Assessment of the Composition and Biologic Activity of Platelet Rich Plasma and its Relationship to Clinical Outcomes in Patients with Knee Osteoarthritis

Daniel Nemirov
Thomas Jefferson University; Hospital for Special Surgery, daniel.nemirov@jefferson.edu

Bijan Dehghani
Hospital for Special Surgery

Habib Zahir
Hospital for Special Surgery

Xiaoning Yuan
Hospital for Special Surgery

Christine Kim
Hospital for Special Surgery

Recommended Citation
Nemirov, Daniel; Dehghani, Bijan; Zahir, Habib; Yuan, Xiaoning; Kim, Christine; Bhandhari, Reyna; Fava, Patrick; Chinenov, Yuriy; Nguyen, Joseph; Donlin, Laura; Halpern, Brian; Rodeo, Scott; and Otero, Miguel, "Assessment of the Composition and Biologic Activity of Platelet Rich Plasma and its Relationship to Clinical Outcomes in Patients with Knee Osteoarthritis" (2020). Phase 1. Paper 29.
https://jdc.jefferson.edu/si_ctr_2022_phase1/29

This Article is brought to you for free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's Center for Teaching and Learning (CTL). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in Phase 1 by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: JeffersonDigitalCommons@jefferson.edu.
Authors
Daniel Nemirov, Bijan Dehghani, Habib Zahir, Xiaoning Yuan, Christine Kim, Reyna Bhandhari, Patrick Fava, Yurii Chinenov, Joseph Nguyen, Laura Donlin, Brian Halpern, Scott Rodeo, and Miguel Otero

This abstract is available at Jefferson Digital Commons: https://jdc.jefferson.edu/si_ctr_2022_phase1/29
Assessment of the Composition and Biologic Activity of Platelet Rich Plasma and its Relationship to Clinical Outcomes in Patients with Knee Osteoarthritis

Bijan Dehghani¹, Habib Zahir¹, Xiaoning Yuan¹, Daniel Nemirov¹, Christine Kim¹, Reyna Bhandhari¹, Patrick Fava¹, Yurii Chinenov¹, Joseph Nguyen¹, Laura Donlin¹, Brian Halpern¹, Scott Rodeo¹, Miguel Otero¹

¹Hospital for Special Surgery New York, New York

Recent studies suggest positive clinical outcomes associated with platelet-rich-plasma (PRP) administration to treat knee osteoarthritis (OA). However, the results remain inconclusive in part because of the high variability in PRP preparations and the limited information regarding the relevant biologically active components of PRP. We hypothesize that the variability in clinical response is driven by the heterogeneous composition of PRP. In this study we evaluated the composition and biological activity of PRP and further correlated our findings to clinical outcomes in patients receiving intra-articular injections for knee OA. After IRB approval and patient consent, we enrolled 51 patients (mean age: 57.9 ± 10.1; mean BMI: 26.0 ± 4.1) with mild-moderate knee OA (Kellgren Lawrence grades 1-3), eligible for intra-articular PRP injection. We obtained MRI at baseline and outcome measures (KOOS JR and PNS) at baseline, 6 weeks, 6 months, and 12 months after PRP injection. Patients were categorized as “good” and “poor” responders based on the outcome measures, corrected using published Minimally Clinically Important Difference (MCID) values. Aliquots of PRP and whole blood from the same patients were used to evaluate composition (CBC with differential and multiplex ELISA) and biologic activity, using a co-culture system of macrophages and fibroblast incubated with TNFa with and without PRP (10% v:v) for 24 hours. Total RNA from cells was used for RNAseq, Nanostring, and RTqPCR analysis. On average, we collected 4.07 ± 0.1.05 mL of PRP, and 3.24 ± 0.85 mL of PRP were injected intra-articularly. PRP preparations yielded mean fold-changes of 1.60 ± 0.37 platelets and 0.19 ± 0.08v leukocytes, relative to whole-blood from the same patients (set as 1). On average, all patients that reached the 6-month time-point (N = 32) reported improved outcomes at 6-weeks and 6-months after PRP administration (KOOS and PNS p<0.05 vs. baseline). After MCID corrections, we identified “good” (N=17, positive response using both measures) and “poor” responders (N=15, poor response in one or both measures). RNAseq analyses showed PRP-dependent changes in the TNFa-induced modulation of a number of genes, including CXCL7 and CCL5. NanoString and RTqPCR analyses confirmed the RNAseq results. Comparisons of PRP from good and poor responders identified changes in the composition and biologic activity between these groups. This pilot study integrated clinical data with genomic approaches to evaluate variability in the composition and activity of PRP, and how this may influence outcomes in patients with knee OA. We uncovered subsets of genes differentially modulated by co-treatment of PRP with TNFa, in agreement with the concept that the reduced knee OA pain in patients treated with PRP is driven by the ability of PRP to modulate inflammation. Furthermore, we identified changes in the composition and biologic activity of PRP between “good” and “poor” responders.