Establishing the threshold for total delivered platelets concentrated in platelet rich plasma sufficient for a therapeutic tendon, cartilage, and ligament regrowth.

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Introduction

Despite widespread use, PRP remains investigational by the FDA because it is autologous.[1] This has led to a lack of standardized therapeutic concentrations, which complicates insurance coverage and clinical consistency.[2,3]

Platelet-rich plasma (PRP) is widely used for orthopedic conditions, but dosing standards are currently undefined. Platelets facilitate healing by secreting growth factors (e.g., VEGF) and chemokines from alpha, dense, and lysosomal granules.[4] This process regulates cell proliferation and revascularizes damaged tissue.[5] In this way, platelets stimulate healing of the tissue.

Platelets stimulate healing by activating inflammatory responses and secreting growth factors like VEGF to aid tissue revascularization.

While many studies focus on concentration alone, this study explores Total Delivered Platelets (TDP)—the product of concentration and volume—as the critical metric for clinical success.[6,7] The TDP was then compared to the patient reported outcome measures (PROM) focused on functional improvement and pain improvement.

Aims and Objectives

To evaluate the relationship between TDP and patient-reported changes in function and pain over a 24-month period.

To attempt to identify a predictable minimal threshold of TDP that triggers significant orthopedic regrowth and symptom relief.

To provide data-driven evidence that can guide future regulatory standards and insurance reimbursement policies.

Methods

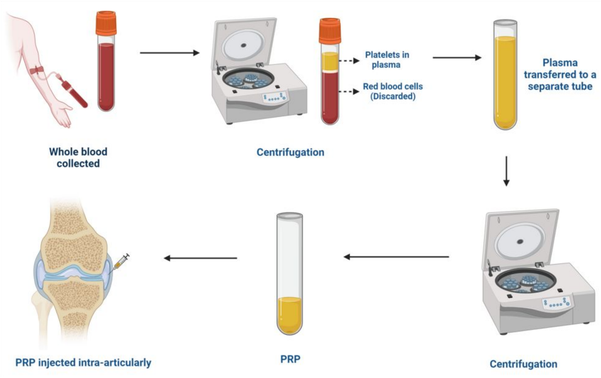

Diagram 1. PRP preparation process prior to reinjection.

Source: Adapted from Cureus article: Efficacy of Platelet-Rich Plasma Intra-articular Injections in Hip and Knee Osteoarthritis.

Study Design
This study was a retrospective analysis of de-identified registry data from DataBiologics, involving 324 unique orthopedic procedures. Selection criteria of procedures included completion of follow-up surveys and treatment profile, including procedures solely using PRP.

Data Collection
Patients were tracked from baseline through 24 months. Outcome measures included the Single Assessment Numeric Evaluation (SANE) for function and the Visual Analog Scale (VAS) for pain.

Statistical Approach
Linear mixed-effects models with repeated measures were used to account for intra-subject correlation. TDP was treated as a continuous variable to observe its effect on the trajectory of recovery.[8]

Regional Breakdown
Shoulder (27.5%), Knee (24.4%), Hip (15.4%), Spine (14.5%), Upper Extremity (12.0%), and Lower Extremity (6.2%).

Results

- The overall cohort showed significant improvement in function ($p < 0.0001$) and reduction in pain ($p < 0.0001$) over 24 months.
- TDP was found to be a significant modifier of functional change over time ($p = 0.0091$). Specifically, higher platelet doses were associated with a faster rate of early functional recovery.
- Hip: Higher TDP was significantly associated with better functional scores ($p = 0.0323$) and enhanced pain reduction over time ($p = 0.0109$).
- Knee & Shoulder: Showed consistent improvement, though the specific dose-response curve was less pronounced than in the hip.
- No single "universal" TDP threshold was identified that applied across all body regions, suggesting that dosing may need to be indication-specific.

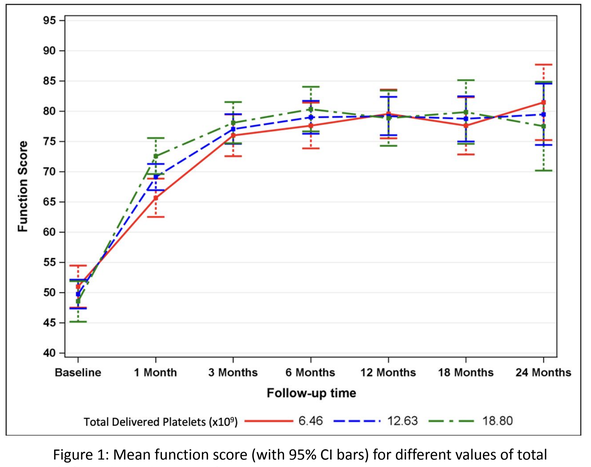

Figure 1: Mean function score (with 95% CI bars) for different values of total delivered platelets over time

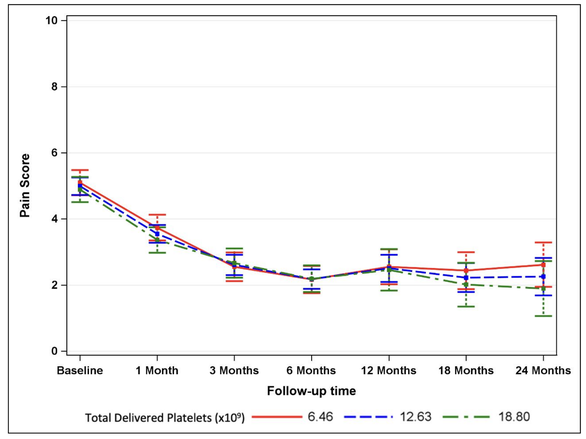

Figure 2: Mean pain score (with 95% CI bars) for different values of total delivered platelets over time

Conclusions

PRP injections lead to sustained, long-term improvements in pain and function for up to two years.

Higher doses of TDP do not necessarily change the final outcome but significantly accelerate the speed of recovery, particularly in the hip.

Clinical practice should move toward standardized reporting of TDP to refine treatment protocols and ensure patients receive a therapeutic dose.[9,10]

References

(1) Johns Hopkins Medicine. Platelet-Rich Plasma (PRP) Injections. 2003.
(2) Beitzel K, et al. US definitions, current use, and FDA stance on PRP. Arthroscopy. 2015.
(3) Jones IA, et al. PRP as a Treatment for Knee OA: A Review. Engineering (Beijing). 2019.
(4) Golebiewska EM, Poole AW. Platelet secretion. Blood Rev. 2015.
(5) Tramś E, et al. Role of Platelets in Osteoarthritis. Cells. 2022.
(6) Nurden AT, et al. Platelets and wound healing. Front Biosci. 2008.
(7) Bansal H, et al. PRP in OA knee: Correct dose critical for success. J Clin Orthop Trauma. 2021.
(8) Berger NM, et al. Platelet-Rich Plasma and the Knee. Cureus. 2021.
(9) DeLong JM, et al. PRP: the PAW classification system. Arthroscopy. 2012.
(10) Lana JF, et al. Platelet-rich plasma: a review of biological mechanisms. Braz J Med Biol Res. 2019.

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