For customized cellular concentrations of platelet-rich plasma from bone marrow aspirate
Technology is what sets the Angel system apart from the competition. The Arthrex Angel® cPRP & Bone Marrow Processing System utilizes a proprietary platelet sensor and 1-button automation to prepare customized PRP concentrate from bone marrow aspirate (BMA).

Bone marrow is a rich source of platelets, nucleated cells and progenitor cells. The Angel device is the only one to provide PRP concentrate from BMA with adjustable cellular levels.

**Features and Benefits:**
- Proprietary platelet sensor system
- Adjustable platelet concentrations
- Adjustable white blood cell (WBC) concentrations
- Flexible processing volume of 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

*Arrow and OnControl are registered trademarks of Teleflex, Inc.*
**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 Arthrex Angel® cPRP System (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.

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**Plasma**

470 nm
940 nm
1300 nm

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.

**Platelet and Nucleated Cells**

470 nm
940 nm
1300 nm

When platelets and nucleated cells 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 will then actuate the valve to collect PRP. The PRP is directed into the collection syringe on top of the unit.

**RBC**

470 nm
940 nm
1300 nm

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 Hermatocrit (HCT) setting selected by the operator.
Instructions For Use

1. Remove the Angel® cPRP processing set from the tray and place it on top of the machine.

2. Insert the variable volume separation chamber into the centrifuge adapter by aligning the notches.

3. Once aligned, press down and turn clockwise until the position indicators snap into place. Place the tube leading from the separation chamber through the centrifuge well slot.

4. Lower the centrifuge stator arm and align it with the raised tab on top of the separation chamber. Close the centrifuge lid.

5. Place the pump loop tubing over the pump rotor. The pump loop will automatically load when the processing cycle is initiated.

6. Press down firmly on the backside of the platelet cuvette until the assembly is snapped in place. Note: It is essential that the platelet cuvette/valve assembly seats fully on the machine to obtain proper sensing of blood components.

7. Hang the 3-compartment reservoir bag on the 2 support pins located on the side of the Angel system.

8. Prepare the heparin flush. Dilute 5000 units of heparin (1000 units/mL) with 5 mL of sterile saline to achieve a final concentration of 500 units per mL. Transfer heparin flush to sterile field. Transfer anticoagulant citrate dextrose solution A (ACD-A) to the sterile field. Each 60-mL syringe will contain 8 mL ACD-A, 30-mL syringes will contain 4 mL of ACD-A and 20-mL syringes require 3 mL of ACD-A.

9. At the sterile field, use the second 30-cc collection syringe to draw up the remaining heparin solution. Flush the bone marrow processing filter. Discharge the remaining heparin solution. Draw up 4 mL of ACD-A into the second 30-cc collection syringe and cap.

10. At the sterile field, draw up the heparin flush in the first 30-cc collection syringe. Flush the bone marrow harvest needle. Return the remaining heparin flush solution to the medicine cup. Draw up 4 mL of ACD-A into the first 30-cc collection syringe and cap.

Bone Marrow Aspirate Harvest Guideline

<table>
<thead>
<tr>
<th>Harvest Site</th>
<th>Approximate BMA Harvest Volume*</th>
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<tbody>
<tr>
<td>Iliac Crest</td>
<td>60 mL-100 mL</td>
</tr>
<tr>
<td>Distal Femur</td>
<td>60 mL-80 mL</td>
</tr>
<tr>
<td>Proximal Tibia</td>
<td>40 mL-60 mL</td>
</tr>
<tr>
<td>Proximal Humerus</td>
<td>20 mL-40 mL</td>
</tr>
<tr>
<td>Calcaneus</td>
<td>15 mL-30 mL</td>
</tr>
</tbody>
</table>

*Guideline only. Actual results may vary.
**Arthroscopic Distal Femur Harvest Technique**

Bone marrow aspiration should occur before drilling tunnels. Arthoscopically insert the needle in the apex of the femoral notch to a depth of 0.3 cm. Turn off the arthroscopic fluid before removing the trocar and attaching the syringe. Slowly aspirate the bone marrow. In order to obtain the desired volume, it may be necessary to rotate 90° or withdraw the needle 0.5 cm when aspirating; prevent withdrawing the needle past the 0.2-cm mark.

**Arthroscopic Proximal Humerus Harvest Technique**

Bone marrow aspiration should occur before any fixation implants are inserted. Arthoscopically insert the needle in the location where the first anchor would be placed; do not exceed a depth of 0.3 cm. Turn off the arthroscopic fluid before removing the trocar and attaching the syringe. Aspirate the bone marrow slowly. In order to obtain the desired volume, it may be necessary to rotate 90° or withdraw the needle 0.5 cm when aspirating; prevent withdrawing the needle past the 0.2-cm mark.

**Calcaneus Harvest Technique**

Make a small incision 0.1 cm anterior and 0.1 cm plantar to the insertion of the Achilles tendon over the lateral portion of the calcaneus, taking care to avoid the sural nerve. When inserting the needle, do not exceed a depth of 0.3 cm. Aspirate a small volume of bone marrow redirecting as necessary until the desired volume of bone marrow aspirate (BMA) is obtained.

**Posterior Iliac Crest Harvest Technique**

Make a small incision at the desired location over the posterior superior iliac spine (PSIS) of the iliac crest. Use the needle tip to locate the center of the iliac crest. Insert the needle and advance 0.3 cm. Aspirate the bone marrow slowly, redirecting as necessary. Repeat until the desired volume is obtained.
After the Arthrex Angel® cPRP System (Angel System) has been assembled and the operator has connected the heparin-flushed bone marrow filter to the “whole blood in” compartment, the citrated bone marrow aspirate may be introduced. The ratio of citrate anticoagulant to whole blood, bone marrow aspirate or a mixture of both is 1:7.

The Angel system can process 40 mL-180 mL of whole blood, bone marrow aspirate or a mixture of both in a single cycle. The approximate spin time for a 40-mL sample is 15 minutes. The spin time for a 180-mL sample 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 system centrifuge.

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 adjust the valve position to collect PRP until red blood cells are detected by the absorption of the 940 nm wavelength of light.

The PRP will be dispensed into the PRP collection syringe after the PPP is collected. 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 Angel system can process up to 180 mL in 1 cycle or a total of 3 cycles for the same patient with the same disposable. Note: If BMA and peripheral blood will be processed separately, it is recommended that peripheral blood be processed first.
Allograft demineralized bone matrix (DBM) is optimal for combination with autologous, biologically active products. DBM putty, sponges and cortical fibers provide a grafting material with excellent handling characteristics when hydrated with a bioactive fluid such as PRP concentrate from BMA. Hydrated DBM provides a scaffold that is rich in growth factors, natural architecture and interconnected porosity.

The Arthrex Angel® cPRP & BMA Processing Kits are a convenient and rapid means of concentrating the cellular contents and growth factors contained in bone marrow aspirate.
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 orthopaedic site.

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

Ordering Information

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Item Code</th>
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<tbody>
<tr>
<td>Angel System</td>
<td>ABS-10060</td>
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<tr>
<td>Angel System, Refurbished</td>
<td>ABS-10060R</td>
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<tr>
<td>Arthrex Angel® cPRP &amp; BMA Kit</td>
<td>ABS-10062 (Canada)</td>
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<tr>
<td>Arthrex Angel® cPRP &amp; BMA Tray</td>
<td>ABS-10062T</td>
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<td>Arthrex Angel® cPRP &amp; Powered BMA Kit</td>
<td>ABS-10062D</td>
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<tr>
<td>Adipose Tissue Harvesting Kit</td>
<td>ABS10055</td>
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<tr>
<td>Arrow® OnControl® Power Driver w/Cradle</td>
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<td>BioXpress™ Graft Delivery Device, 10 cm, Blunt Tip</td>
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<td>BioXpress Graft Delivery Device, 15 cm, Blunt Tip</td>
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<td>BioXpress Graft Delivery Device, 10 cm, Angled Tip</td>
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<tr>
<td>Viscous Gel, High Viscosity</td>
<td>ABS-10050</td>
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<td>Viscous Spray, Low Viscosity</td>
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<td>Viscous Spray II, Low Viscosity</td>
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<td>Fenestrated Delivery Needle</td>
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<td>Tuohy Delivery Needle</td>
<td>ABS-21000</td>
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<tr>
<td>Cannula Bending Tool</td>
<td>AR-6650</td>
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</table>

To order, please call Arthrex, Inc. at 1-800-933-7001.
Contact your local Arthrex Representative for additional information.

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 orthopaedic site.

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