ORIGINAL ARTICLE

Efficacy of Platelet-Rich Plasma Therapy in Athletes Returning to Sport: A Randomized Controlled Trial

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Abstract

Background: Platelet-rich plasma (PRP) therapy has garnered increasing attention in sports medicine due to its proposed ability to accelerate tissue healing and reduce downtime following musculoskeletal injuries. In athletes, rapid return to pre-injury performance is paramount, yet evidence regarding the efficacy of PRP in facilitating earlier and safer return to sport remains inconclusive. The objective of this study was to assess the efficacy of platelet-rich plasma in athletes returning to sport.

Methods: This prospective, randomized controlled trial was conducted at a single sports medicine facility in India. Athletes with acute or subacute sports-related tendon injuries were enrolled and randomized into two groups. One group (PRP) received ultrasound-guided PRP injection, and another group (Control) received saline as a placebo injection, followed by a standardized rehabilitation protocol. The primary outcome measure was time to return to full sports participation, and secondary outcomes included pain intensity using Visual Analog Scale (VAS) and function using Cincinnati Sports Activity Scale assessed at baseline, 4 weeks, and 12 weeks. Safety and adverse events were also documented.

Results: A total of 60 participants were included in this study. Athletes who received PRP demonstrated a significantly shorter mean time to return to sport (5.9 ± 1.2 weeks) compared to controls (7.4 ± 1.6 weeks; $p<0.01$). Moreover, the PRP group exhibited marked improvements in VAS pain scores and functional ratings at both 4 and 12 weeks ($p < 0.05$). No severe adverse events were recorded; mild, transient post-injection pain was the most frequently reported side effect in both groups.

Conclusion: Our findings suggest that PRP therapy can be a viable adjunct in the management of sports-related tendon injuries, potentially expediting return-to-play timelines and improving pain and function in the short to mid-term. Further large-scale, multicenter trials are warranted to confirm these results and optimize PRP preparation and delivery methods.

Keywords: Platelet-Rich Plasma; Sports Injuries; Tendon Healing; Return to Play; Biologic Therapy

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Introduction

Musculoskeletal injuries, particularly tendon strains or partial tears, are among the most prevalent causes of lost training and competition time in athletic populations[1]. Athletes demand timely and effective treatment strategies that not only alleviate symptoms but also facilitate an expeditious return to pre-injury performance. Conventional therapies including rest, physiotherapy, nonsteroidal anti-inflammatory drugs (NSAIDs), and corticosteroid injections—can mitigate pain and inflammation but do not necessarily accelerate the intrinsic healing processes of tendinous tissue[2]. In some cases, these approaches may fail to restore optimal function, resulting in prolonged rehabilitation and recurrent injuries[3].

Platelet-Rich Plasma (PRP) therapy, derived from the patient's own blood, is increasingly used in sports medicine as a regenerative approach to musculoskeletal repair[4]. The procedure involves centrifugation of whole blood to isolate a plasma fraction with high platelet concentrations. Once activated, platelets release a suite of growth factors, including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), and vascular endothelial growth factor (VEGF), which are believed to promote healing through angiogenesis, fibroblast recruitment, and collagen synthesis[5]. As such, PRP has been hypothesized to accelerate tissue regeneration, reduce pain, and shorten downtime in athletes with tendon or ligament injuries.

However, despite promising preclinical findings, the clinical efficacy of PRP in facilitating earlier return-to-play remains a topic of debate[6]. Differing PRP preparation protocols—such as leukocyte-rich versus leukocyte-poor formulations—and variable rehabilitation regimens contribute to heterogeneous study outcomes. Furthermore, factors like injury chronicity, tendon pathology type, and patient age may modulate therapeutic response[7]. The athlete population poses an additional complexity: their injuries often demand quicker recovery timelines, and the high physical demands of sport can challenge the healing process if not properly managed[8].

Given these uncertainties, the current study aims to evaluate the efficacy of PRP therapy in aiding athletes' return to sport following acute or subacute sports-related tendon injuries. By standardizing PRP preparation and applying uniform rehabilitation protocols, we seek to isolate the potential benefits of PRP and provide more robust evidence to guide sports medicine practitioners. Our hypothesis is that PRP, when administered under optimal conditions, will reduce the time to full sports participation, alleviate pain more effectively, and improve functional outcomes compared to a saline placebo.

Methods

This was a prospective, randomized controlled trial conducted at a single sports medicine facility between January and December of a 12-month period. Ethical approval was obtained from the Institutional Review Board, and all participants provided written informed consent prior to enrolment.

Participant selection

A total of 60 competitive athletes (age range, 18–35 years) presenting with acute or subacute tendon injuries were recruited. Inclusion criteria were as follows: diagnosis of a tendon injury (e.g., patellar, Achilles, or rotator cuff tendons) confirmed by ultrasound or magnetic resonance imaging (MRI), symptom duration of less than 3 months and regular competitive sports participation (at least 3 sessions/week). Exclusion criteria included full-thickness tendon ruptures, previous surgical interventions on the injured tendon, systemic inflammatory or autoimmune conditions, use of anticoagulant medications, and any contraindication to venepuncture.

Randomization and blinding

Participants were randomly assigned to receive either a single PRP injection (PRP group) or a saline placebo injection (Control group) in a 1:1 ratio, using a computer-generated allocation sequence. Allocation concealment was maintained via sealed, opaque envelopes opened just prior to the procedure. Both participants and outcome assessors remained blinded to the intervention, while the physician preparing the injection was aware of group assignment.

PRP preparation and intervention

In the PRP group, approximately 20 mL of venous blood was drawn under aseptic conditions. A double-centrifugation process was employed to obtain 3–4 mL of leukocyte-poor PRP. Platelet count was quantified to confirm a threefold increase over

baseline. The PRP was then injected, under ultrasound guidance, into the tendon lesion site. The Control group received an equivalent volume of sterile 0.9% saline solution using the same ultrasound-guided technique.

Rehabilitation protocol

All participants followed a standardized, progressive rehabilitation program over 12 weeks. Phase I (weeks 0–2) focused on rest and gentle range-of-motion exercises. Phase II (weeks 3–6) introduced controlled strengthening and proprioceptive drills. Phase III (weeks 7–12) emphasized sport-specific exercises and gradual return to full athletic activity. Compliance was monitored via weekly physiotherapy sessions.

Outcome measures

Primary outcome: Time to return to full sport participation, defined as the point at which the athlete resumed unrestricted training and competition as determined by a sports physician.

Secondary outcomes:

Visual Analogue Scale (VAS)[9]: This scale is widely used to assess pain intensity. It is marked in 0-10 according to intensity of pain. The criteria of VAS is: 0 (no pain), 1-2 (no pain at rest, mild pain on movement), 3-4 (mild pain on rest, moderate pain with movement and coughing), 5-6 (moderate pain at rest, severe pain with movement or coughing), 7-8 (severe pain at rest, acute pain with movement or coughing), 9-10 (acute pain on rest).

Cincinnati Sports Activity Scale[10]: A validated tool for functional status, scored 0 100, with higher scores indicating better function. Assessments occurred at baseline, 4 weeks, and 12 weeks post-injection. Any adverse events, including infection or severe pain, were recorded throughout the study.

Statistical Analysis

Data were analyzed using SPSS (version 26.0). Continuous variables were reported as mean ± standard deviation and compared with an independent t-test. Categorical variables were compared using the chi-square test. A p-value of < 0.05 was considered statistically significant. Sample size calculation was based on an anticipated 2-week difference in return-to-play timelines, power set at 80%, and alpha at 0.05.

Discussion

All 60 enrolled athletes completed the study (30 in the PRP group, 30 in the Control group). Baseline characteristics were comparable between groups (Table I). The mean age was 25.8 ± 3.7 years, with no significant differences in sex distribution or baseline pain and function scores.

Table I: Baseline demographics and clinical scores

Variable	PRP Group (n=30)	Control Group (n=30)	p-value
Age (years)	25.6 ± 3.4	26.1 ± 3.9	0.53
Male/Female	18/12	19/11	0.78
Duration of Injury (weeks)	4.7 ± 1.5	4.9 ± 1.4	0.67
VAS Pain (Baseline)	6.8 ± 1.2	6.9 ± 1.1	0.82
Cincinnati Scale	64.3 ± 6.5	63.7 ± 6.1	0.71

Data were expressed as mean ± SD and absolute number.

Athletes in the PRP group returned to their sports significantly faster compared to the Control group (5.9 ± 1.2 weeks vs. 7.4 ± 1.6 weeks, $p < 0.01$). The distribution of return-to-play times is detailed in Table II, highlighting that most PRP recipients resumed training and competition by week 6, whereas controls reached the same milestone closer to weeks 7–8.

Table II: Time to return to sport (weeks)

Group	Mean ± SD	Range	p-value
PRP	5.9 ± 1.2	4 – 8	< 0.01
Control	7.4 ± 1.6	5 – 10	

Data were expressed as mean ± SD

Significant differences were noted in pain and functional scores at weeks 4 and 12 ($p < 0.05$). The PRP group demonstrated a steeper decline in VAS pain scores and a more robust improvement in Cincinnati scale ratings. Figure 1 shows the difference in Cincinnati score of the participants.

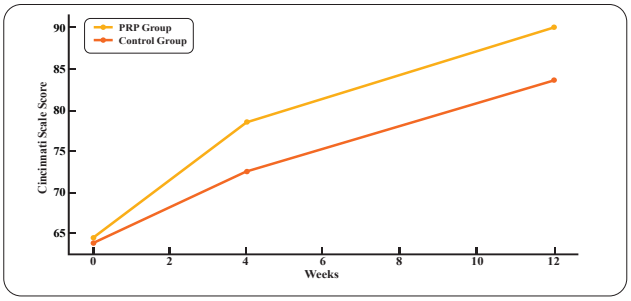

Figure 1: Cincinnati sports activity scale score of the studied groups.

Both groups reported minimal adverse events. Mild injection-site discomfort and localized swelling occurred in approximately 20% of PRP recipients and 15% of controls. No infections or severe complications were observed. All adverse effects resolved within 48–72 hours.

Discussion

The present study demonstrates that a single ultrasound-guided PRP injection, coupled with a standardized rehabilitation regimen, can significantly reduce the time needed for athletes to return to full sports participation. These findings build upon growing evidence that PRP's high concentration of platelets and growth factors may accelerate tissue repair, particularly within tendinous structures[11]. While previous meta-analyses have reported mixed outcomes for PRP across various injury types, the specificity of our population (competitive athletes with acute or subacute tendon lesions) and the use of a well-defined PRP formulation likely contributed to the positive results observed[12].

A key factor influencing the efficacy of PRP is the preparation technique. Our study employed leukocyte-poor PRP, which may minimize inflammatory responses and optimize the local healing environment[13]. In contrast, some protocols involve leukocyte-rich PRP, which can release catabolic cytokines that potentially undermine tendon healing[14]. Moreover, precise ultrasound guidance ensures accurate delivery of PRP into the lesion site, enhancing its local effects.

Pain and functional improvements, as evidenced by significant changes in VAS and Cincinnati scores, further support the benefit of PRP. Recent work suggests that growth factors released by platelets including PDGF and TGF-β facilitate collagen synthesis, angiogenesis, and fibroblast proliferation, thereby contributing to tissue remodeling and reduced pain[15]. This mechanism holds particular importance for athletes, whose high activity levels may otherwise perpetuate microtrauma and delay recovery.

Nevertheless, limitations must be acknowledged. First, our follow-up period of 12 weeks predominantly captures short- to mid-term outcomes, leaving questions about the durability of PRP's effects. Second, while our sample size was sufficient to demonstrate statistical differences, a larger, multicenter cohort could validate these findings across diverse athletic populations and different tendon injury sites[16]. Third, the placebo group received saline injections, which, while inert, may not fully account for all psychological or mechanical factors. Future research might explore whether multiple PRP injections, different rehabilitation timelines, or adjunct treatments (e.g., shockwave therapy) could further optimize return-to-play rates.

In summary, the evidence presented here aligns with the hypothesis that PRP offers tangible advantages over conventional management for tendon injuries in athletes. By reducing pain more effectively and enhancing functional recovery, PRP may shorten the overall rehabilitation period, thereby minimizing lost competitive time. Additional investigations with extended follow-up and standardized protocols will be crucial in consolidating PRP's role in sports medicine and refining best practices.

Conclusion

In conclusion, our randomized controlled trial indicates that a single injection of leukocyte-poor PRP, administered under ultrasound guidance and followed by a structured rehabilitation program, significantly shortens the time to return to full sports participation among competitive athletes with acute or subacute tendon injuries. PRP recipients also exhibited greater improvements in pain and function compared to controls at 4 and 12 weeks. These findings underscore PRP's therapeutic potential in sports medicine. Future large-scale, long-term studies are needed to confirm these observations, standardize PRP preparation, and elucidate optimal treatment protocols for sustained athletic performance.

Declaration

Ethics approval

The study was approved by the Ethical Review Board.

Author contributions

Conception and development of the idea MC, SD
Writing MC
Data analysis CC, VB, LS
Data collection MC, LS, SL, VB
Review and Editing MC, SD

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Conflict of interests: None

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