ZIMMER BIOMET
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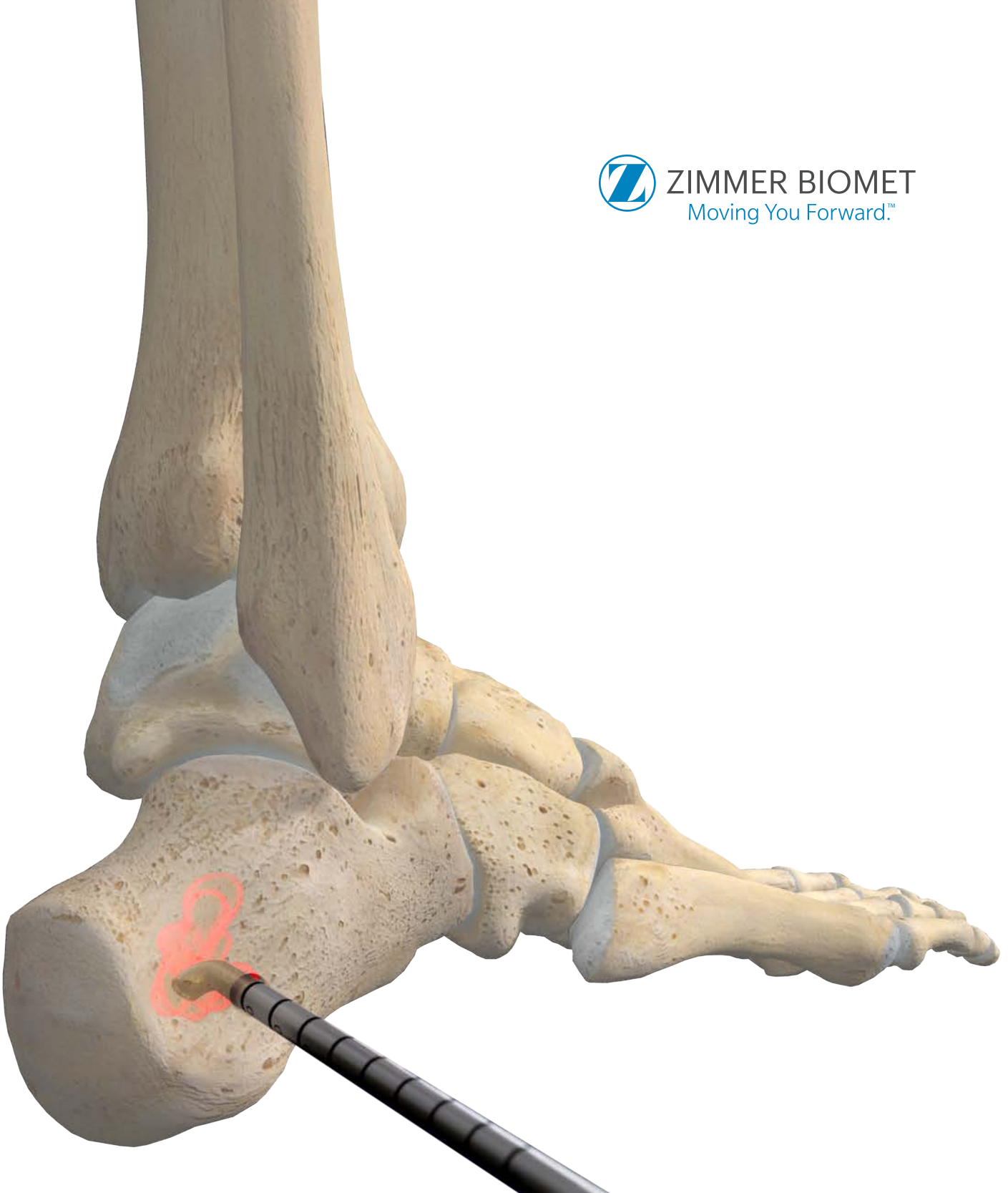


Avitus® Bone Harvester

Surgical Technique


AVITUS
BONE
HARVESTER

Table of Contents

Indications For Use

The Avitus Bone Harvester is intended:

1. To harvest cancellous bone and marrow

2. To debride and capture infected, necrotic, or diseased cancellous bone (e.g. osteomyelitis, cancellous bone tumor)

Contraindications

1. Osteoporosis, or other disorder that diminishes the quality of bone tissue.

2. Active infection in or around the donor site (unless using device to remove bone infection).

3. Bone anatomy in which the device cannot fit.

4. Previous donor site harvest.

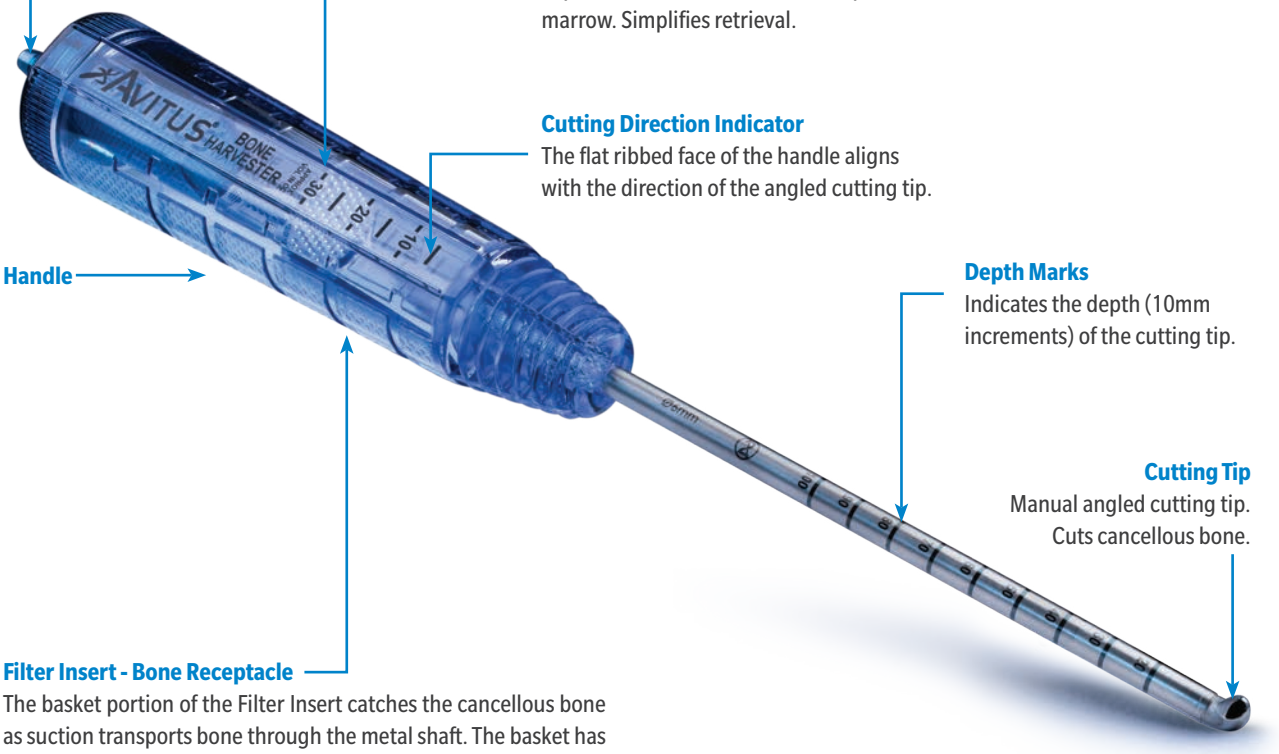
5. Patients who are not a candidate for autograft.

Summary

The Avitus Bone Harvester can be used in primary and revision orthopaedic, foot & ankle, trauma, and upper extremity procedures requiring bone graft as well as for debridement and capture of infected, necrotic, or diseased cancellous bone. Most common harvest sites include Proximal Tibia, Distal Tibia, Calcaneus, and Distal Femur. In the case of debriding and capture of infected, necrotic, or diseased cancellous bone that are minimally invasive, the use of fluoroscopy is recommended to take care not to perforate diseased state cortical bone. The Avitus Bone Harvester is available in two diameters (6 mm and 8 mm) to allow the surgeon versatility in harvest needs.

AVITUS® Bone Harvester

Features



Barbed Nozzle
Hooks to standard suction.

Filter Insert — Bone Marrow Separation
Seperates cancellous bone from liquid bone marrow. Simplifies retrieval.

Cutting Direction Indicator
The flat ribbed face of the handle aligns with the direction of the angled cutting tip.

Handle

Depth Marks
Indicates the depth (10mm increments) of the cutting tip.

Cutting Tip
Manual angled cutting tip. Cuts cancellous bone.

Filter Insert - Bone Receptacle
The basket portion of the Filter Insert catches the cancellous bone as suction transports bone through the metal shaft. The basket has a 30 cc maximum capacity until it needs to be emptied and re-inserted for more grafting (if multi-use in same procedure is needed) volume markings provide an estimation of graft volume.

Color Code	Product Code	Size	Avitus Pilot Hole Creator Pairing
Yellow	BH-110	8 mm	PC-100
Magenta	BH-220	6 mm	PC-200

NOTE: Color codes refer to product packaging color labels

AVITUS Pilot Hole Creator - System Overview

Indications For Use

The Avitus Pilot Hole Creator is an orthopaedic manual surgical instrument intended for use in surgical procedures with other devices in orthopedic surgery.

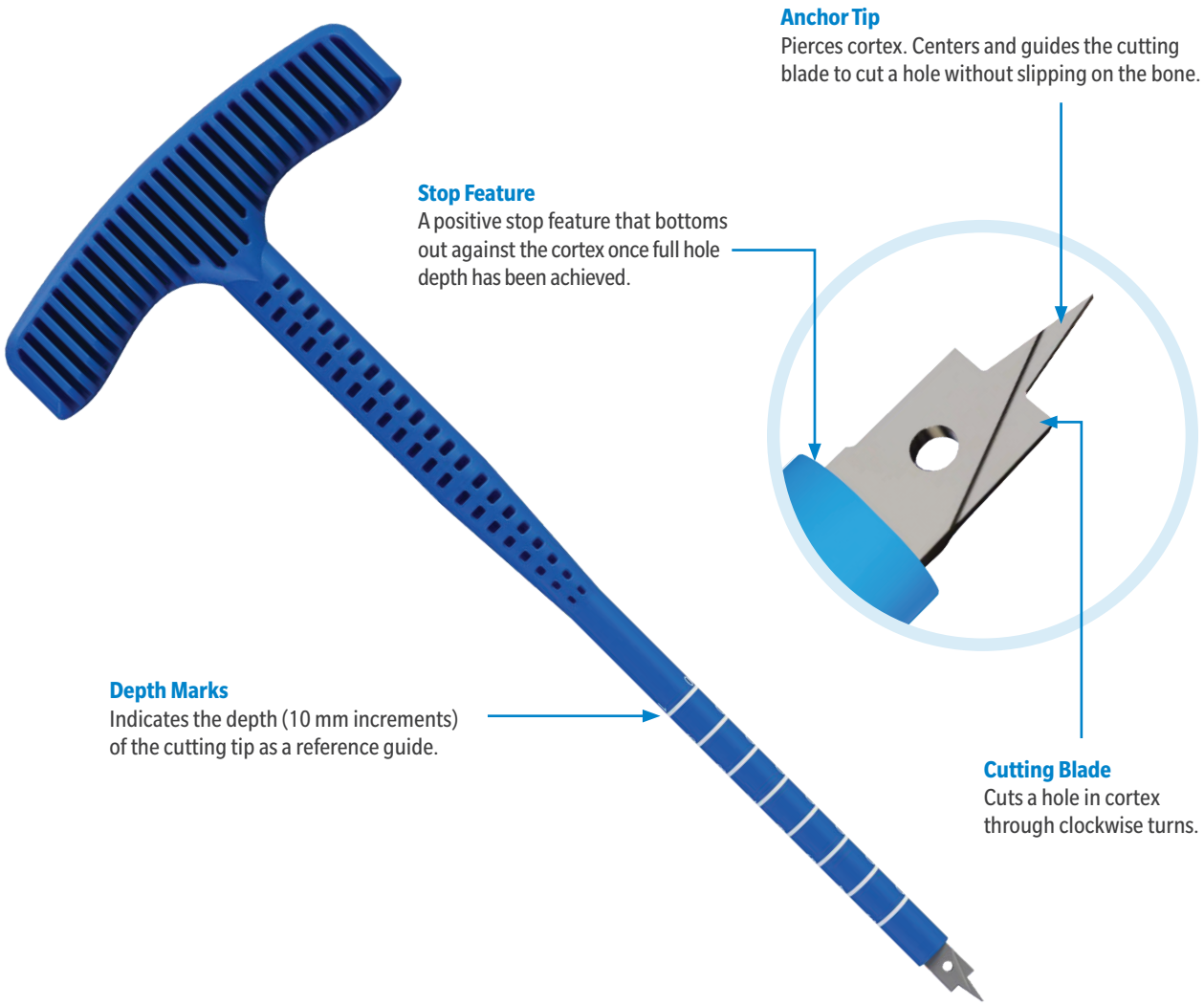
Summary

The Avitus Pilot Hole Creator is a manual surgical instrument that easily and safely breaches a hole in the cortex to expose the inner cancellous bone. The Avitus Pilot Hole Creator (single use disposable. Comes in two sizes 11 mm and 8 mm) PC-100 is used in conjunction with the BH-110. The PC-200 is used in conjunction with the BH-220.

Caution

To avoid abrasion between Pilot Hole Creator and metal retractors, take care to keep a clearance between pilot hole creator shaft and metal retractors **or** create Pilot Hole Creator prior to the use of retractors.

AVITUS Pilot Hole Creator - Features



PC-100	PC-200
Avitus Pilot Hole Creator ø11 mm x 20 mm single use, sterile Used in conjunction with BH-100	Avitus Pilot Hole Creator ø8 mm x 20 mm single use, sterile Used in conjunction with BH-200

Device Assembly

Component Breakdown

1. Cap
2. Filter Insert
3. Spatula
4. Plunger
5. Filter Insert

(Debrider is pre-assembled with Filter Insert and Cap)

Device Assembly

Insert the Filter Insert

Orientation

Hold the Filter Insert with the rectangular opening of the receptacle facing upward Similarly, hold the Harvester with the Avitus logo facing upwards.

Insertion

Insert the Filter Insert into the handle of the Harvester until the Filter Insert sits flush at the bottom of the handle.

NOTE The Filter Insert will not sit flush against the bottom of the Harvester handle if the orientation shown left is not followed.

Screw on the Cap & Attach Suction

Screw On Cap

Screw on the Cap and tighten until the flat sides of the Cap and Handle align.

Connect Suction Tube

Attach a standard suction tube (6-8 mm) to the barbed nozzle of the Cap. Ensure that the suction tube is connected to a waste canister and suction source (min 150 mmHg, max setting is recommended) Check the cutting tip of the metal shaft to confirm that suction is active.

Device Assembly

Prepare two specimen cups for collection

One cup for is needed for cancellous graft collection. And one cup for is needed for marrow collection.

General Harvesting

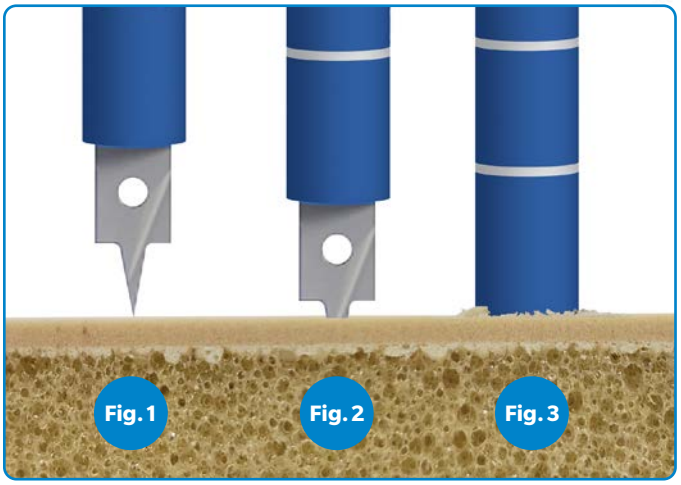
Pilot Hole Creation

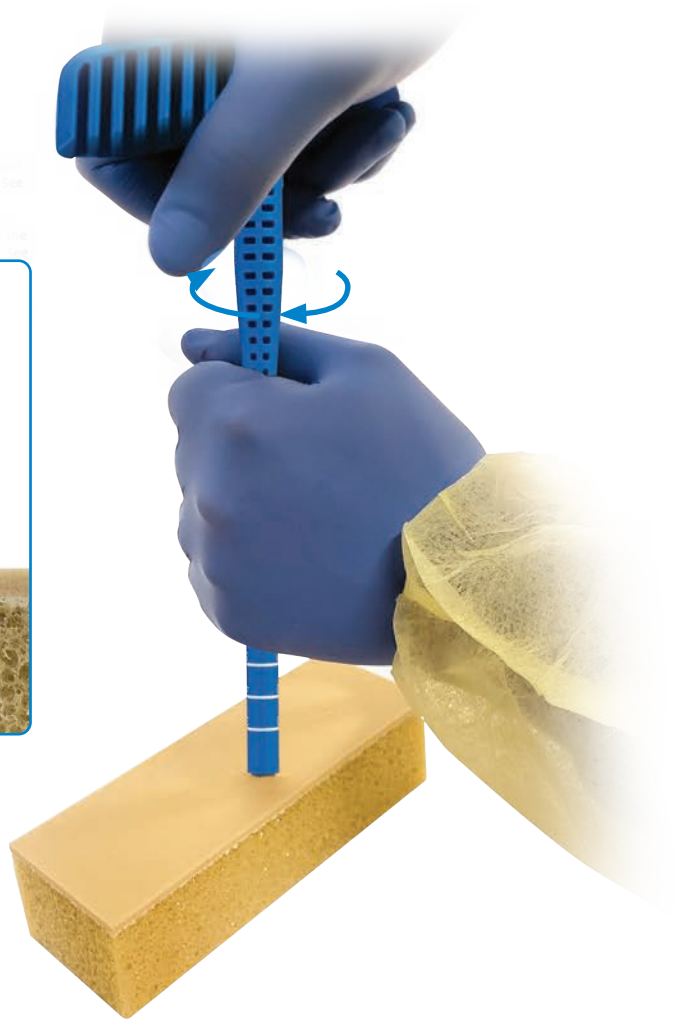
Hold the Avitus Pilot Hole Creator perpendicular to the surface of the bone (**Figure 1**).

Apply downward pressure in order to seat the Anchor Tip 3-5 mm into the cortical bone (**Figure 2**).

Continue to apply downward pressure while rotating the handle in complete 360˚ **clockwise** rotations until the Stop Feature is seated flush against the surface of the bone (**Figure 3**).

NOTE: Impaction of the handle is NOT RECOMMENDED.





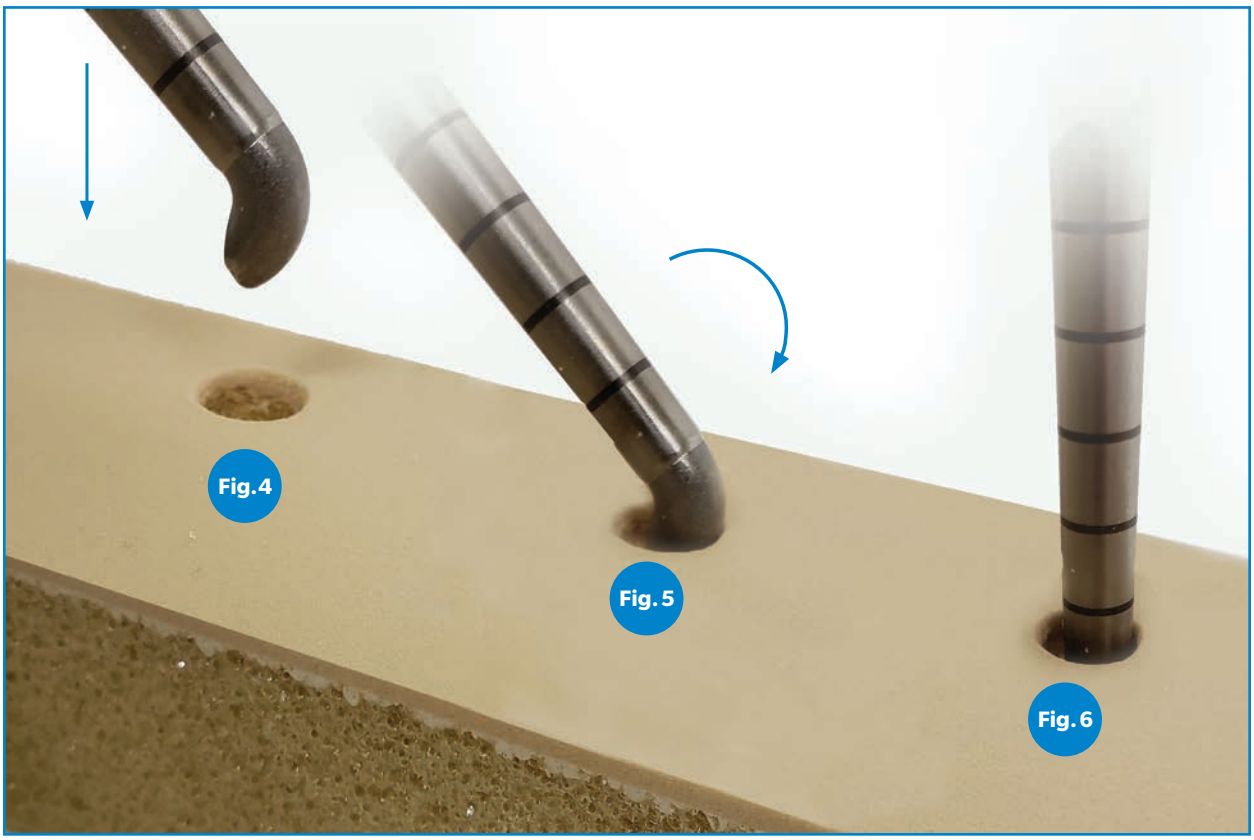
General Harvesting

Harvester Insertion

Hold the Harvester with the cutting tip facing downward towards the pilot hole (**Figure 4**).

Thread the cutting tip of the Avitus Bone Harvester into the pilot hole (**Figure 5**).

Once the cutting tip is seated in the cancellous bone, straighten the Harvester (**Figure 6**) and proceed to begin harvesting. (see Harvesting Techniques)



General Harvesting

Rotation Stroke

Tilt the handle. Apply downward pressure. Rotate the handle while maintaining the tilt. Rotate 360° alternating between clockwise and counter clockwise.

General Harvesting

Sweep Stroke

Drop the flat side of the handle down to pull the cutting tip back.

While applying downward pressure, sweep the handle across until the flat side of the handle is tilted upwards.

Repeat the Sweep Stroke 2-3 times.

Rotate 180˚ so the cutting tip faces the opposite direction. Repeat the Sweep Stroke 2-3 times.

General Harvesting

Up Stroke

Press the cutting tip into a wall of cancellous bone.

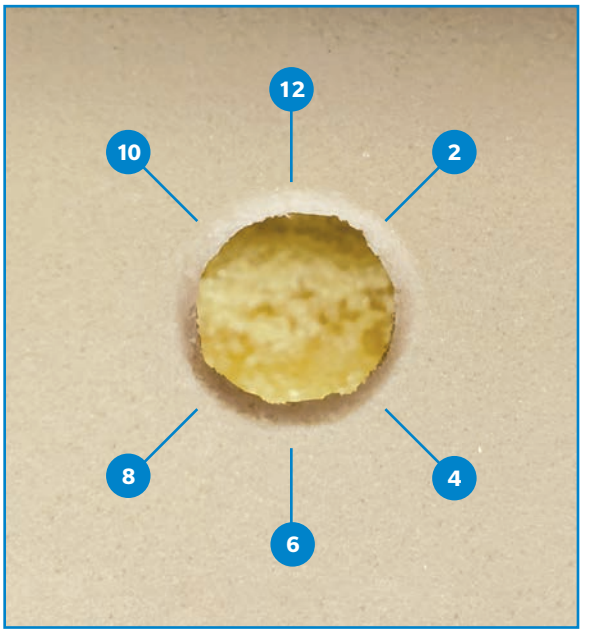
Apply an upward force away from the pilot hole to drag the cutting tip upward across the cancellous wall.

General Harvesting

Other Harvesting Tips

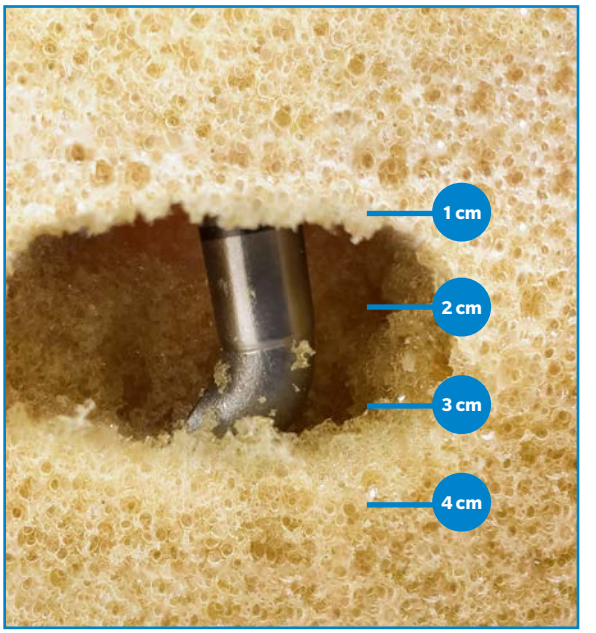
Work the Clock

Maximize your harvest volume by working the pilot hole like a clock, using the various strokes described in this section to reach pockets of graft at the 12 o'clock, 2 o'clock, etc. positions.



Work the Levels

Maximize your harvest volume by using the various strokes described in this section at various depths into the cancellous region. Use the gradation marks on the metal shaft of the Harvester to gauge the depth of the cutting tip in the cancellous region.



Estimating Graft Volume

How to Measure Cancellous Graft Volume During Harvest:

Shine the OR light onto the Bone and Marrow Harvester and an estimate of solid graft volume can be obtained from reading the volumetric lines.

When to Harvest and Perioperative Storage

It is recommended to harvest as close to time of implantation as possible to optimize graft viability. If perioperative storage of the graft is necessary, store the graft combined with the marrow or with saline solution. Avoid drying of the graft.

Jang, E. C., Lee, E. W., Kang, S. Y., & Kang, K. S. (1997). Bone cell viability after exposure to air. Journal of the Korean Orthopaedic Association, 32(6), 1464. https://doi.org/10.4055/jkoa.1997.32.6.1464 Hassanein, A. H., Greene, A. K., Arany, P. R., & Padwa, B. L. (2012). Intraoperative cooling of iliac bone graft: An experimental evaluation of cell viability. Journal of Oral and Maxillofacial Surgery, 70(7), 1633–1635. https://doi.org/10.1016/j.joms.2011.07.005

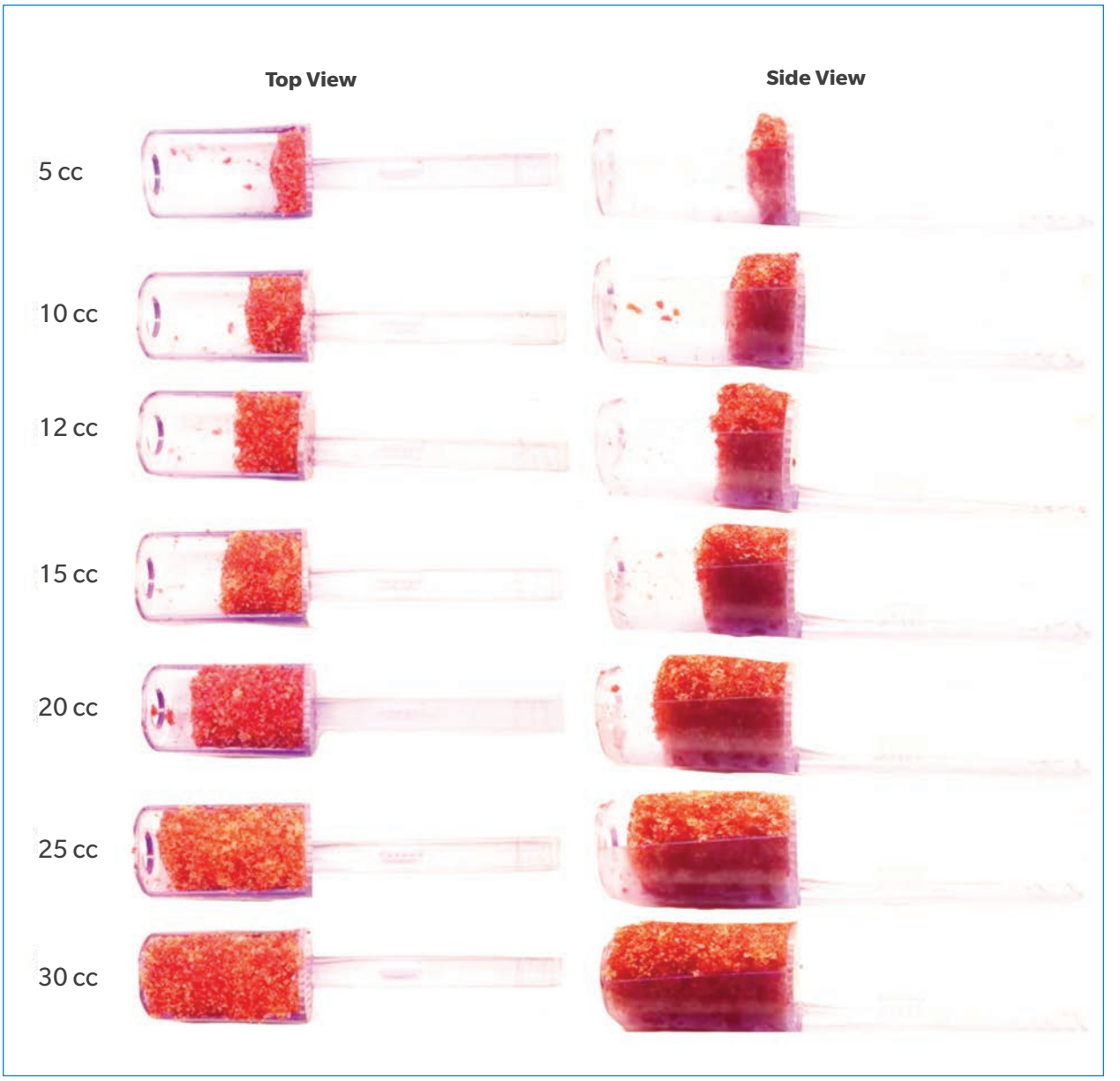
Laursen, M., Christensen, F., Bünger, C., & Lind, M. (2003). Optimal handling of fresh cancellous bone graft different peroperative storing techniques evaluated by in vitro osteoblast-like cell metabolism. Acta Orthopaedica Scandinavica, 74(4), 490–496. https://doi.org/10.1080/00016470310017848

Maus, U., Andereya, S., Gravius, S., Siebert, C. H., Schippmann, T., Ohnsorge, J. A., & Niedhart, C. (2008). How to store autologous bone graft perioperatively: An in vitro study. Archives of Orthopaedic and Trauma Surgery, 128(9), 1007–1011. https://doi.org/10.1007/s00402-008-0616-8

Rocha, F. S., Batista, J. D., Zanetta-Barbosa, D., & Dechichi, P. (2013). Effect of different storage media on the regenerative potential of autogenous bone grafts: A histomorphometrical analysis in Rabbits. Journal of Oral Implantology, 39(6), 635–642. https://doi.org/10.1563/aaid-joi-d-11-00020.

Estimating Graft Volume

When the Filter Insert is removed from the Handle of the Harvester, cancellous bone volume can be estimated in the Bone Receptacle as follows:



Technique Guide - Proximal Tibia Harvest

Harvesting Site Preparation

A **tourniquet is recommended** to minimize bleeding and to reduce bone marrow contamination and dilution. Fluoroscopy can be used to facilitate incision placement.

Location

Make a 1-2 cm vertical incision over the proximal tibia metaphyseal flare.

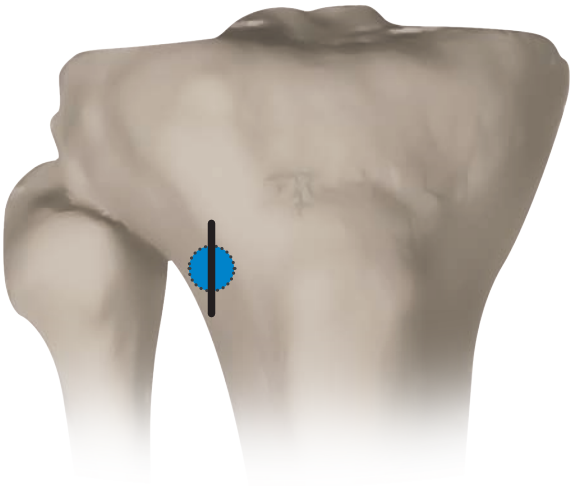
Dissection

Bluntly dissect down. **Elevate the periosteal tissue over the cortical layer of bone.** A small army navy retractor is recommended to protect surrounding tissue.

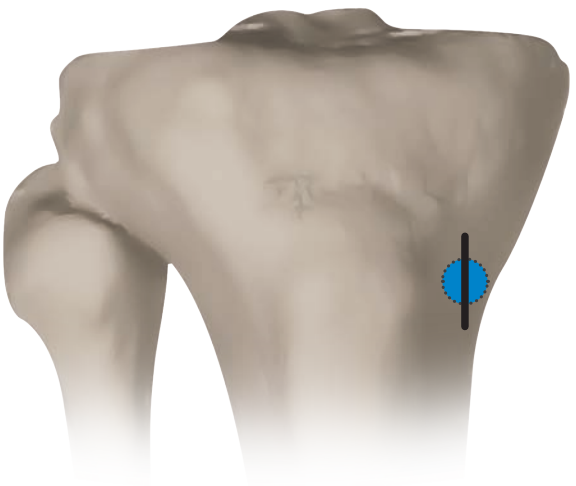
For Knee Scooters: consider lateral approach with incision placement more posteriorly to avoid pressure or discomfort during scooting. A small retractor is recommended to protect surrounding tissue and create clearance for suction. TIP: Suction should be audible during harvesting.

Entry Hole

Use the Avitus Pilot Hole Creator to cut an entry hole into the metaphyseal flare.



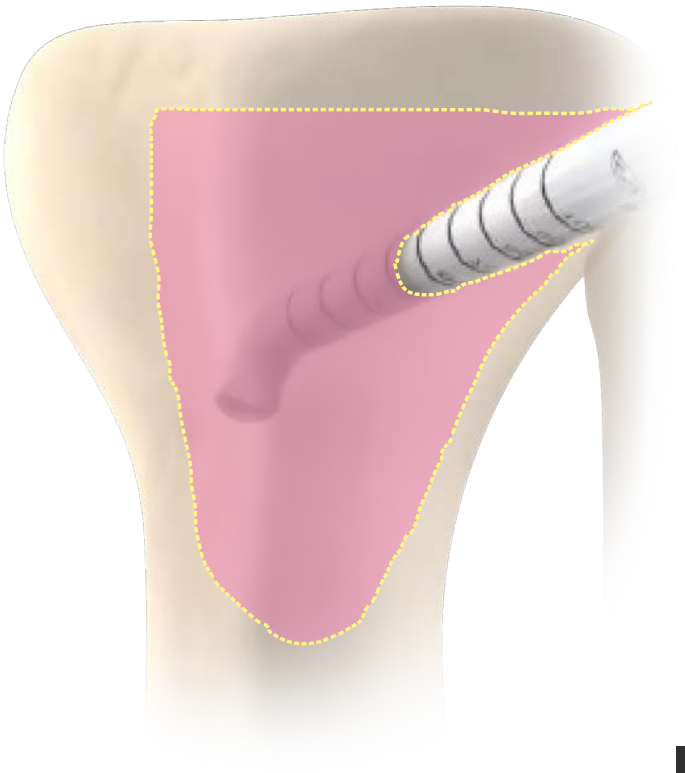
Lateral Approach: Incision is made lateral to the tibial tuberosity, in the metaphyseal flare. Care is taken to elevate muscle tissue.



Medial Approach: Incision is made at the medial aspect of the tibial tuberosity, in the metaphyseal flare. Incision should be slightly wider than Avitus Pilot Hole Creator.

Technique Guide - Proximal Tibia Harvest

Proximal Tibia Harvest Summary



Average Volumes

Cancellous Bone Range: 5-55cc's. BMA Range: 5-40cc's. Volumes depends on surgeon needs and patient anatomy.

NOTE: Either medial or lateral approach can be used. There is no difference in obtainable volume between these approaches. Medial approach provides less tissue to dissect while lateral approach provides additional tissue cushion over the entry hole post harvest.

Radiograph example of lateral proximal tibia harvest (35cc)

Technique Guide - Distal Femur Harvest

Harvesting Site Preparation

A **tourniquet is recommended** to minimize bleeding and to reduce bone marrow contamination and dilution. Fluoroscopy can be used to facilitate incision placement.

Location

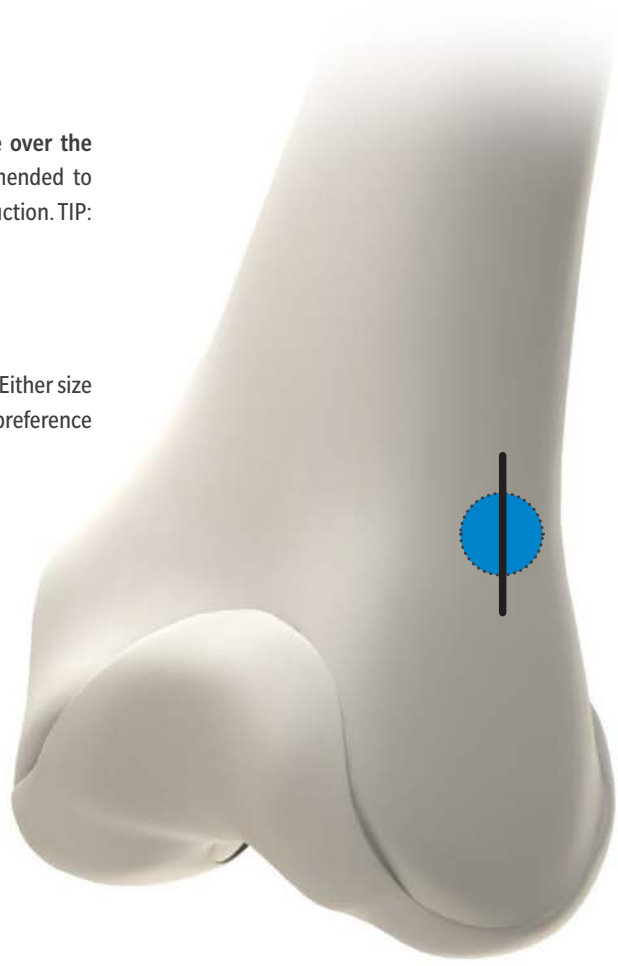
Incision and pilot hole are made into the flare of the distal femur lateral epicondyle. Incision should be slightly wider than Avitus Pilot Hole Creator (1-2 cm). Be aware of the tibiofemoral and patellofemoral joints.

Dissection

Bluntly dissect down. **Elevate the periosteal tissue over the cortical layer of bone.** A small retractor is recommended to protect surrounding tissue and create clearance for suction. TIP: Suction should be audible during harvesting.

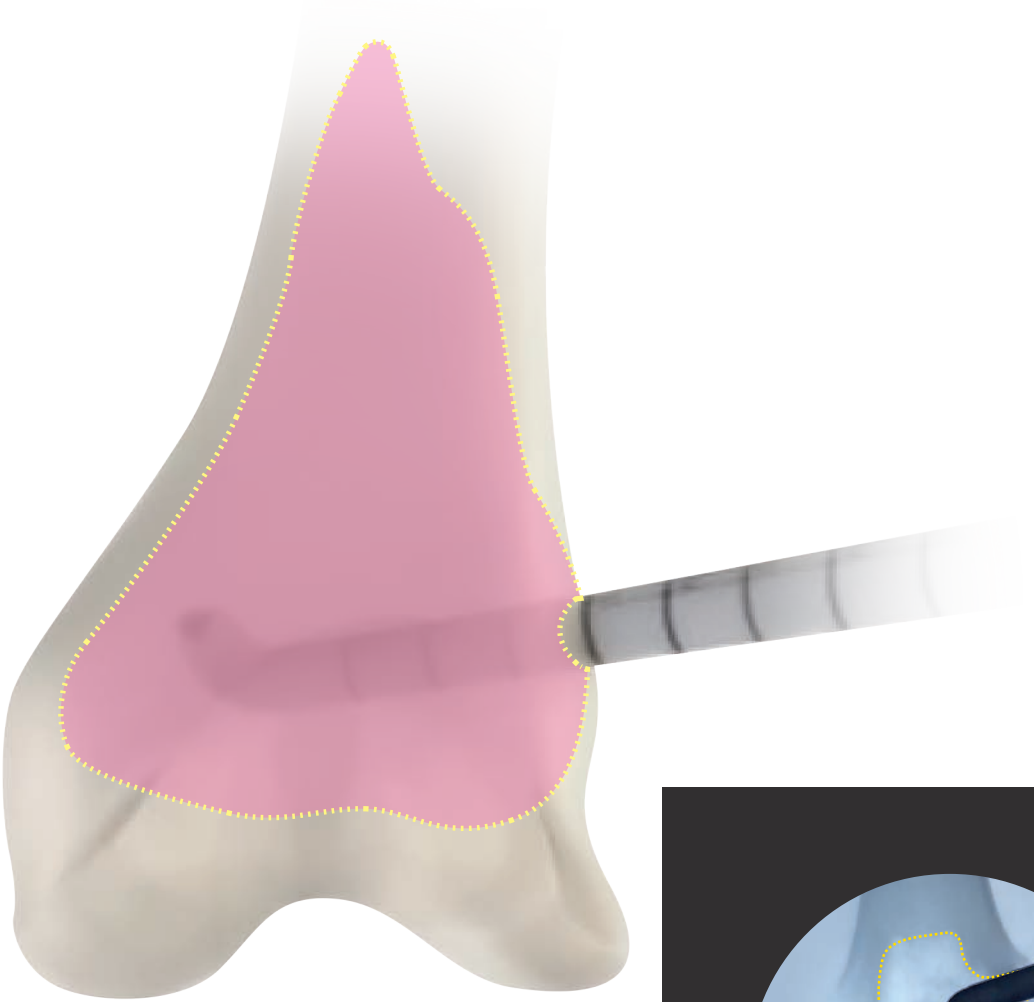
Entry Hole

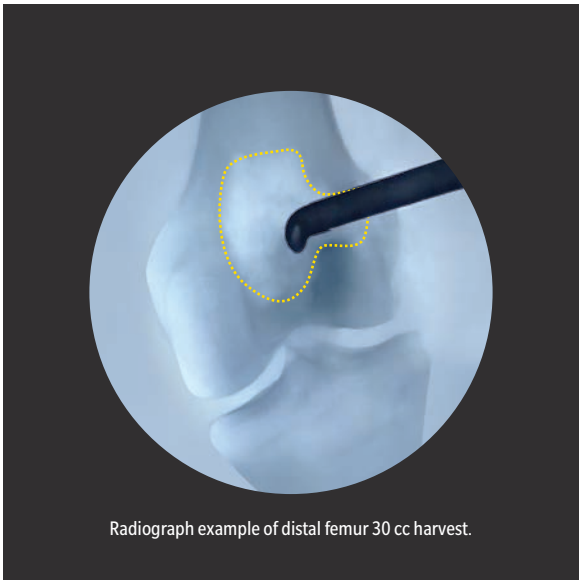
Use the Avitus Pilot Hole Creator to cut an entry hole. Either size of Avitus Pilot Hole Creator can be used per surgeon preference (PC-100, or PC-200).



Technique Guide - Distal Femur Harvest

Distal Femur Harvest Summary





Radiograph example of distal femur 30 cc harvest.

Average Volumes

Cancellous Bone Range: 5-50 ccs BMA Range: 5-20 ccs

Technique Guide - Distal Tibia Harvest

Harvesting Site Preparation

A **tourniquet is recommended** to minimize bleeding and to reduce bone marrow contamination and dilution. Fluoroscopy can be used to facilitate incision placement.

Location

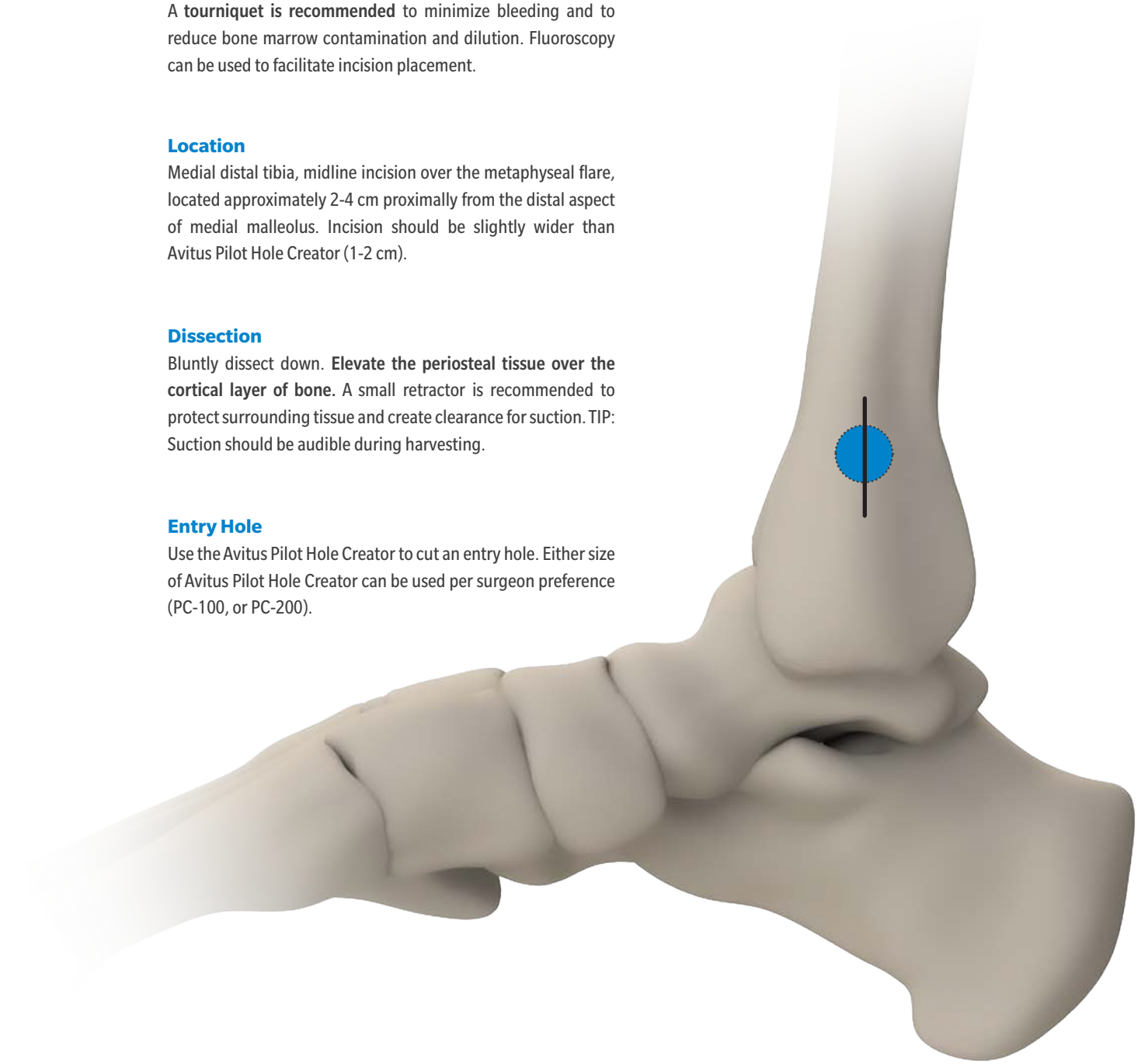
Medial distal tibia, midline incision over the metaphyseal flare, located approximately 2-4 cm proximally from the distal aspect of medial malleolus. Incision should be slightly wider than Avitus Pilot Hole Creator (1-2 cm).

Dissection

Bluntly dissect down. **Elevate the periosteal tissue over the cortical layer of bone.** A small retractor is recommended to protect surrounding tissue and create clearance for suction. TIP: Suction should be audible during harvesting.

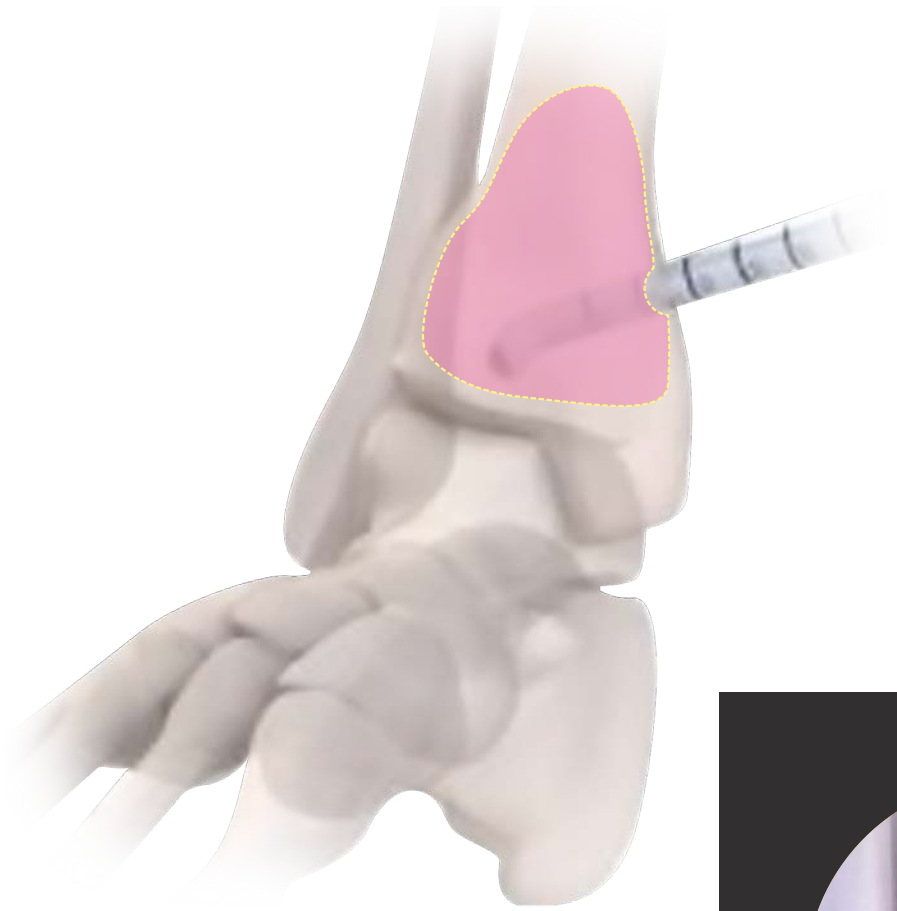
Entry Hole

Use the Avitus Pilot Hole Creator to cut an entry hole. Either size of Avitus Pilot Hole Creator can be used per surgeon preference (PC-100, or PC-200).



Technique Guide - Distal Tibia Harvest

Distal Tibia Harvest Summary



Volume Range

Cancellous Bone Range: 5-25 ccs. Volumes depends on procedural needs and patient anatomy.

Technique Guide - Calcaneus Harvest

Harvesting Site Preparation

A **tourniquet is recommended** to minimize bleeding and to reduce bone marrow contamination and dilution. Fluoroscopy can be used to facilitate incision placement.

Location

Lateral aspect of the calcaneus, posterior and inferior to the peroneal tendons and sural nerve.Incision should be slightly wider than Avitus Pilot Hole Creator (1-2cm).Incision should be parallel to the sural nerve. Care should be taken to protect the sural nerve.

Dissection

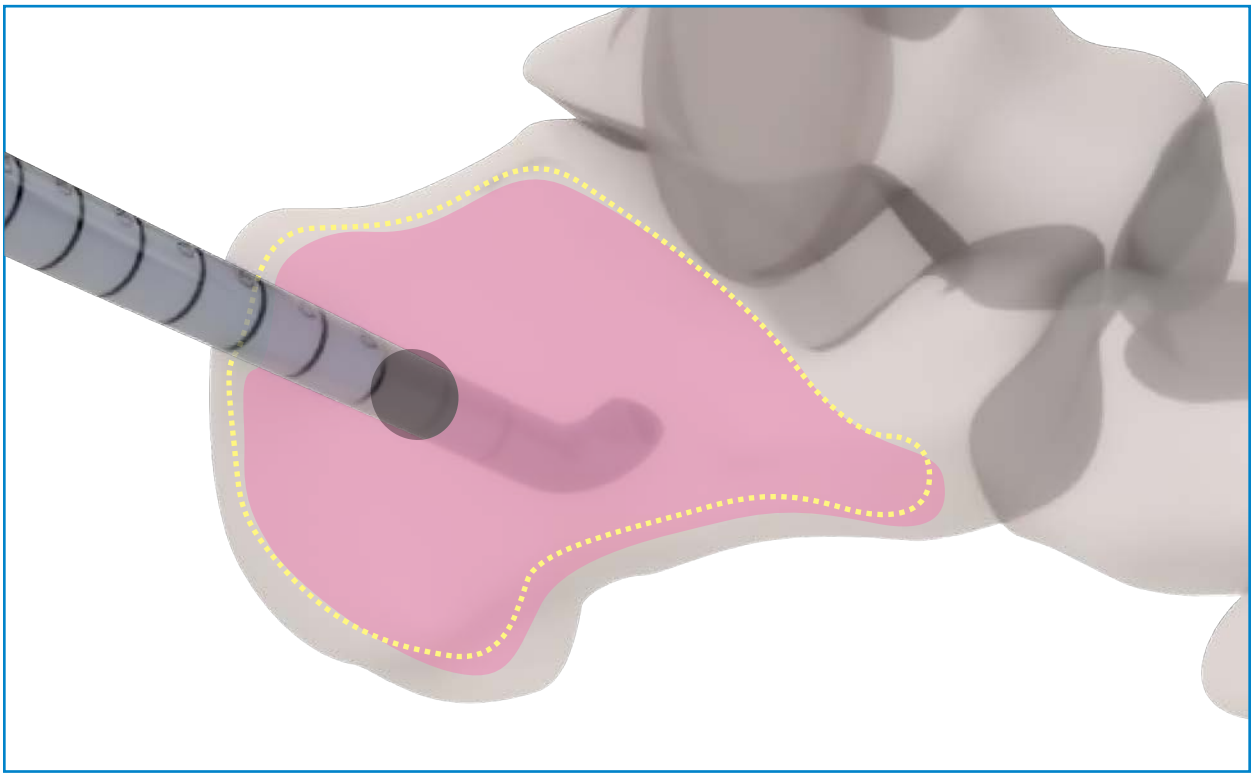
Bluntly dissect down. **Elevate the periosteal tissue over the cortical layer of bone.** A small retractor is recommended to protect surrounding tissue and create clearance for suctionsuction. TIP: Suction should be audible during harvesting.

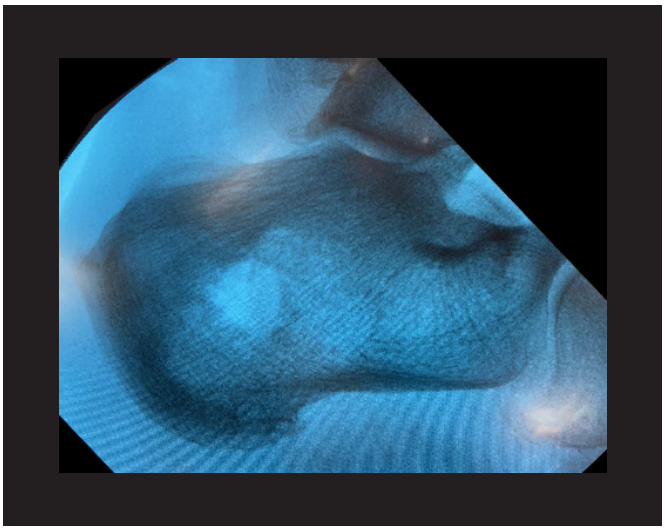
Entry Hole

Use the Avitus Pilot Hole Creator to cut an entry hole. Either size of Avitus Pilot Hole Creator can be used per surgeon preference (PC-100, or PC-200).

Technique Guide - Calcaneus Harvest

Calcaneus Harvest Summary



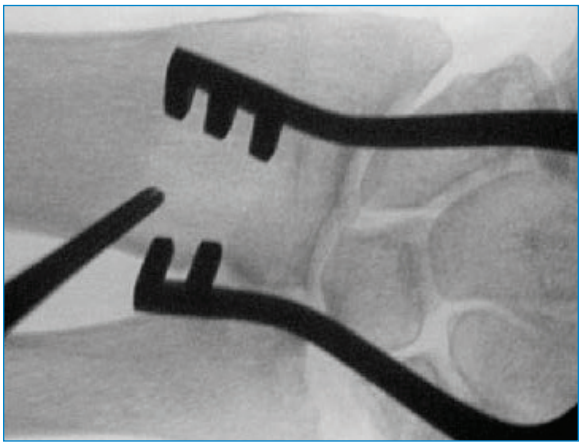


Volume Range
Cancellous Bone Range: 3 3-25CC's. BMA Range: 0-20CC's Volumes depends on procedural needs and patient anatomy.

Distal Radius Harvest – Dorsal Approach

Dissection

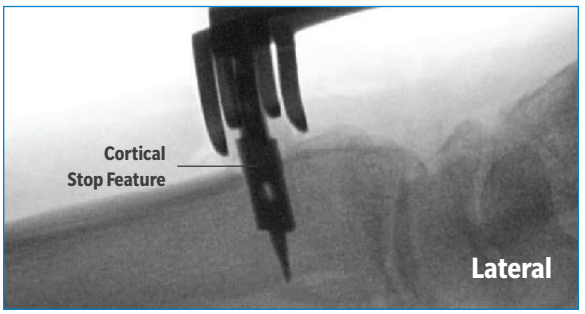
1. Tourniquet recommended 2 cm longitudinal or transverse incision is made on the dorsal aspect of the wrist centered over Lister's tubercle.
2. Subcutaneous tissue should be bluntly dissected to protect the radial and ulnar dorsal sensory nerves.
3. Identify extensor pollicis longus tendon just ulnar to Lister's tubercle incise extensor retinaculum along ulnar border of tendon.
4. Retract the extensor pollicis longus radially and the fourth dorsal compartment ulnarly to expose the dorsal radius. (may need to subperiosteally elevate 2nd/4th compartment).

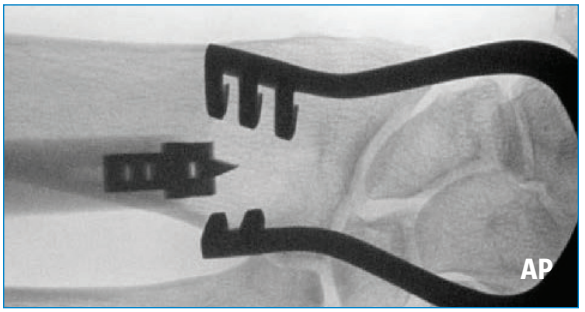


Distal Radius Harvest – Dorsal Approach

Make Pilot Hole

Gain access to the distal radius metaphysis by utilizing the Avitus Pilot Hole Creator Aim the device perpendicular to the dorsal radius overlying Lister's tubercle. Apply pressure into the cortex while rotating the handle 360 degrees clockwise, until the blade is buried in the bone. Device comes to a shoulder stop when maximum depth has been achieved (~15 mm depth). Care must be used to not penetrate the volar cortex.





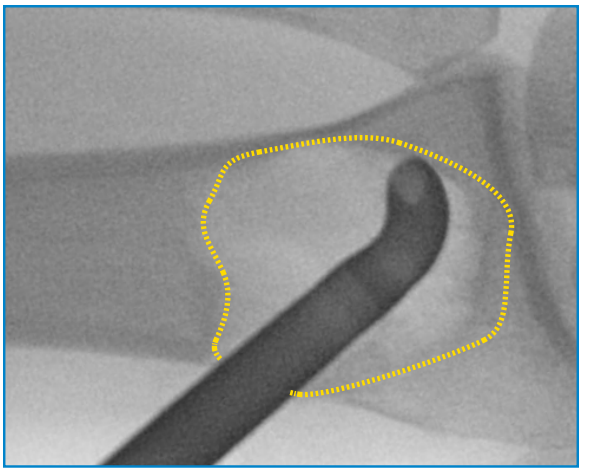
Distal Radius Harvest – Dorsal Approach

Harvest

Obtain cancellous bone graft and bone marrow by placing the Avitus Bone Harvester into the pilot hole. While applying pressure with the cutting tip, execute a series of scrapes, cuts, and scoops. One hand on the metal shaft with one hand on the plastic handle will stabilize the device while collecting bone. Explore all directions to maximize harvest Fluoroscopic guidance can be used to identify pockets of available cancellous graft Harvest until desired volume is obtained.

Have assistant hold the arm to stabilize the harvest site during harvest.

Care must be used as to not violate the distal radius articular cartilage.



Distal Radius Harvest – Dorsal Approach

Retrieve Graft & Closure

Once desired volume is obtained, remove Bone and Marrow Harvester and retrieve collected graft.

Irrigate the wound. At surgeon's discretion, back fill the metaphyseal void.

Repair the extensor retinaculum with the extensor pollicis longus subcutaneously transposed.

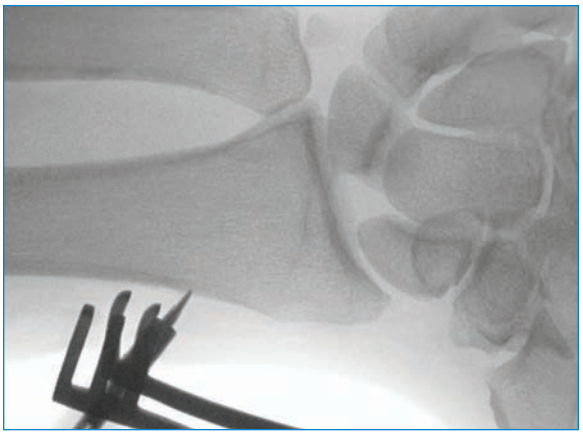
Close skin in standard fashion.

12cc shown harvested from a cadaver

Distal Radius Harvest – Radial Approach

Dissection

1. Tourniquet recommended. Starting 3 cm proximal to the radial styloid, make a 2 cm longitudinal incision.
2. Bluntly dissect the subcutaneous tissue and protect any branches of the superficial radial nerve.
3. Deep exposure should be proximal to the first dorsal compartment If needed, the first dorsal compartment can be released.
4. Retract the abductor pollicis longus and extensor pollicis brevis dorsally to expose the radial cortex.
5. Incise the periosteum longitudinally.

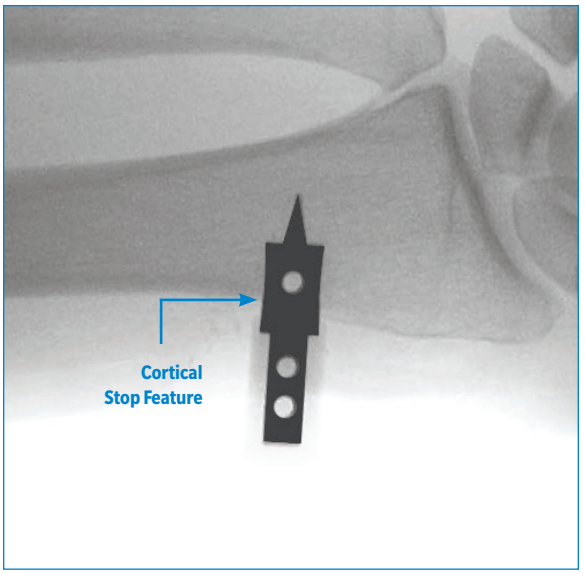


Distal Radius Harvest – Radial Approach

Make Pilot Hole

Gain access to the distal radius metaphysis by utilizing the Avitus Pilot Hole Creator perpendicular to the radial column.

Apply pressure into the cortex while rotating the handle 360 degrees clockwise, until the blade is buried in the bone. Device comes to a shoulder stop when maximum depth (~15 mm) has been achieved.

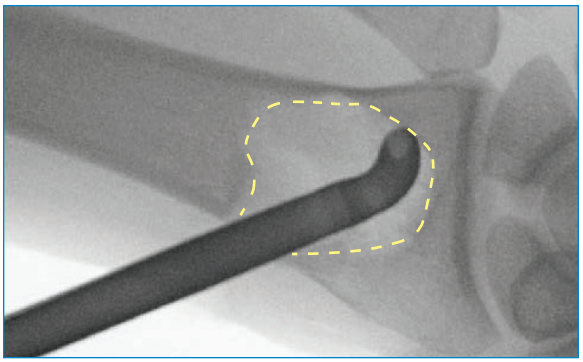


10cc shown harvested from a cadaver

Distal Radius Harvest – Radial Approach

Harvest

Obtain cancellous bone graft and Bone Harvester by placing the Avitus Bone Harvester into the pilot hole. While applying pressure with the cutting tip, execute a series of scrapes, cuts, and scoops. One hand on the metal shaft with one hand on the plastic handle will stabilize the device while collecting bone. Explore all directions to maximize harvest. Care must be used as to not violate the distal radius articular cartilage. Fluoroscopic guidance can be used to identify pockets of available cancellous graft. Harvest until desired volume is obtained.



Have an assistant stabilize the limb during harvest.

Distal Radius Harvest – Radial Approach

Retrieve Graft & Closure

Once desired volume is obtained, remove harvester and retrieve collected graft.

Irrigate the wound. At surgeon's discretion, back fill themetaphyseal void.

If the periosteum is robust enough, then repair over the graft harvest site.

Close skin in standard fashion.

10cc shown harvested from a cadaver

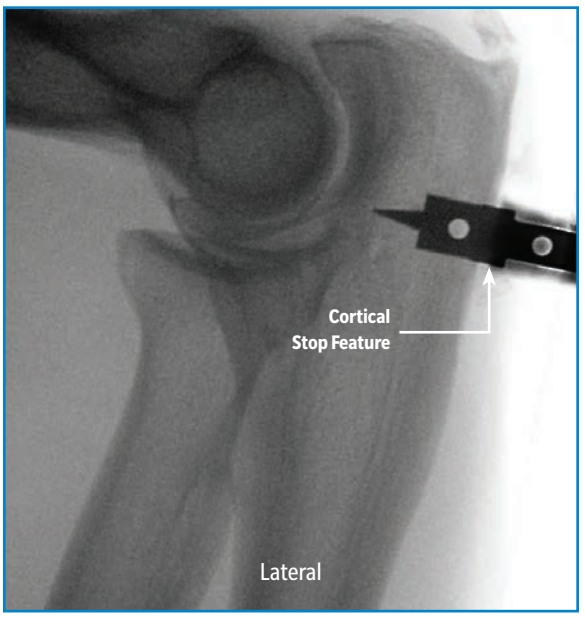
Olecranon (Proximal Ulna) Harvest – Posterior Approach

Dissection

1. Tourniquet recommended Starting 2 cm distal to the tip of the olecranon, make a 2 cm longitudinal incision through skin.
2. Bluntly elevate the subcutaneous tissue and identify the underlying fascia.
3. Incise the fascia longitudinally followed by the underlying periosteum as a separate layer.

Make Pilot Hole

Gain access to the proximal ulna metaphysis by utilizing the Avitus Pilot Hole Creator perpendicular to the ulna. Apply pressure into the cortex while rotating the handle 360 degrees clockwise, until the blade is buried in the bone. Device comes to a shoulder stop when maximum depth (~15 mm) has been achieved. Care must be used to not penetrate the articular cartilage.



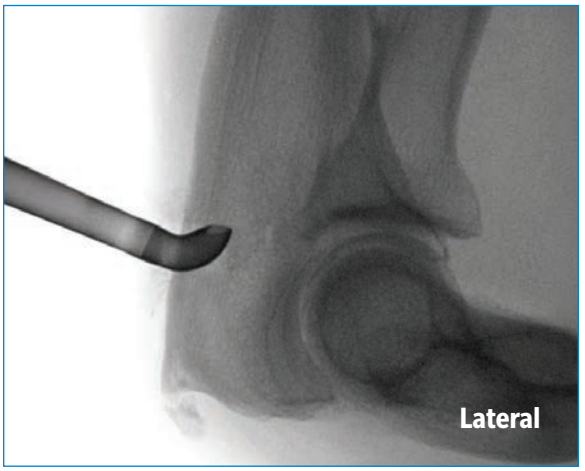
Olecranon (Proximal Ulna) Harvest – Posterior Approach

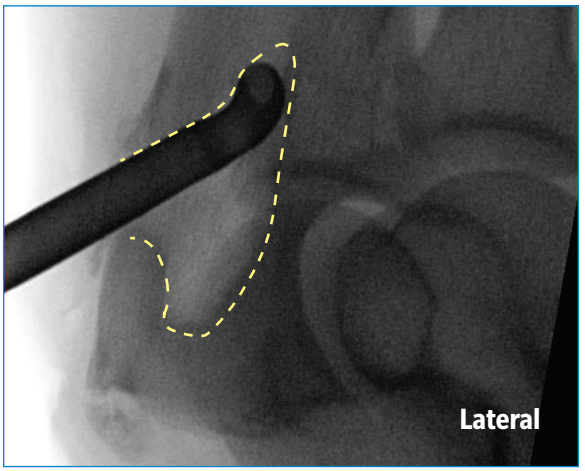
Harvest

Obtain cancellous bone graft and bone marrow by placing the Avitus Bone Harvester into the pilot hole. While applying pressure with the cutting tip, execute a series of scrapes, cuts, and scoops. One hand on the metal shaft with one hand on the plastic handle will stabilize the device while collecting bone. Explore all directions to maximize harvest. Care must be used as to not violate the articular cartilage.

Fluoroscopic guidance can be used to identify pockets of available cancellous graft. Harvest until desired volume is obtained.

Have an assistant stabilize the limb during harvest.





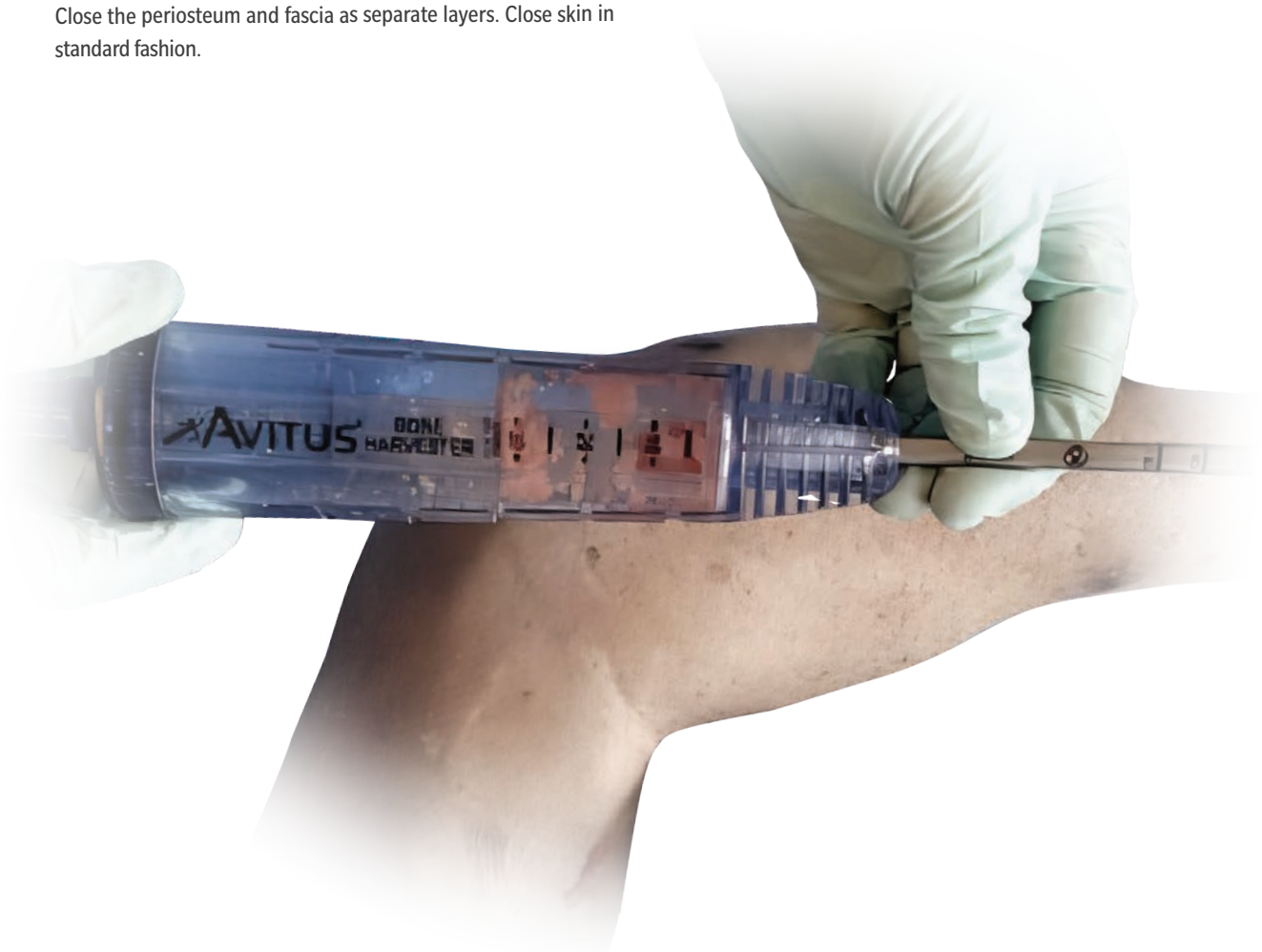
Olecranon (Proximal Ulna) Harvest – Posterior Approach

Retrieve Graft & Closure

Once desired volume is obtained, remove harvester and retrieve collected graft.

Irrigate the wound. At surgeon's discretion, back fill the metaphyseal void.

Close the periosteum and fascia as separate layers. Close skin in standard fashion.



10cc shown harvested from a cadaver

Harvest Site Closure

Closure Preparation and Considerations

- Saline flush the harvest site prior to closure
- Backfill may be used per surgeon preference Gel foam may be used to pack the harvest site for hemostasis See below section for backfilling considerations
- Close periosteum over pilot entry hole Proceed to close in layers
- Standard bulk compressive dressing. Consider extra padding at the proximal tibia harvest site if patient will be using a scooter
- Literature suggests 6 weeks non weight bearing status at the harvest site

Example of harvest site incision closed in layers. Pictured is an incision made for a medial approach proximal tibia harvest.

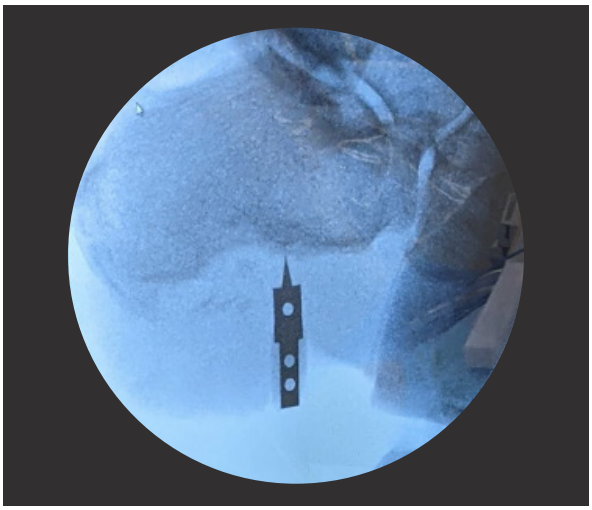
Backfilling Considerations

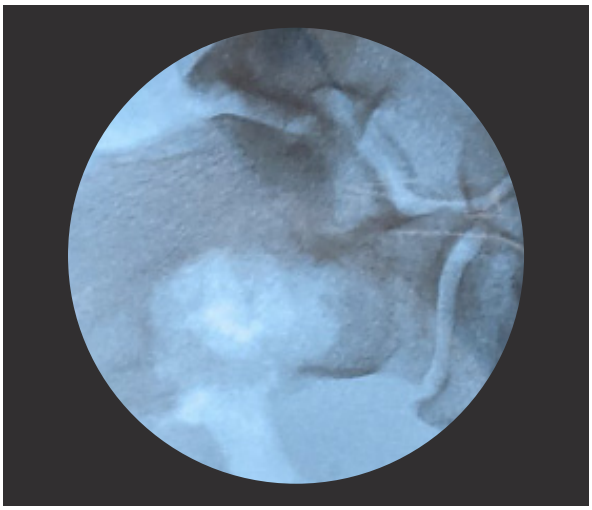
Clinical Scenario	Backfilling
Patient is otherwise healthy	No backfill coupled with layered closure is mostcommon. Gel foam with or without thrombin can be used for additional hemostasis.
Patient has many comorbidities, osteopenic or a compliance concern	Structural backfill products such as allograft chips or bone void fillers can be considered coupled with layered closure.
Patient needs to be immediately weightbearing	Structural backfill products such as allograft chips or bone void fillers can be considered. Generally, bone harvests of 5cc or less do not receive backfilling.

Bone Infection / Bone Tumor Debridement

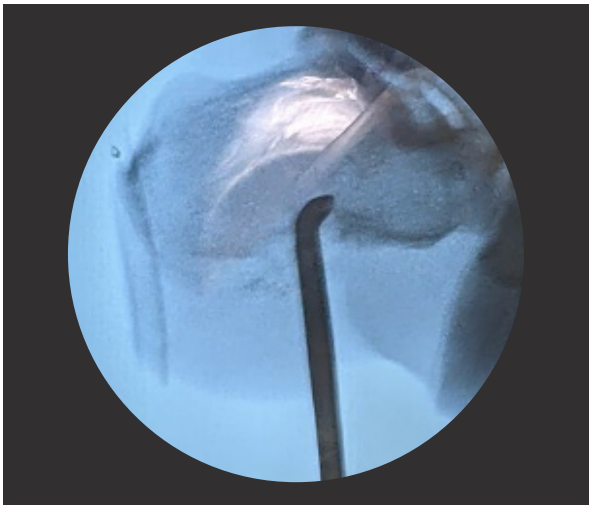
1. Set suction to high
2. Irrigation can be used in conjunction with Avitus Debridement if desired
3. The use of fluoroscopy is recommended to visualize diseased bone area for debridement

NOTE: During infected bone debridement, possible excess capture of coagulated blood or soft tissue can fill up the canister. If canister fills, simply empty the contents. Make sure to clean off the filter cap of all excess soft tissue prior to reassembly.





Example: Calcaneus osteomyelitis debridement with Avitus



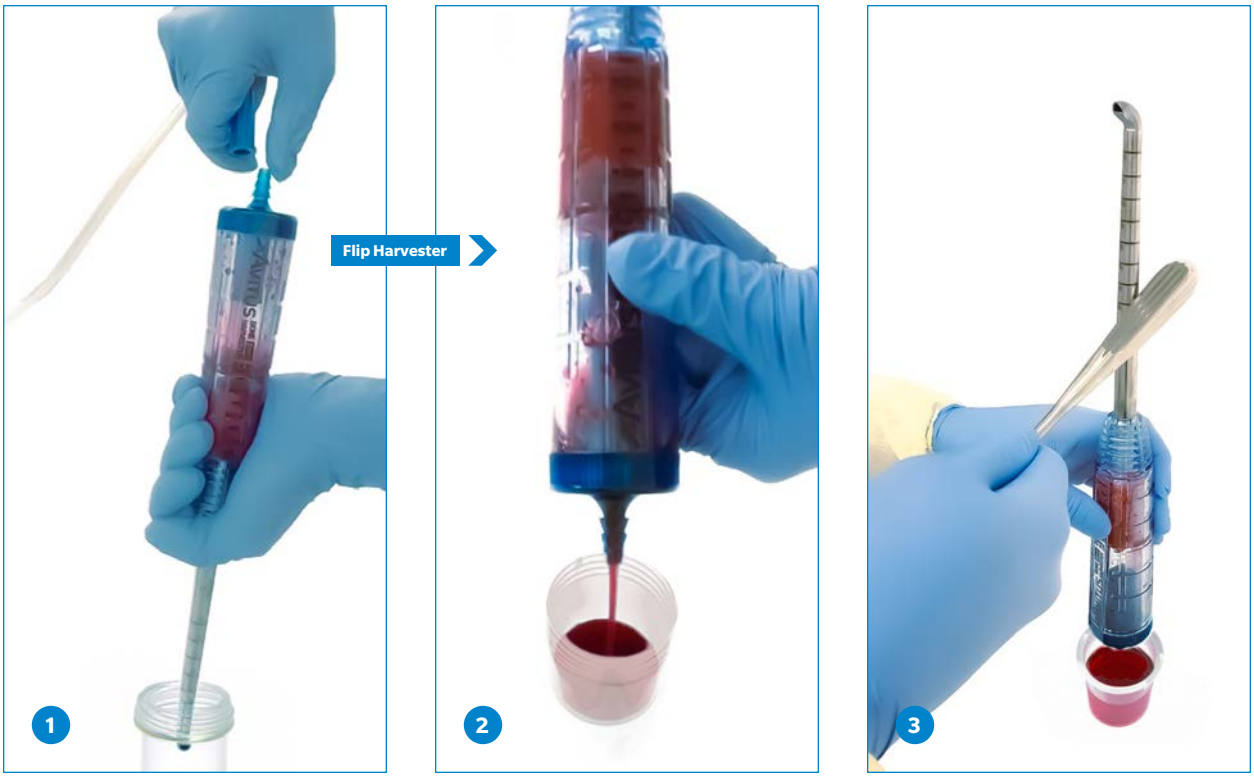
Graft & Marrow Retrieval

Drain Marrow and Clear Metal Shaft

Hold Harvester Upright Prior to Removing Suction

Take effort to keep the Barbed Nozzle of the Cap upright while active suction tubing is connected

NOTE: Tipping the Harvester upside down (i e barbed nozzle facing down) **while connected to active suction tubing** will lose liquid marrow from the Handle and not allow user to collect liquid marrow contents



Remove Suction Tube

Disconnect the suction tube and immediately flip the device to have the barbed nozzle pointing into a collection/specimen cup.

NOTE: Prior to disconnecting the suction tube, keep the Cutting Tip over the specimen cup to catch any contents that may escape the cutting tip prior to flipping the device.

Drain Liquid Marrow

Flip Harvester. Allow 10 to 15 seconds for the liquid marrow to drain out the Barbed Nozzle of the Cap.

Clear Metal Shaft

While the liquid marrow drains, tap the side of the metal shaft of the Harvester with a heavy metal object (e.g. osteotome handle) to dislodge any cancellous graft from the metal shaft into the Filter Insert Bone Receptacle.

Graft & Marrow Retrieval

Remove the Cap

Hold the Harvester horizontally over the Specimen Cup and unscrew the Cap. Slightly tilt the handle to allow any remaining liquid to pour out.

NOTE: Take care to stop the Filter Insert from sliding out of the handle at this point.

Remove the Filter Insert

Ensure that the handle is held horizontally with the logo facing upwards. Carefully remove the Filter Insert.

NOTE: If the logo is not facing upwards, the cancellous graft will fall out of the Filter Insert as it is removed from the handle.

Graft & Marrow Retrieval

Retrieve Cancellous Bone from the Filter Insert Receptacle

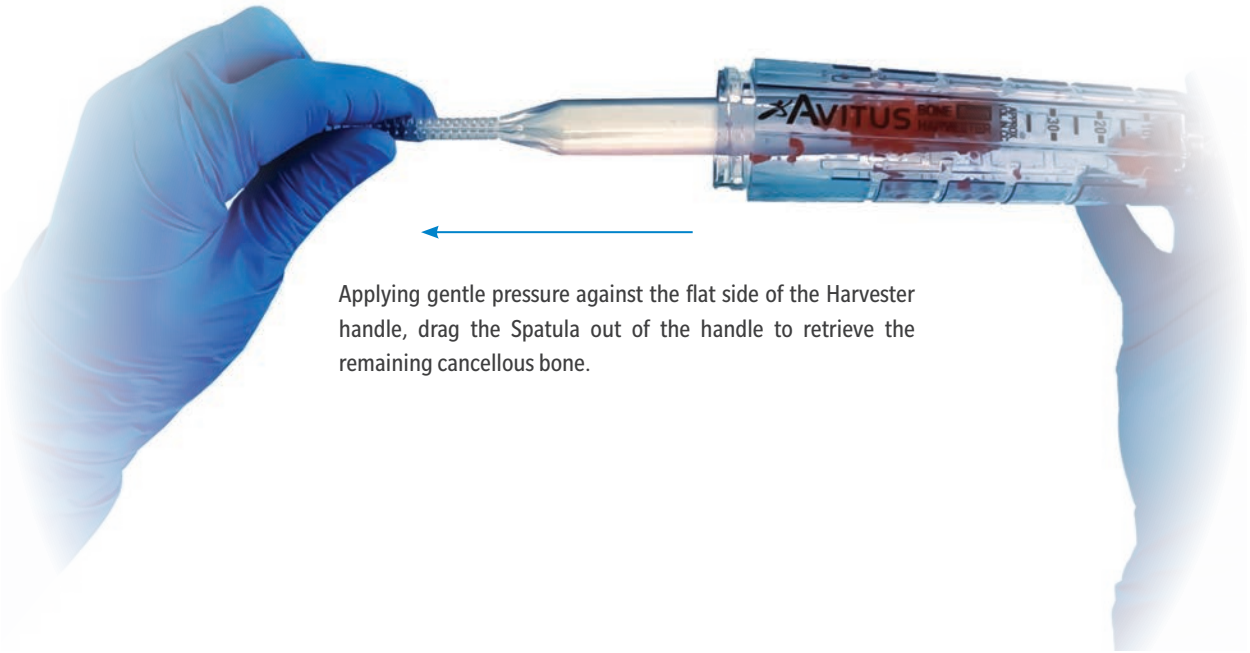
Use the rounded end of the Plunger accessory (included) to remove the cancellous graft from the Filter Insert receptacle into a specimen cup. Take care to retrieve every chunk.

Graft & Marrow Retrieval

Retrieve Remaining Cancellous Bone from the Harvester Handle

Use the Spatula accessory (included) to remove any remaining cancellous graft from the Harvester handle.

Insert the Spatula into the Harvester handle and press gently against the wall while rotating the Harvester handle to scrape any remaining cancellous graft into the Spatula.



Applying gentle pressure against the flat side of the Harvester handle, drag the Spatula out of the handle to retrieve the remaining cancellous bone.

Troubleshooting

De-clogging

If the cutting tip of the Harvester gets clogged with cancellous bone, follow these steps:

1. Confirm that the suction tube forms an air-tight connection with the barbed nozzle and that the suction source is powered on high.

2. Perform several additional cutting strokes to unclog the Harvester. If the cutting tip is still clogged, use the Plunger accessory.

3. Holding the Plunger by the thumb holder, hook the L of the Plunger into the Harvester opening and follow the curve to unclog and resume harvesting.

Ordering Information

Harvesting

Avitus Bone Harvester

Sterile, disposable surgical instrument for large volume cancellous bone and marrow harvesting with marrow separation insert. Collect 5, 50 ccs of cancellous bone + bone marrow aspirate.

Part #	Size
BH-220	6 mm
BH-110	8 mm

Cortical Entry

Avitus Pilot Hole Creator

Sterile, disposable surgical instrument for creating a pilot hole.

Part #	Size
PC-200	ø8 mm x 20 mm Used with: BH-220
PC-100	ø11 mm x 20 mm Used with: BH-110

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Legal Manufacturer
Biomet Orthopedics
56 East Bell Drive
PO Box 587
Warsaw, IN 46581
www.zimmerbiomet.com

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