ACP Max™ System: Cellular Characterization and PRP Comparisons

Arthrex Orthobiologics

Background

The ACP Max System uses a double-spin technique to create platelet-rich plasma (PRP) with an increased concentration of platelets. Platelets release growth factors that play a critical role in tissue healing.[1] PRP produced using the ACP Max system is depleted of red blood cells and granulocytes, including neutrophils, which are associated with inflammation.[2] The ACP Max device can process variable whole blood (WB) volumes of 30 mL, 60 mL, and 90 mL. The purpose of this study was to analyze cellular content in PRP produced from the ACP Max system, EmCyte PurePRP® SupraPhysiologic and PurePRP® II, and Harvest SmartPreP® 2.

Methods

A licensed phlebotomist collected WB from 6 healthy donors into syringes preloaded with each manufacturer's recommended volume of ACD-A (Salus IRB #1082, n=6). Using blood from the same donor, all devices were filled with 60 mL WB/ACD-A, while an additional ACP Max device was filled with 90 mL WB/ACD-A. Each device contained a final ACD-A concentration of 13% (v/v). A baseline complete blood cell count (CBC), with white blood cell differential, was measured using the WB/ACD-A sample from each device (Sysmex XE-5000). Devices were centrifuged and processed per each manufacturer's directions for use (Table 1). After PRP was collected from each device, product volume was recorded and each PRP sample was analyzed via CBC.

Concentrations of platelets (PLTs), white blood cells (WBCs) including neutrophils (NEs), and red blood cells (RBCs) were measured using CBC analysis. The fold change (Fold ×) of PRP cell counts, relative to baseline, was calculated using the following equation: (concentration in PRP)/(concentration in WB). Fold × values for all devices were compared with a one-way RM ANOVA and post-hoc analysis (SigmaPlot 14.0, α = 0.05). Statistical significance was shown when $p \leq 0.05$.

Results

Table 1. Processing methods for each PRP system

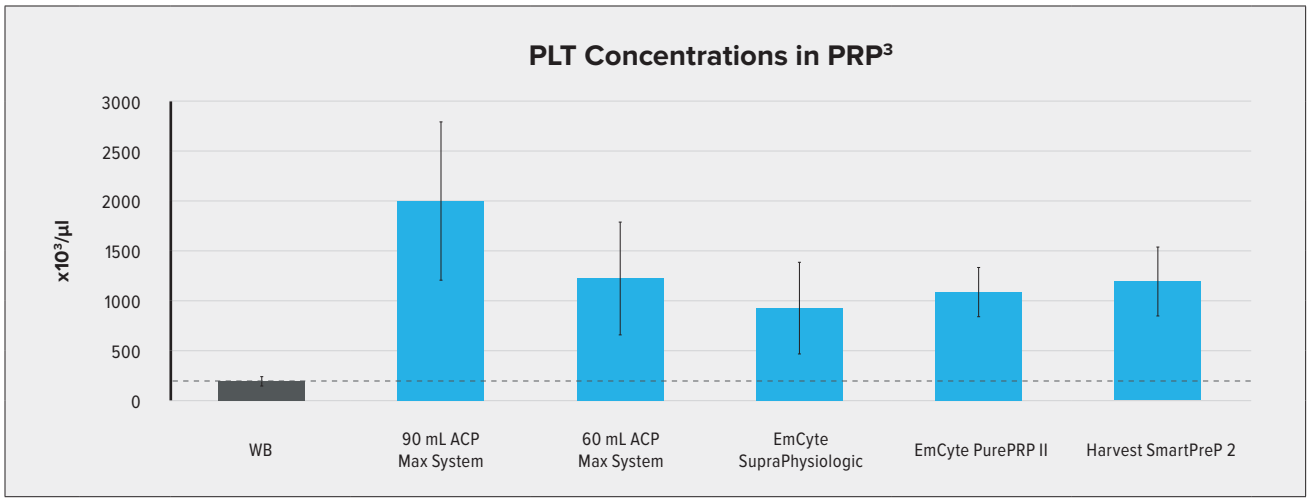
Device (Processing Volume)		Spin Regime	Centrifuge
Arthrex	ACP Max System (90 mL)	■ 1st spin: 3200 rpm for 9 min ■ 2nd spin: 1500 rpm for 5 min	Hettich Rotofix 32A
	ACP Max System (60 mL)	■ 1st spin: 3200 rpm for 6 min ■ 2nd spin: 1500 rpm for 5 min	
EmCyte	SupraPhysiologic (60 mL)	■ 1st spin: 3800 rpm for 1.5 min ■ 2nd spin: 3800 rpm for 5 min	Platinum Series
	PurePRP II (60 mL)		
Harvest	SmartPreP 2 (60 mL)	Single spin: 14 min (unspecified speed)	Harvest SMP2-115

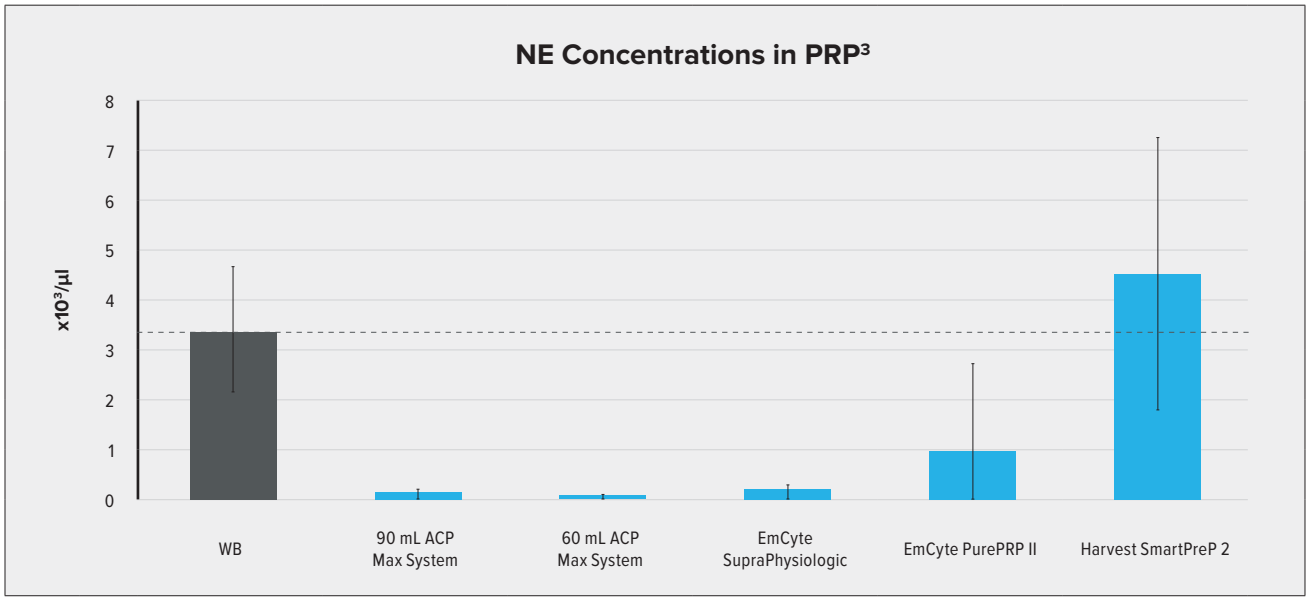
Table 2. Comparison of average Fold × and volumes, with standard deviation, between PRP products (n=6)

Device		FoldX				PRP Volume (mL)
		PLT	WBC	NE	RBC	
Arthrex	ACP Max™ System (90 mL)	12.3 ± 2.8 (A)	2.1 ± 1.9 (B)	0.02 ± 0.02 (B)	0.05 ± 0.02 (B)	4.9 ± 0.9
	ACP Max System (60 mL)	7.1 ± 1.9 (B)	0.5 ± 0.6 (B)	0.01 ± 0.02 (B)	0.02 ± 0.01 (B)	5.8 ± 2.1
EmCyte	SupraPhysiologic	5.6 ± 2.0 (B)	0.7 ± 0.5 (B)	0.03 ± 0.03	0.02 ± 0.01 (B)	7.0 ± 0.3
	PurePRP II	6.7 ± 1.9 (B)	1.7 ± 0.9 (B)	0.22 ± 0.32	0.14 ± 0.25 (B)	6.9 ± 0.6
Harvest	SmartPreP 2	7.1 ± 0.9 (B)	3.9 ± 0.9 (A)	1.43 ± 0.89 (A)	0.62 ± 0.17 (A)	6.1 ± 0.2

Differing letters denote $p < 0.05$.

Figure 1. Average PLT and NE concentrations in PRP compared to WB baseline, with standard deviation, between PRP products (n=6)





Conclusion

The ACP Max™ system (90 mL volume) produced PRP with significantly higher PLT Fold × (12.3 ± 2.8) than all other systems ($p < 0.001$). When comparing 60 mL regimes, ACP Max PRP had equivalent or higher average PLT Fold ×, with equivalent or lower WBC, RBC, and NE Fold ×. SmartPreP2 PRP had significantly higher WBC Fold × compared to all other devices, with significantly higher NE Fold × compared to PRP from the ACP Max system ($p < 0.05$).While all devices produced an RBC-reduced PRP, SmartPreP2 PRP had a significantly higher RBC Fold × ($p < 0.001$).

References

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2. Borregaard N, Sørensen OE, Theilgaard-Mönch K. Neutrophil granules: a library of innate immunity proteins. *Trends Immunol*. 2007;28(8):340-345. doi:10.1016/j.it.2007.06.002
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