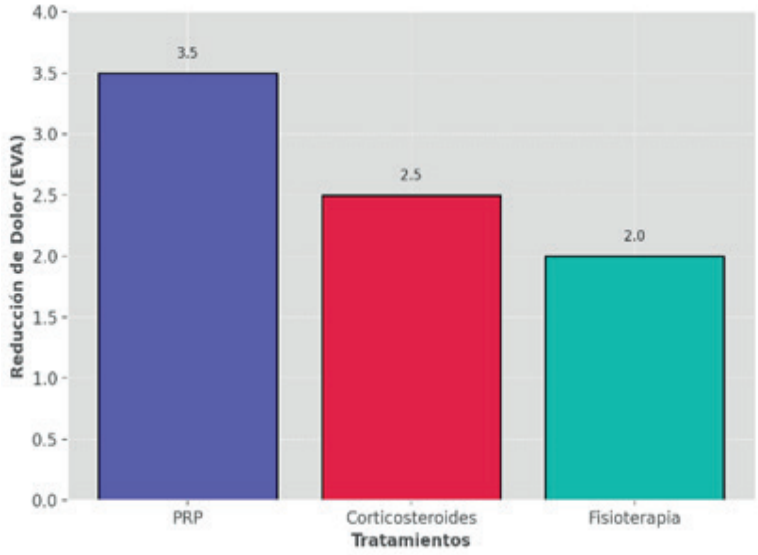

Figure 2. Comparison of pain reduction in SAI

Charles et al. Significant improvement in pain scores (also measured with VAS) was reported in patients with partial rotator cuff tears after PRP application; the improvement was marked in those with damage greater than 50 %.

Zhang et al.[2]. Based on an analysis of 2 571 patients who received PRP for musculoskeletal conditions, symptomatic relief was reported in shoulder tendinopathies (without specifying VAS scores), and no severe adverse complications were reported.

Forogh et al.[3] and Cai et al.[1] Reported a decrease in pain in chronic rotator cuff tendinopathies, as reflected in VAS scales, compared to conventional therapies. However, the authors noted differences in application technique and injection frequency.

Results in shoulder function

Fitzpatrick et al.[4] and Mautner et al.[6] Observed improvements in tendon function assessed with scales such as Quick DASH and Constant-Murley in patients who received PRP.

Saltzman et al.[5]. Reported an increase in Constant-Murley scores after several PRP injections, accompanied by a significant reduction in pain.

Charles et al. In addition to pain reduction, they described improvements in Quick DASH scores, particularly in partial tears greater than 50 %.

Drs. Goschenko T. and Pisanti L.: In an observational study of patients treated with PRP, an increase in the Constant score from 72,8 to 96,1 and an improvement in the DASH questionnaire from 27 to 6,7 were found at three months (p<0,001).

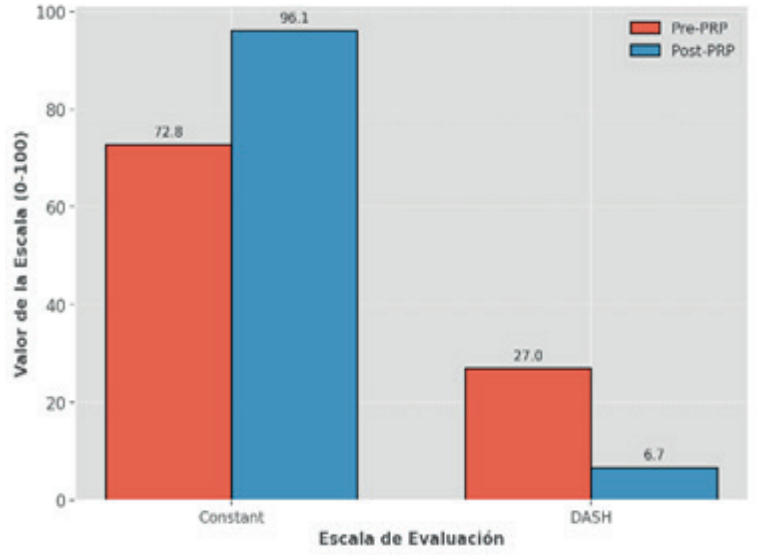

Figure 3. Improvement in Constant and DASH scales after treatment with PRP

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Safety and adverse events

Most studies analyzed reported no infectious complications or significant adverse reactions associated with PRP administration.

According to billing records, Charles et al. did not observe progression to full-thickness tears in their sample, while Zhang et al.[2] described few adverse events overall.

Costs and scope of application

Zhang et al.[2] reported an average cost of $1,755 per PRP injection in outpatient surgical centers in the United States, with no clear consensus on insurance coverage.

The studies were conducted in sports medicine clinics, orthopedic centers, and hospitals, and the applications were generally guided by ultrasound.

DISCUSSION

The findings of this study suggest that platelet-rich plasma (PRP) may promote clinical improvement in patients with rotator cuff injuries, both in pain reduction and functional recovery of the shoulder. Research conducted by Pasin et al. and Charles et al. provides evidence of significant pain relief and increased functional scales, particularly in partial tears and in patients who had not responded to conservative therapies. These observations are consistent with reports by Fitzpatrick et al.[4] and Mautner et al.[6], highlighting improvements assessed using questionnaires such as Quick DASH and Constant-Murley.

The effectiveness of PRP, however, is not unanimous. Some publications report less conclusive results, possibly due to methodological heterogeneity between studies: platelet concentration, frequency and number of injections, use of ultrasound guidance, and even follow-up time vary. For example, Zhang et al.[2] described large differences in indications and costs in their analysis but without a uniform approach to evaluating clinical outcomes.

Saltzman et al.[5] reflects that while PRP may contribute to improved function, individual factors—such as the severity of the injury and overall health status—may influence the therapeutic response.

The absence of standardized protocols for PRP preparation and patient selection makes it difficult to compare findings rigorously.[7,8] In addition, many studies have small sample sizes (between 50 and 150 patients), and few have a long follow-up period, which does not allow for the evaluation of long-term benefits. Some studies do not differentiate between the exclusive effect of PRP and its combination with other interventions (e.g., physical therapy or anti-inflammatories), which is also a potential methodological flaw. Most of the studies analyzed agree that PRP has a favorable safety profile, with a low level of adverse events and no progression to complete tears in most cases.[9,10,11] This characteristic, combined with the regenerative potential of growth factors, justifies the growing interest in its use as an alternative or complement to conventional treatments.[12,13]

What is novel about these findings is the role of PRP as a biological therapy capable of promoting myotendinous regeneration, as opposed to other methods that only temporarily relieve symptoms (such as corticosteroid injections). However, greater uniformity in study methodology is needed to confirm these benefits and establish solid recommendations for application, especially regarding optimal dosage and injection intervals.

CONCLUSIONS

In future research, it is important to design controlled clinical trials with larger samples and follow-up periods longer than six months with standardized PRP preparation and application protocols. These details will allow for a more accurate determination of this therapy's actual efficacy in different patient subgroups and its cost-effectiveness compared to conventional surgical or pharmacological treatments.

In conclusion, the studies reviewed provide encouraging evidence regarding the efficacy of PRP in improving shoulder function and reducing pain in rotator cuff injuries.

Although questions remain regarding the variation in results, these are due to the lack of a standardized protocol for PRP applications.

PRP remains a promising alternative, mainly in patients with chronic tendinopathies and partial tears. It has minimal risks and a potential regenerative effect that warrants further investigation.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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