Single Spin Leukocyte-Rich ACP Max™ System Regimens

Arthrex Orthobiologics

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OBJECTIVE

This study aimed to determine a regimen using 60 mL and 90 mL of whole blood in the ACP Max system to significantly concentrate platelets and leukocytes above circulating levels in a single centrifugation step.

MATERIALS AND METHODS

Blood Collection

Blood was collected from donors (N = 6) using 13.3% acid citrate dextrose solution A (ACD-A) as the anticoagulant. A small volume of anticoagulated blood from each donor was aliquoted for baseline complete blood count (CBC) analyses.

Platelet-Rich Plasma (PRP) Preparation

PRP was prepared for each donor as described in Table 1.

Table 1. Spin regimes to prepare the various groups.

Step	60 mL Leukocyte Rich	90 mL Leukocyte Rich
1	Centrifuge at 3200 rpm for 6 minutes.	Centrifuge at 3200 rpm for 15 minutes.
2	Remove PPP until the bottom of the plunger is level with the RBC layer.	
3	Collect the next 6 mL of fluid into a 10 mL syringe.	

To determine the concentrations of cells per milliliter of fluid, separate samples were created that collected ten 1-mL aliquots once the bottom of the plunger was level with the RBC layer, rather than collecting 6 mL in a single syringe.

The volumes of the PRP were recorded. A small aliquot of each PRP was collected for each device, and a CBC with differential was recorded.

Data Analysis

The following analyses were performed on all CBC results, with a focus on the platelet (PLT), white blood cell (WBC), red blood cell (RBC), neutrophil (NE), lymphocyte (lymph), and monocyte (MONO) groups.

The fold change in the concentration of each cell type over baseline was determined by dividing the results from the PRP by the corresponding value from the respective whole blood.

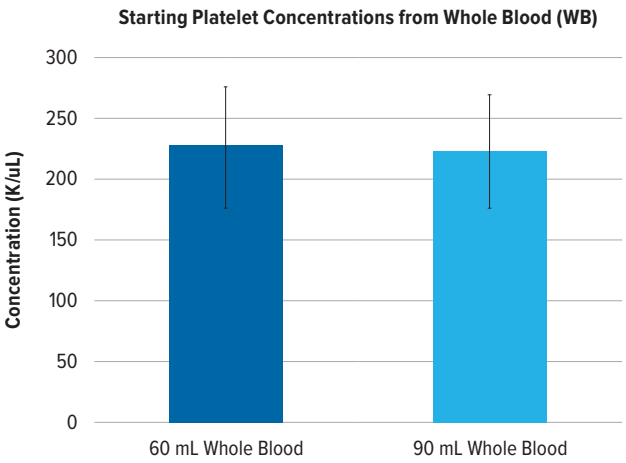
The dose was calculated by multiplying the PRP concentrations by the recovered fluid volume.

After each device's calculations were completed, the data were averaged across the six donors for each group. For the 6 mL final-volume analyses, a Student or Welch t test was used, based on equal variance. For the ten 1-mL aliquots, a two-way ANOVA with the Holm-Sidak method and multiple comparisons was used. Significance was set at $\alpha = .05$ for all analyses.

RESULTS

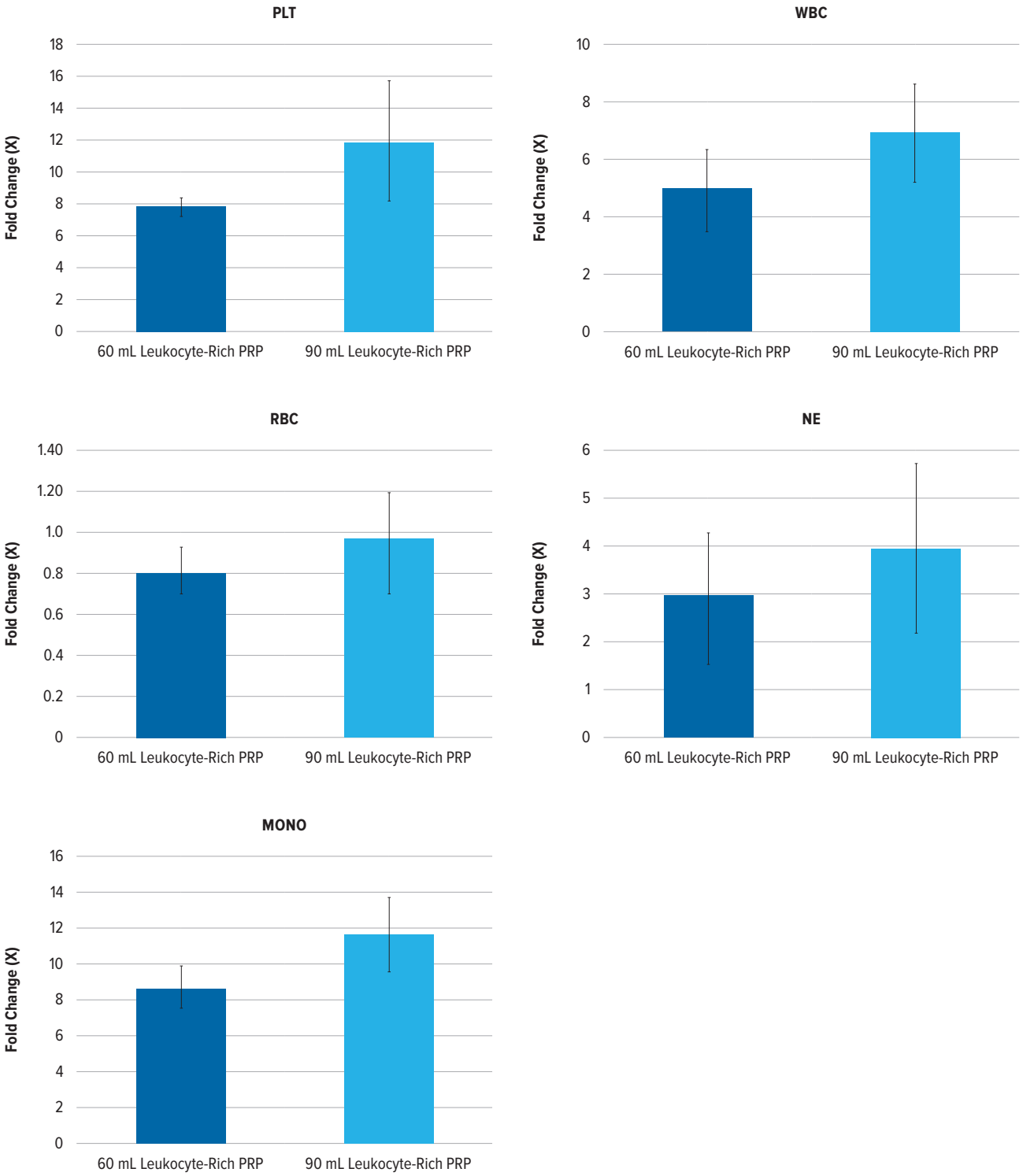
The average starting concentration of platelets in the whole blood is demonstrated in Figure 2. There were no significant differences between the two groups; however, starting healthy platelet concentrations can range from 150-400 K/µL.

Figure 2. The average starting platelet concentration (K/µL) within each group (mean ± SD; N = 6).



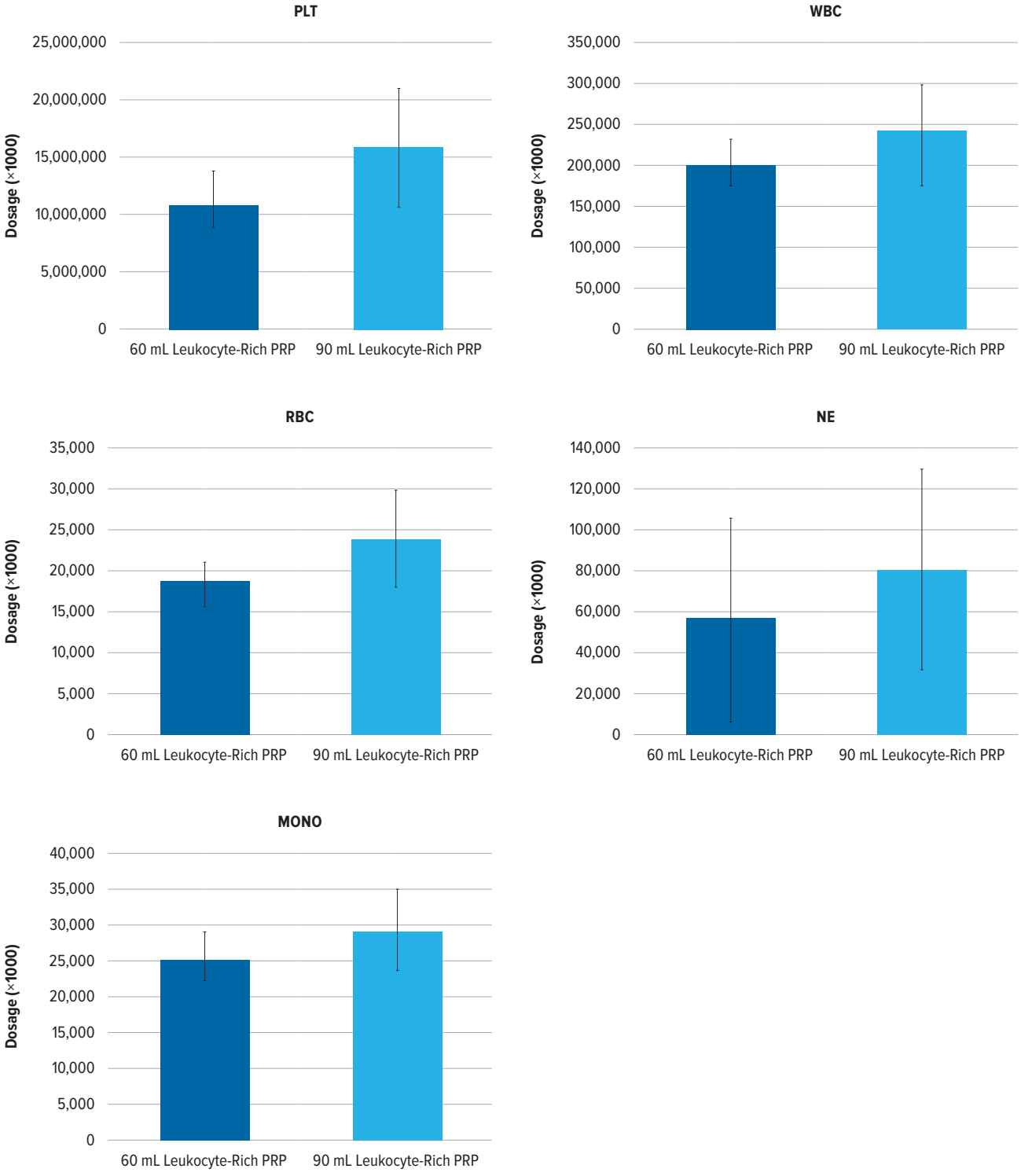
The fold change in cell concentration above baseline was calculated. The fold change for the final 6 mL is shown in Figure 3.

Figure 3. The average Fold X of PLT, WBC, RBC, NE, and MONO for the 6 mL final PRP volume of the 60 mL and 90 mL spins.



From the concentrations and the known volumes of each sample, the dose was calculated. The average of the 6 mL final samples is shown in Figure 4.

Figure 4. The average dosage of PLT, WBC, RBC, NE, and MONO for the 6 mL pulls of the 60 mL and 90 mL spins.



DISCUSSION

The 60 mL and 90 mL whole blood input volumes can be processed in a single spin with the ACP Max™ PRP system using the methods described above. This results in a PRP with significantly concentrated platelets and white blood cells while remaining simple to perform. According to the PAW classification of PRP, these new PRP formulations would be classified as P4-Aα, as the platelet concentrations are above 1.25 M/µL, the WBCs are above baseline, and the neutrophils are above baseline, while the normal ACP Max PRP is classified as P4-Bβ.[1] The ten 1-mL aliquots demonstrated that platelets are found within the 3-5 mL mark, with very few past that point, while WBCs can be found mostly in the 4-5 mL mark, with some found further into the fluid. PRP is a common conservative treatment employed by orthopedic surgeons, with different compositions of PRP being used to treat different ailments. Notably, leukocyte-rich PRP may be better suited to a tendon environment, as leukocyte-rich PRPs have been shown to stimulate tenocyte proliferation more effectively.[2,3] Conversely, leukocyte-poor PRP may be better suited to joint environments, as leukocyte- and red blood cell–rich concentrates have been shown to cause greater synoviocyte cell death than leukocyte-poor concentrates.[3,4] The ACP Max system normally produces leukocyte-poor PRP; however, this study demonstrates that it can be used to create leukocyte-rich PRP with only slight changes to the spin regimen, allowing surgeons to tailor their PRP preparation to the treatment.

References

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