

# The Angel<sup>®</sup> cPRP System

for Customized Cellular Concentrations of Platelet-Rich Plasma



Arthrex<sup>®</sup>



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## The Angel<sup>®</sup> cPRP System

Technology is what sets the Angel cPRP system apart from the competition. The Angel cPRP system uses proprietary sensor technology and one-button automation to deliver customized PRP concentrate. The Angel cPRP system is the only device that can provide PRP concentrate from BMA with adjustable cellular levels. Bone marrow is a rich source of platelets, nucleated cells, and progenitor cells.

## The Angel® cPRP System Features and Benefits

- Proprietary platelet sensor system
- Adjustable platelet concentrations
- Adjustable white blood cell (WBC) concentrations
- Flexible processing volume 40 mL – 180 mL
- Each processing kit can process 3 cycles up to 180 mL, on the same patient
- Programmable – can store up to 30 custom processing protocols
- Closed system, delivers PRP, platelet-poor plasma (PPP), and red blood cells (RBCs) into separate, sterile compartments

Product Description	Item Number
Angel System Centrifuge (a)	ABS-10060
Angel System Centrifuge, refurbished	ABS-10060R
Angel PRP Kit	ABS-10061T
Angel Kit (b)	ABS-10063
Arthrex Biologics Cart	ABS-10100



## Delivery Systems Features and Benefits

- Quick and simple to attach/detach
- Easy to fill – no need to disassemble
- 11:1 and 1:1 ratios allowing homologous mixture of 2 fluids
- Use to provide a low- or high-viscosity fluid
- ACP/PRP can be mixed with allograft or autograft bone prior to application to an orthopedic surgical site as a spray, gel, or clot
- Extra long, blunt, fenestrated, and beveled delivery needles

### Delivery Systems

Product Description	Item Number
Viscous-Gel Applicator, high-viscosity (a)	ABS-10050
Viscous-Spray Applicator, low-viscosity (b)	ABS-10051
Viscous-Spray II Applicator, low-viscosity (c)	ABS-10052
Ratio Applicator Assembly 11:1 Ratio (d)	SA-3310
Applicator With Dual Spray Tips 11:1 Ratio (e)	SA-3660
Blending Connector With Single Spray	SA-3674
Blending Connector With Mixer	SA-3678

### BioXpress™ Graft Delivery Device, Vented (f)

Product Description	Item Number
Blunt Tip Cannula, 10 cm	ABS-10053-10
Angled Tip Cannula, 10 cm	ABS-10053-10-45
Blunt Tip Cannula, 15 cm	ABS-10053-15
Angled Tip Cannula, 15 cm	ABS-10053-15-45





1  
Open the centrifuge lid cover and lift the centrifuge stator arm to lock the rotating centrifuge adapter within the centrifuge. Remove the Angel Whole Blood Separation Processing Set from the tray and lay it on top of the machine.



2  
Insert the variable-volume separation chamber into the centrifuge adapter by aligning the notches in the separation chamber plate with the mating feature on the centrifuge adapter. Do not hold by the raised tab on the variable separation chamber.



3  
Once aligned, press the separation chamber plate down near the location of the position indicator and turn clockwise until the position indicator snaps into place. *The centrifuge will not rotate if improperly loaded.*



4  
Lower the centrifuge stator arm and align it with the raised tab on top of the variable-volume separation chamber. Place the tube leading from the variable-volume separation chamber through the centrifuge well slot. Close the centrifuge lid ensuring that the tubing is in the slot and not occluded.



5  
Place the pump loop tubing over the pump rotor. The pump loop will automatically load when the processing cycle is initiated. Seat the platelet cuvette/valve assembly by aligning the platelet cuvette and the valve assembly with the platelet sensor body and the valve assembly driver.



6  
Press down firmly on the backside of the platelet cuvette/valve assembly near the pump loop until the assembly snaps in place.

## Angel® System Assembly (Cont.)



**Note: It is essential that the platelet cuvette/valve assembly seats fully on the machine to obtain proper sensing of blood components.**



Hang the 3-compartment reservoir bag on the 2 support pins located on the side of the Angel Whole Blood Separation System.



Remove the breather cap from the PRP valve port located on the valve assembly. If desired, attach the syringe-activated valve to the PRP valve port. Attach the 20 mL luer lock syringe (or alternate syringe, if desired) to the PRP valve port.  
**Note: The luer in the PRP valve port will accommodate most luer lock syringes.**



After setup, inspect the circuit to make sure there are no kinks or occlusions.

## Angel® cPRP System Processing



After the Angel system has been assembled, the operator will begin processing when citrated venous blood has been obtained. The ratio of citrate anticoagulant to whole blood is 1:7. For example, a 60 mL syringe would contain 8 mL of a citrate anticoagulant and 52 mL of whole blood. A 40 mL sample would require 5 mL of a citrate anticoagulant.



The Angel system can process 40 mL to 180 mL of whole blood in a single cycle. The first component to be harvested is the platelet-poor plasma (PPP) followed by the platelet-rich plasma (PRP). The red blood cells (RBCs) will be collected last in the RBCs Out compartment. The approximate spin time for 40 mL of whole blood is 15 minutes. The spin time for 180 mL of blood is 26 minutes.



PRP collection is automated. No manual steps are required for preparation and there are no syringes to change, buffy coats to resuspend, or plasma to decant. The automated process is driven by the 3-sensor technology employed by the Angel centrifuge. The valves that divert the blood fractions to the appropriate sterile collection compartments are activated by the light sensors monitoring the fluid path during collection.



The first component to be collected is PPP. The Angel system will stop collecting PPP when the 470 nm wavelength of light is absorbed by platelets. The Angel system will turn the valve to collect PRP until RBCs are detected by the absorption of the 940 nm wavelength of light.

## Angel® cPRP System Processing (Cont.)



The PRP will be deposited into the PRP collection syringe after the PPP is collected. If a highly concentrated PRP is desired, the PRP collection syringe may be disconnected and used in the treatment area. To increase the volume of the PRP syringe by diluting with PPP, simply pull back on the plunger of the syringe. If PPP is desired, it may be withdrawn from the port on the PPP compartment.

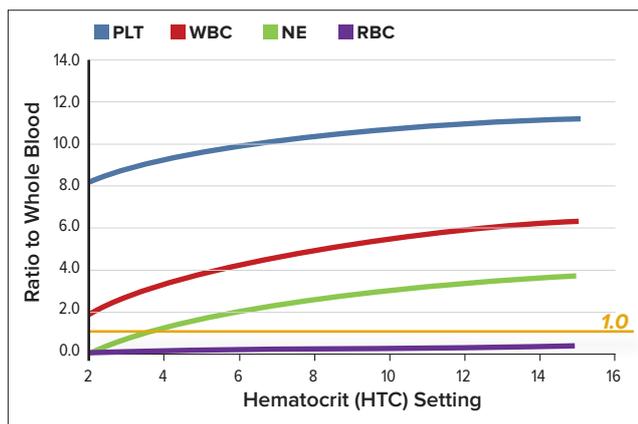


The cycle is complete with the collection of the RBCs in the RBC Out compartment. The Angel system can process up to 180 mL of blood in 1 cycle or a total of 3 cycles for the same patient with the same disposable. If another cycle is desired, simply touch “New Cycle” on the touch screen. If a new cycle is not desired, touch “End Case” on the touchscreen to finalize processing.

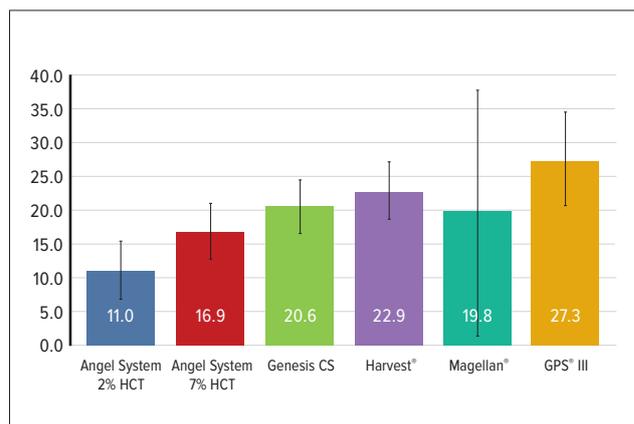
## Angel® System Performance

In order to evaluate the difference between the Angel® system PRP output and whole blood, the Angel system PRP was prepared from the venous blood of 6 healthy donors at hematocrit settings of 2%, 5%, 7%, 10%, and 15%. The concentrations of platelets, white blood cells (WBCs), and neutrophils (NE) were measured with a standard complete blood count (CBC). The density of platelets in the Angel system PRP compared to whole blood at those settings, the concentration of inflammatory white blood cells, and neutrophils at the corresponding hematocrit settings are all reported in Figure 1.<sup>1</sup> Figures 2-6 show the composition of PRP preparations from the Arthrex Angel system and competitor systems.<sup>2</sup>

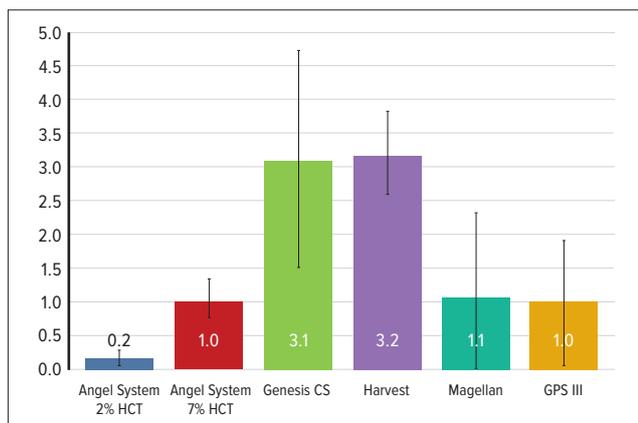
**Figure 1. Angel System PRP Output**



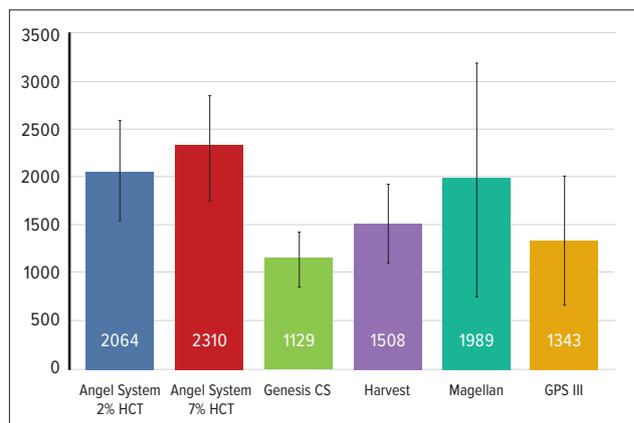
**Figure 2. WBC (K/ $\mu$ L)**



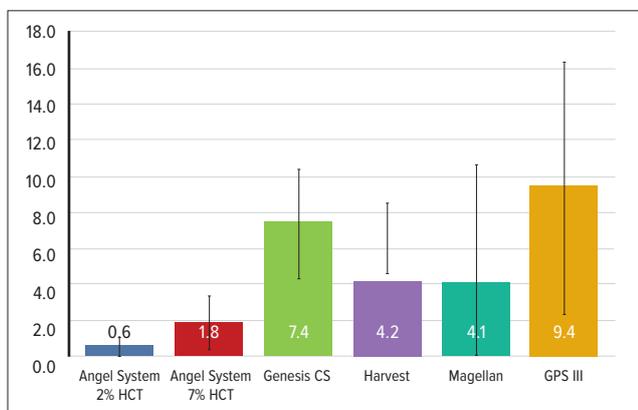
**Figure 3. RBC (M/ $\mu$ L)**



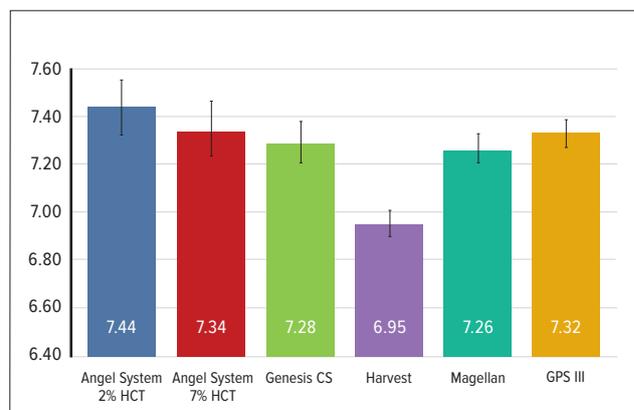
**Figure 4. PLT (K/ $\mu$ L)**



**Figure 5. NE (K/ $\mu$ L)**



**Figure 6. pH**



### References

1. Arthrex, Inc. APT 2465. Naples, FL; 2014.
2. Degen RM, Bernard JA, Oliver KS, Dines JS. Commercial separation systems designed for preparation of platelet-rich plasma yield differences in cellular composition. *HSS J.* 2017;13:75-80. doi:10.1007/s11420-016-9519-3.

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## Precision Separation

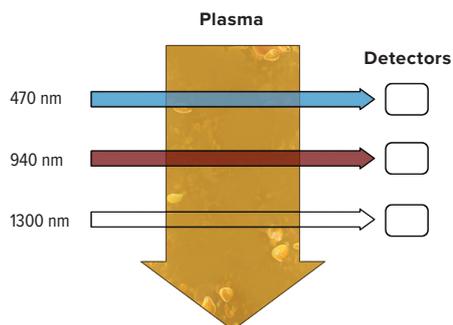
### Advantages of 3-Sensor Technology (3ST):

- No syringe switching
- No manual steps to prepare PRP
- Delivers PRP, PPP, and RBCs into separate, sterile compartments
- Ability to modulate platelet, leukocyte, and RBC content
- Consistent PRP output

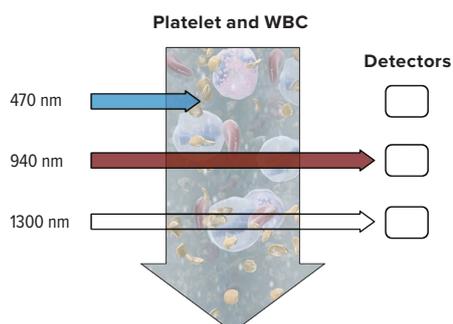
High-specificity 3ST light sensor technology and automated valve actuation are the foundation of the Angel system. The results of these features are the production of a high yield of PRP and PPP from whole blood.

### 3-Sensor Technology

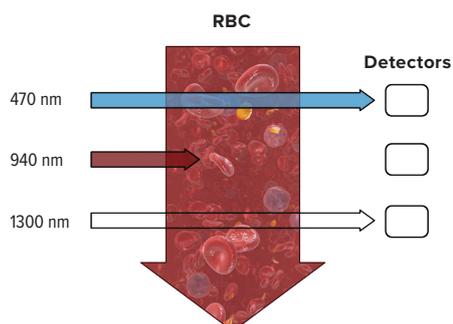
The Angel system incorporates 3 sensors to accurately separate blood components using cell-specific wavelengths of light to increase cellular yields. Absorption of 470 nm light detects platelets and leukocytes, 940 nm detects erythrocytes, and the 1300 nm wavelength corrects for ambient light and the presence of air bubbles.



When plasma is present, all 3 light beams pass through and contact the detector. The Angel device recognizes the presence of plasma and turns the valve to collect PPP. The PPP is deposited in the PPP collection reservoir.



When platelets and WBCs are present, the 470 nm wavelength of light is absorbed. The absence of the 470 nm beam on the detector alerts the Angel system to stop collecting PPP. The Angel device will then actuate the valve to collect PRP. The PRP is directed into the collection syringe on top of the unit.



The 940 nm wavelength is absorbed by RBCs. When the detector no longer detects the 940 nm beam, the Angel system will allow a percentage of RBCs to pass through into the PRP collection syringe. The percentage of RBCs collected in the PRP syringe is determined by the HCT setting selected by the operator.

## Ordering Information

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This description of technique is provided as an educational tool and clinical aid to assist properly licensed medical professionals in the usage of specific Arthrex products. As part of this professional usage, the medical professional must use their professional judgment in making any final determinations in product usage and technique. In doing so, the medical professional should rely on their own training and experience and should conduct a thorough review of pertinent medical literature and the product's directions for use. Postoperative management is patient-specific and dependent on the treating professional's assessment. Individual results will vary and not all patients will experience the same postoperative activity level or outcomes.

**Indications for Use:** To be used in the clinical laboratory or intraoperatively at the point of care for the safe and rapid preparation of platelet-poor plasma and platelet concentrate (platelet-rich plasma) from a small sample of whole blood or a small mixture of blood and bone marrow. The platelet-rich plasma can be mixed with autograft and/or allograft bone prior to application to an orthopedic site.

**Caution:** Federal law (USA) restricts this device to sale by or on the order of a physician.

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