Single-Spin Regimens in ACP Max™ System

Arthrex Orthobiologics

OBJECTIVE

The ACP Max system allows for the collection of 30, 60, or 90 mL of whole blood (WB) for the preparation of platelet-rich plasma (PRP). Standard processing of ACP Max consists of a double-spin regime that creates about 4-6 mL of PRP product depleted of red blood cells (RBCs) and granulocytes, and contains up to 11 times more platelets compared to baseline WB.[1] This method is contrary to the Arthrex ACP® double-syringe system, which consists of only a single spin of 15 mL of WB that produces about 4-6 mL of autologous conditioned plasma (ACP). This product contains 2-3 times more platelets from baseline and is also depleted in RBCs and granulocytes.[2] However, if a larger volume of PRP is desired, a single spin in the ACP Max system can be completed, with or without the use of anticoagulant.

The objective of this study was to determine single-spin regimens for 30, 60, and 90 mL in the ACP Max system that yielded a larger volume PRP output and to characterize the cellular content of these regimens.

METHODS

Two studies were performed to determine spin protocols for 30, 60, and 90 mL WB starting volumes.[3] For the first study (Study 1), two 60 mL syringes of WB were collected per donor (n = 7). One syringe was preloaded with 8 mL of anticoagulant citrate dextrose solution A (ACD-A), and one syringe did not contain any ACD-A. ACP Max kits were filled with either 60 mL of anticoagulated or nonanticoagulated WB, and baseline complete blood counts (CBC) were obtained. Devices were spun at 1800 rpm for 6 minutes in a Hettich centrifuge. The top layer of PRP was collected into a 30 mL syringe. PRP was collected until the RBCs hit the top of the ACP Max plunger, with caution to avoid pulling any RBCs into the collection syringe. A final CBC analysis was conducted.

The fold change of platelets (PLTs), RBCs, and WBCs was determined by calculating the concentration of each blood parameter in PRP from baseline CBC counts in WB. A paired T-test was run to determine any differences in fold change of PLTs, RBCs, and WBCs between PRP with or without ACD-A (α = .05, SigmaPlot 14.0). When the normality test failed, a nonparametric Wilcoxon signed rank test was run.

Once the methods from the above study were confirmed, an additional study (Study 2) was performed. This study tested an additional 30 and 90 mL WB input volumes, using the protocol from Study 1, for three donors (n = 3). Each device was spun at 1800 rpm for 3, 6, or 9 minutes, per 30, 60, or 90 mL input volume, respectively.

RESULTS

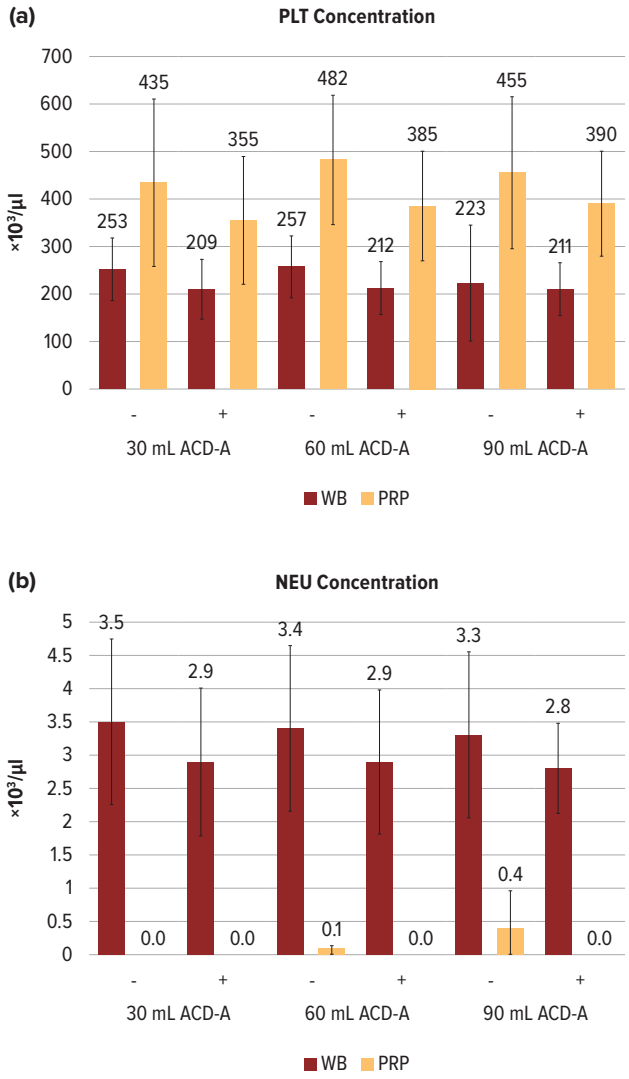
Table 1. PRP volume and fold change of PLTs, RBCs, and WBCs in PRP produced in the ACP Max PRP system with or without the use of ACD-A, using a **60 mL** input volume (Study 1; n = 7).

ACD-A	Fold Change			PRP Volume (mL)
	PLT	RBC	WBC	
–	**2.4 ± 0.6**	**0.0 ± 0.0**	**0.3 ± 0.2**	**26 ± 3**
+	2.0 ± 0.2	0.0 ± 0.0	0.3 ± 0.3	25 ± 3

Table 2. PRP volume and fold change of PLTs, RBCs, and WBCs in PRP produced in the ACP Max PRP System system from **30, 60, and 90 mL** input volumes, with or without the use of ACD-A (Study 2, n = 3).

Input Volume (mL)	ACDA	FoldX			PRP Volume (mL)
		PLT	RBC	WBC	
30	–	**1.7 ± 0.3**	**0.0 ± 0.0**	**0.0 ± 0.0**	**12 ± 1**
	+	1.7 ± 0.2	0.0 ± 0.0	0.0 ± 0.0	13 ± 2
60	–	**1.9 ± 0.2**	**0.0 ± 0.0**	**0.1 ± 0.1**	**27 ± 4**
	+	1.8 ± 0.1	0.0 ± 0.0	0.1 ± 0.1	27 ± 3
90	–	**2.4 ± 1.0**	**0.0 ± 0.0**	**0.4 ± 0.3**	**40 ± 5**
	+	1.8 ± 0.1	0.0 ± 0.0	0.3 ± 0.2	40 ± 4

Figure 1a-1b. Concentration of PLTs and neutrophils (NEU) in PRP produced in the ACP Max™ PRP system from 30, 60, 90 mL input volumes, compared to baseline WB concentrations, with (+) or without (-) the use of ACD-A (Study 2, n = 3).



DISCUSSION

Results from Study 1, shown in Table 1, conclude that both methods produced a larger PRP product volume of 25 to 26 mL. There was a significant difference between the products, in which PRP without the use of ACD-A results in a higher PLTs fold change (*P* = .043). However, both PRP products contained at least 2 times more platelets over baseline (PLTs fold change), with depletion of RBCs and WBCs.

Study 2 showed that 30, 60, and 90 mL WB input volumes in ACP Max devices using a single spin, with or without the use of ACD-A, achieved a larger volume of PRP, depleted of RBCs and WBCs (Table 2 and Figure 1a-1b). Although 2 times more PLT concentration from baseline was not achieved for all input volumes, the desired outcome was met in terms of a larger volume of PRP (>6 mL), and processing did not require the use of ACD-A.

It must be noted that when handling blood that does not contain ACD-A, there is the possibility of clotting. Unavoidable cell clumping in the sample can occur before or during hematological analysis, causing an interference with the CBC. Additionally, ACD-A dilutes the whole blood, and therefore, anticoagulated blood samples inherently contain less cellular content than whole blood samples without ACD-A, which may contribute to differences in PRP outputs between sample types. PRP should be used within 30 minutes of the blood draw if ACD-A is not used. If ACD-A is used, PRP should be used within 4 hours of the blood draw.

Overall, 30, 60, and 90 mL WB input volumes, with or without the use of ACD-A, can be processed with a single spin using the ACP Max PRP system to produce a large volume of PRP containing platelet concentrations above baseline levels, with depletion of red blood cells and white blood cells.

References

1. Arthrex, Inc. Data on file (APT-5535). Naples, FL; 2022.
2. Arthrex, Inc. Data on file (APT-4153). Naples, FL; 2019.
3. Arthrex, Inc. Data on file (APT-06931). Naples, FL; 2024.

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