Fabrication of the Plastic in Leather AFO

Delphi Ortho

Description

Leather AFO gauntlet with internal plastic stiffener

Called by many names, the Baldwin Boot & Arizona AFO among them, this type of AFO is a marriage of part ankle gauntlet and part plastic orthosis. It gives the wearer the total contact benefits of a leather gauntlet combined with the rigidity of a conventional thermoplastic orthosis. The instructions contained herein are for the fabrication of this device without going through the time consuming hassle of using wet molding leather which often takes days to dry. If you're in a hurry to fit one of these popular AFO types, this might be a method for you. All methods used in this process are subject to change depending on the desired outcome for you and your patient.

Delphi Ortho

Indications

- ✓ Ankle arthritis or DJD (Degenerative Joint Disease)
- ✓ Paralytic equinus or drop foot
- ✓ Ankle, subtalar or midtarsal trauma
- ✓ PTTD (Posterior Tibial Tendon Dysfunction)
- ✓ Charcot foot
- ✓ Severe pronation or pes planus
- ✓ Chronic Achilles tendonitis
- ✓ Chronic ankle sprains
- ✓ Support for the obese patient
- ✓ Talocalcaneal vargus or valgus
- ✓ Increased stability for varum or valgum at the knee
- ✓ Tibialis tendonitis (posterior or anterior)

These are the primary clinical uses for a plastic in leather AFO.

Casting procedure

- ✓ **Cast just like an AFO cast**
  - ✓ **At least as high as Head of Fibula**
  - ✓ **On casting board of desired heel height**
  - ✓ **90 degrees at ankle**
- ✓ **Full circumference cast**
- ✓ **Beyond end of toes**

Casting for this type of AFO is virtually the same as casting for a standard AFO; cast a little higher than you'd like the orthosis to be, cast as close to 90 degrees as the patient can get and cast on a heel height board that represents the anticipated heel height of the patients shoes. One special criteria is that this AFO will go the full circumference around the limb and an intimate cast should be strived for.

Design criteria

- ✓ **Height**
  - ✓ **Typically about 4-6” above malleoli**
  - ✓ **Sometimes as high as standard AFO (1” below fib. head)**
- ✓ **Footplate**
  - ✓ **Typically met head trims**
  - ✓ **Full footplate**
  - ✓ **Toe fillers**
  - ✓ **Foam UCB inserts**
- ✓ **Articulated**
- ✓ **Weight bearing**

As with most orthoses, there are many different ways to design and construct this type of brace. They can be made of standard height or extended higher for more control. Footplate trims can vary widely too and also incorporate either toe fillers for Symes amputations or UCB inserts for the treatment of any number of pedorthic ailments. With the addition of ankle joints they can become articulated for more normal movement, if the diagnosis allows. And by using various modification techniques and materials we can un-weight the ankle for a very adaptable design.

Design criteria

- ✓ **Rigidity**
  - ✓ **Solid ankle style plastic stiffener**
  - ✓ **“Ritchie” style plastic stiffener**
- ✓ **Materials**
  - ✓ **Leather type & thickness**
  - ✓ **Plastic type & thickness**
- ✓ **Closures**
  - ✓ **Lacers**
  - ✓ **Velcro**
  - ✓ **Speed hooks**

The plastic stiffener which is the hallmark of the plastic in leather AFO can be manufactured for various levels of control. It can be made full and offer maximum control or it can be designed with an open Achilles tendon area using medial and lateral struts for more flexibility. In the same way, you can select materials of varying thicknesses and densities to fine tune the amount of control you desire. And with numerous closure options you can address any range of patients hand dexterity.

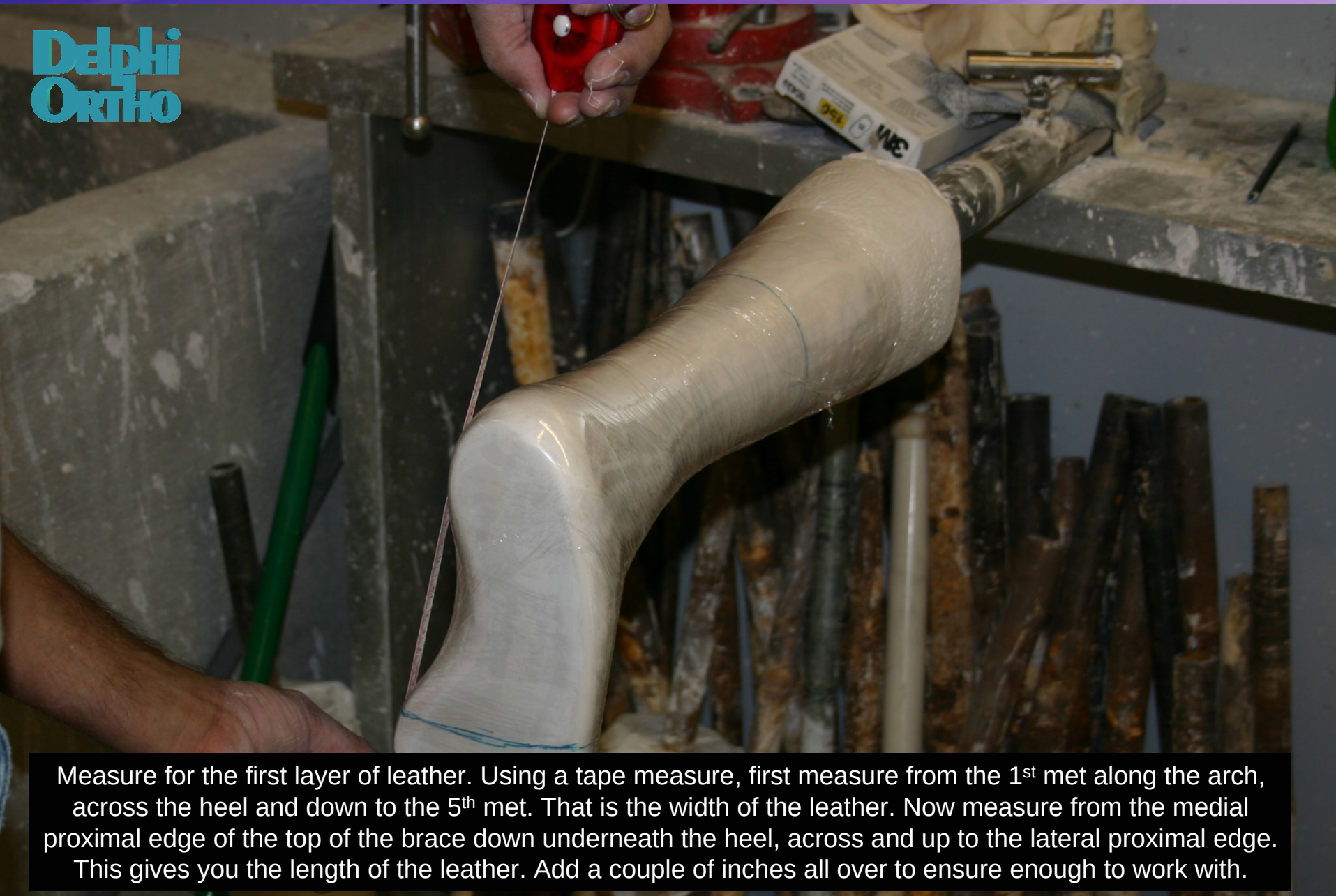
Fabrication

Modify the mold in full circumference. Remove any lumps and dips for a cosmetic appearance. Build up all boney prominences paying special attention to the malleoli, navicular, cuboid and 1st & 5th metatarsals. Do not add a proximal flair. Smooth up the mold much as you would do for the average solid ankle AFO. Extend the toe section of the footplate to full length if the design requires it.

Fabrication

Cover the entire mold with plastic wrap, like Saran Wrap or similar, to protect the leather from it. Because of the narrower width of packing wrap it is usually easier to use. Check at any office supply store for this narrow width plastic wrap.

Fabrication

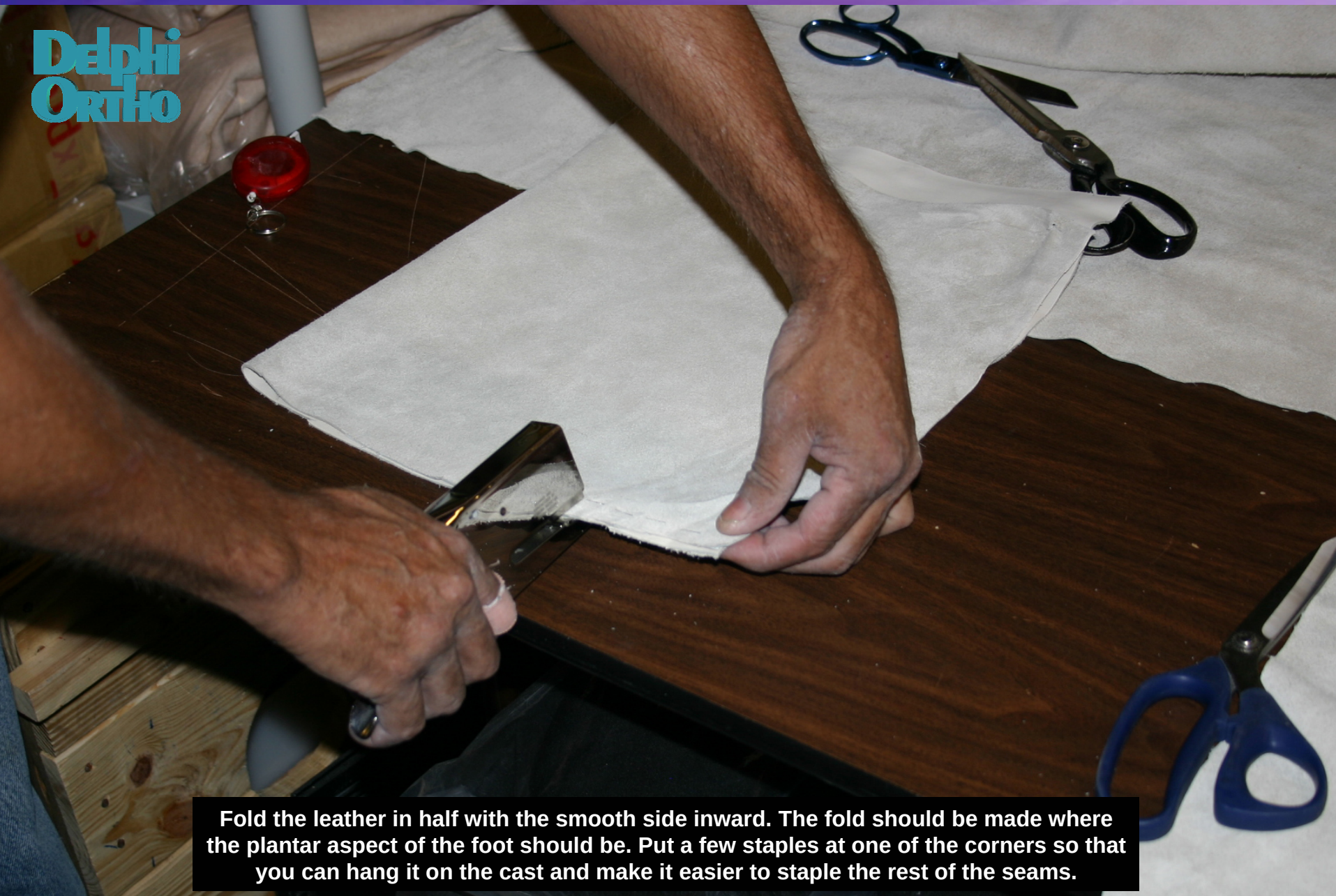


Measure for the first layer of leather. Using a tape measure, first measure from the 1st met along the arch, across the heel and down to the 5th met. That is the width of the leather. Now measure from the medial proximal edge of the top of the brace down underneath the heel, across and up to the lateral proximal edge. This gives you the length of the leather. Add a couple of inches all over to ensure enough to work with.

Fabrication

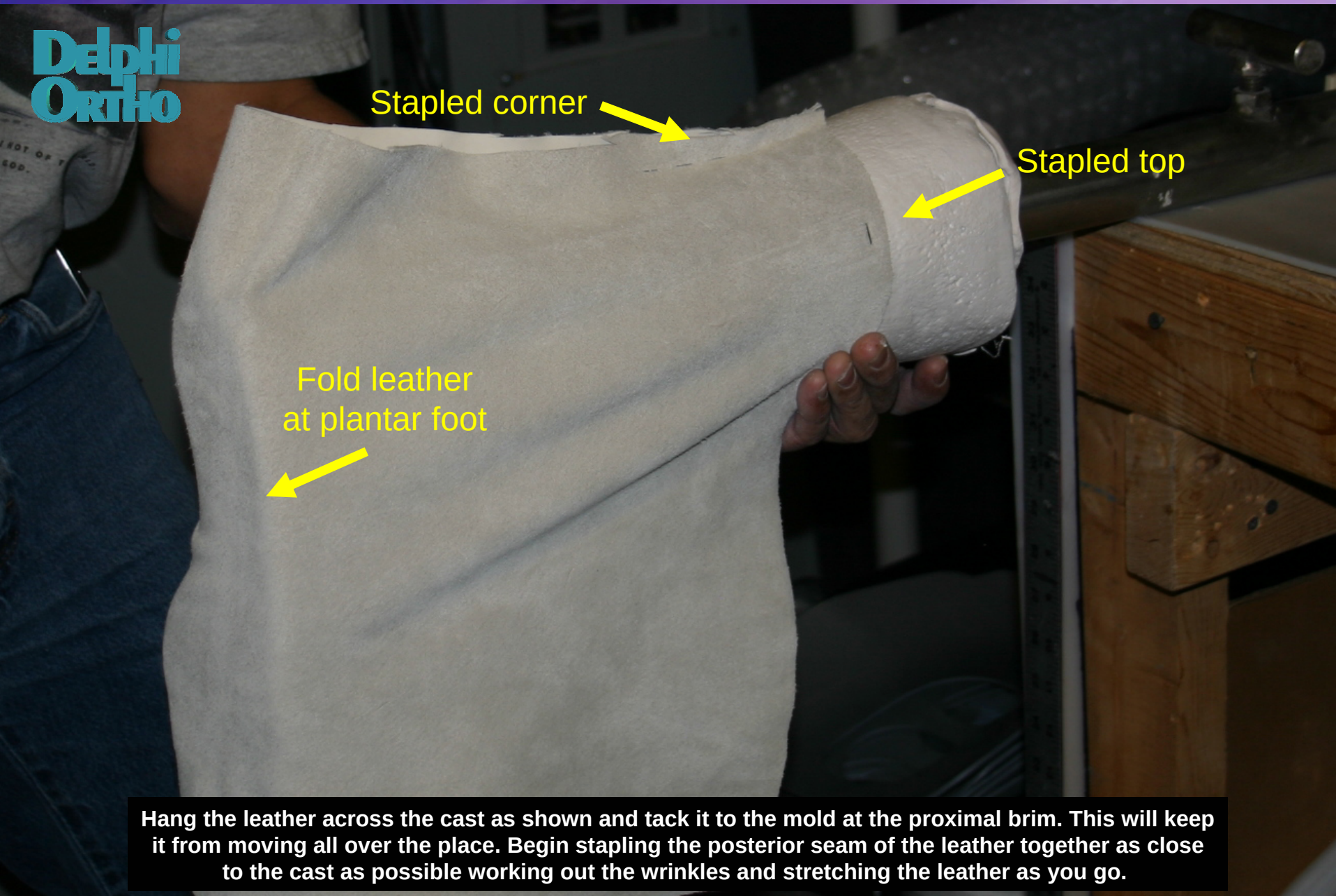
Cut the leather to size. The type of leather you use is up to you but remember that this layer will be up against the patients skin. You'll probably want to use something soft and pliable like cream cow hide.

Fabrication



Fold the leather in half with the smooth side inward. The fold should be made where the plantar aspect of the foot should be. Put a few staples at one of the corners so that you can hang it on the cast and make it easier to staple the rest of the seams.

Fabrication



Hang the leather across the cast as shown and tack it to the mold at the proximal brim. This will keep it from moving all over the place. Begin stapling the posterior seam of the leather together as close to the cast as possible working out the wrinkles and stretching the leather as you go.

Fabrication

Stretch and staple the leather around the mold making sure only to staple the seams along the edges and not in the middle where the orthosis will be.

Fabrication

Staple the leather to itself along the posterior as close as you can to the cast. Stretch the leather evenly across the surface of the cast as you staple it.

Fabrication

Creating a “Y” shaped seam will help accommodate the compound curve found at the heel. Take care to staple this area symmetrically.

Fabrication

Remove staples from anterior section and remove leather from mold. Draw a sewing line just inside (toward the brace) of the staples so that the staples can be cut away afterwards.

Fabrication

Carefully sew along the posterior seam directly on sew line.
Sew only the straight posterior seam first and then sew heel.

Fabrication

Cut off excess leather at posterior seam. At this point the staples will fall away with scrap leather.

Fabrication

The “Y” shaped seam at the heel is a little tricky to sew but will become easy with practice.

Fabrication

When cutting the excess leather away from the heel seam, cut as close as possible without compromising the threads. This area is at a weight bearing, boney prominence and should be as low profile as possible.

Fabrication

With seam facing outward, away from the cast, reapply the sewn leather snug to mold.

Fabrication

Staple the leather shell to the mold again along the edges. Be sure not to staple anywhere the final orthosis will be stretching it as you go.

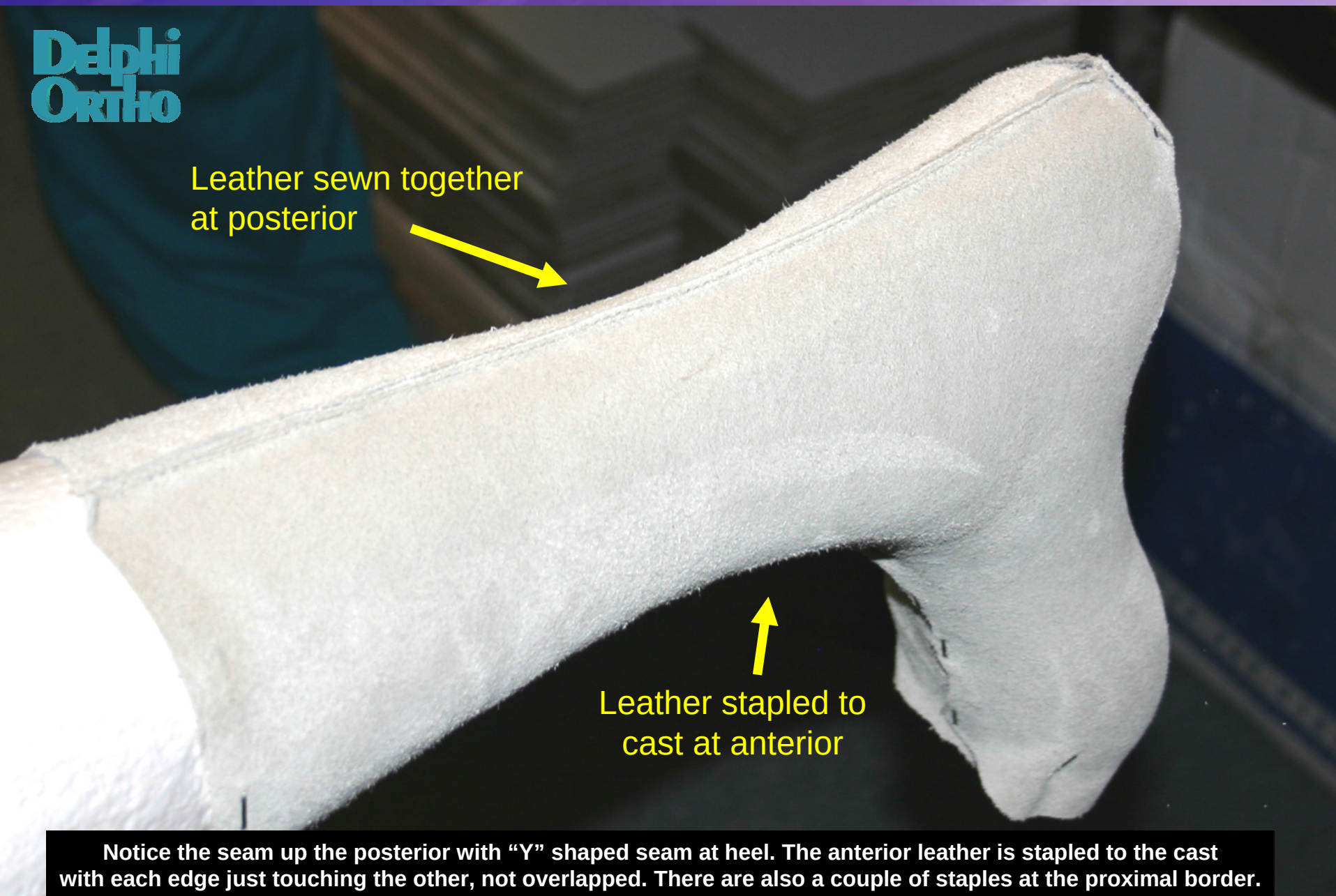
Fabrication

Remove excess leather at anterior border and toes as you work.

Fabrication

Continue stretching, stapling and trimming until the cast is covered in a skin of leather.

Fabrication

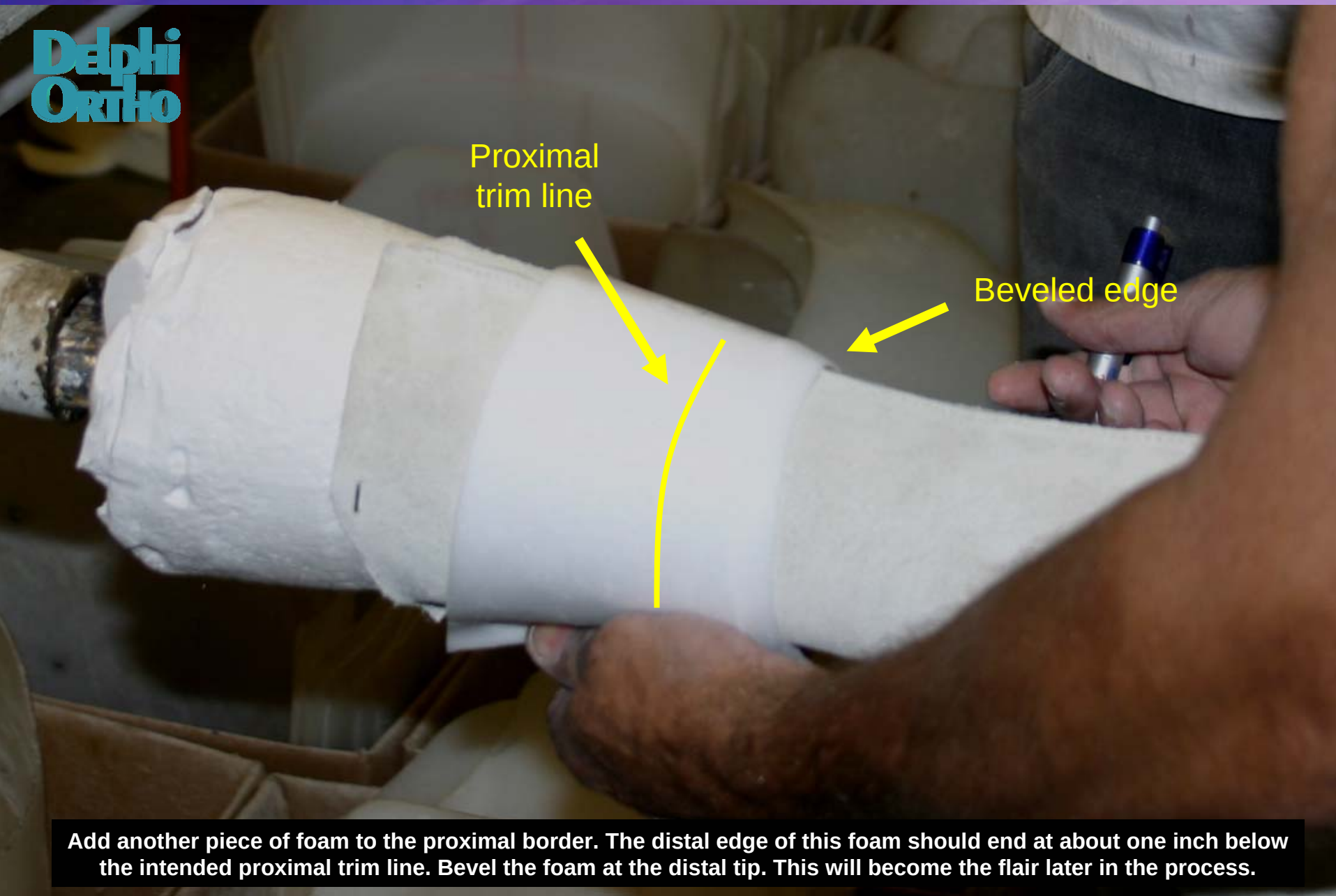


Notice the seam up the posterior with “Y” shaped seam at heel. The anterior leather is stapled to the cast with each edge just touching the other, not overlapped. There are also a couple of staples at the proximal border.

Fabrication

Warm mold some 3/16” or 1/4” foam at each ankle and the navicular complex. Draw the shape of the padded areas and cut them out, sanding them smooth.

Fabrication

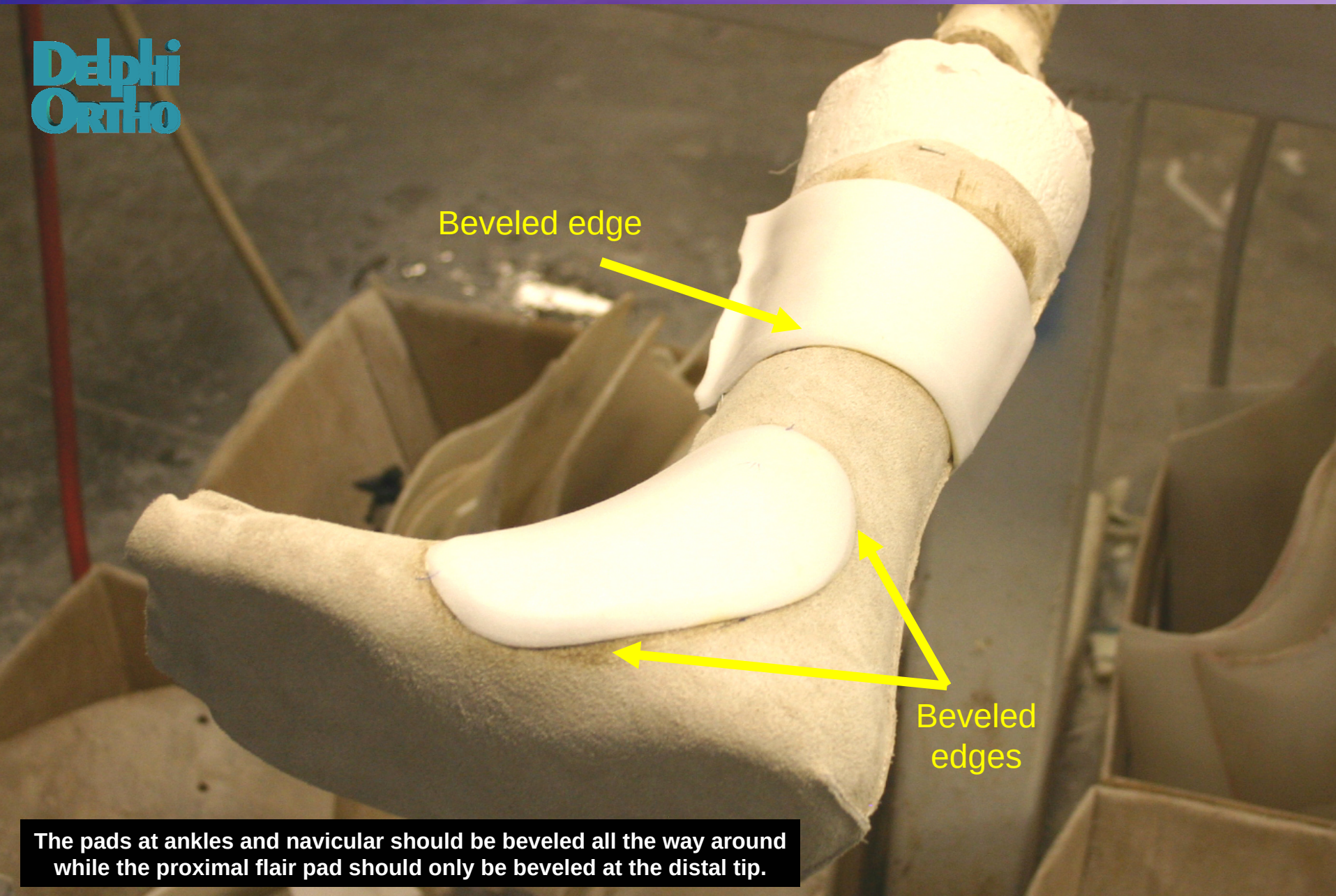


Add another piece of foam to the proximal border. The distal edge of this foam should end at about one inch below the intended proximal trim line. Bevel the foam at the distal tip. This will become the flair later in the process.

Fabrication

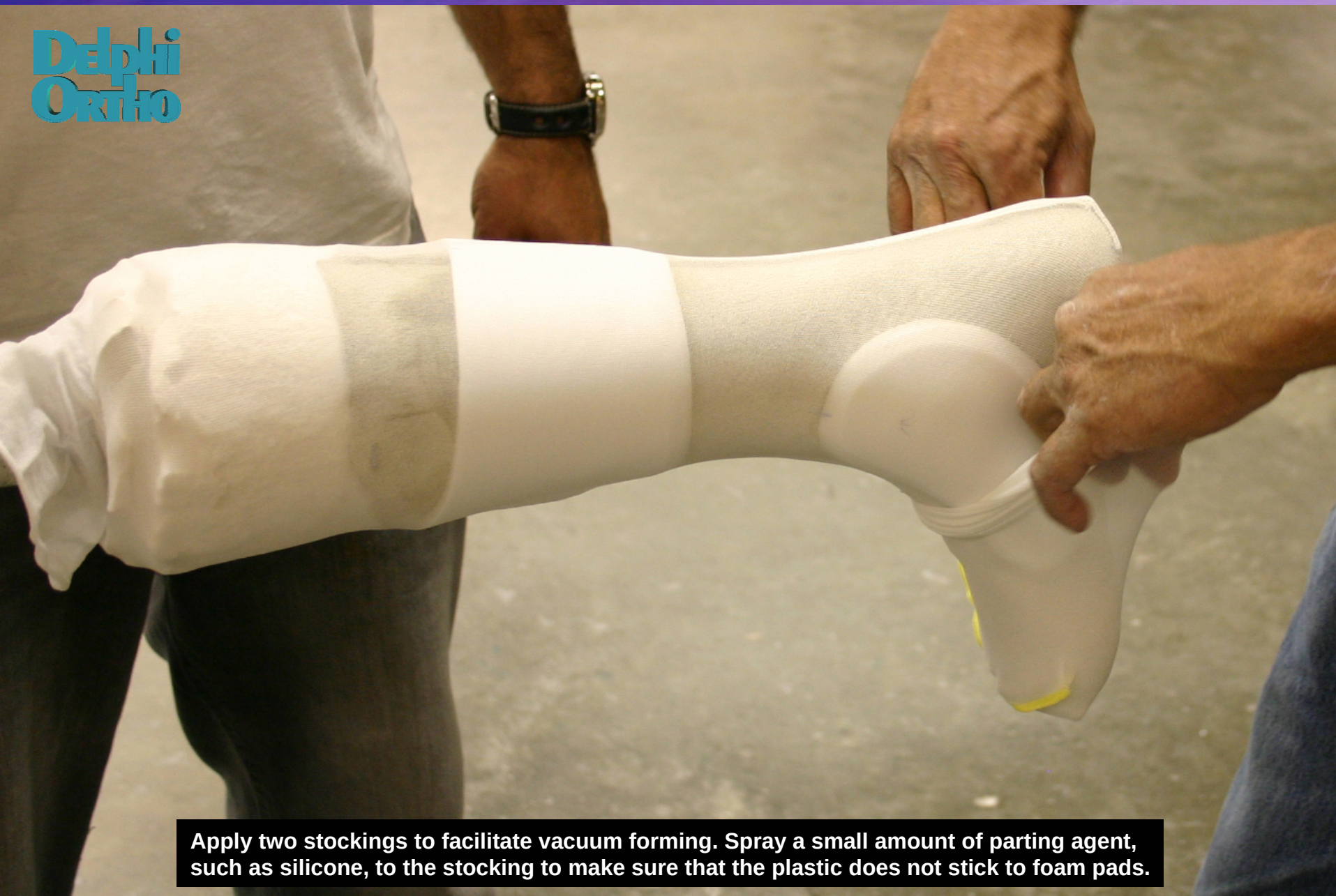
Using your favorite contact cement, glue all foam pads back into place.

Fabrication



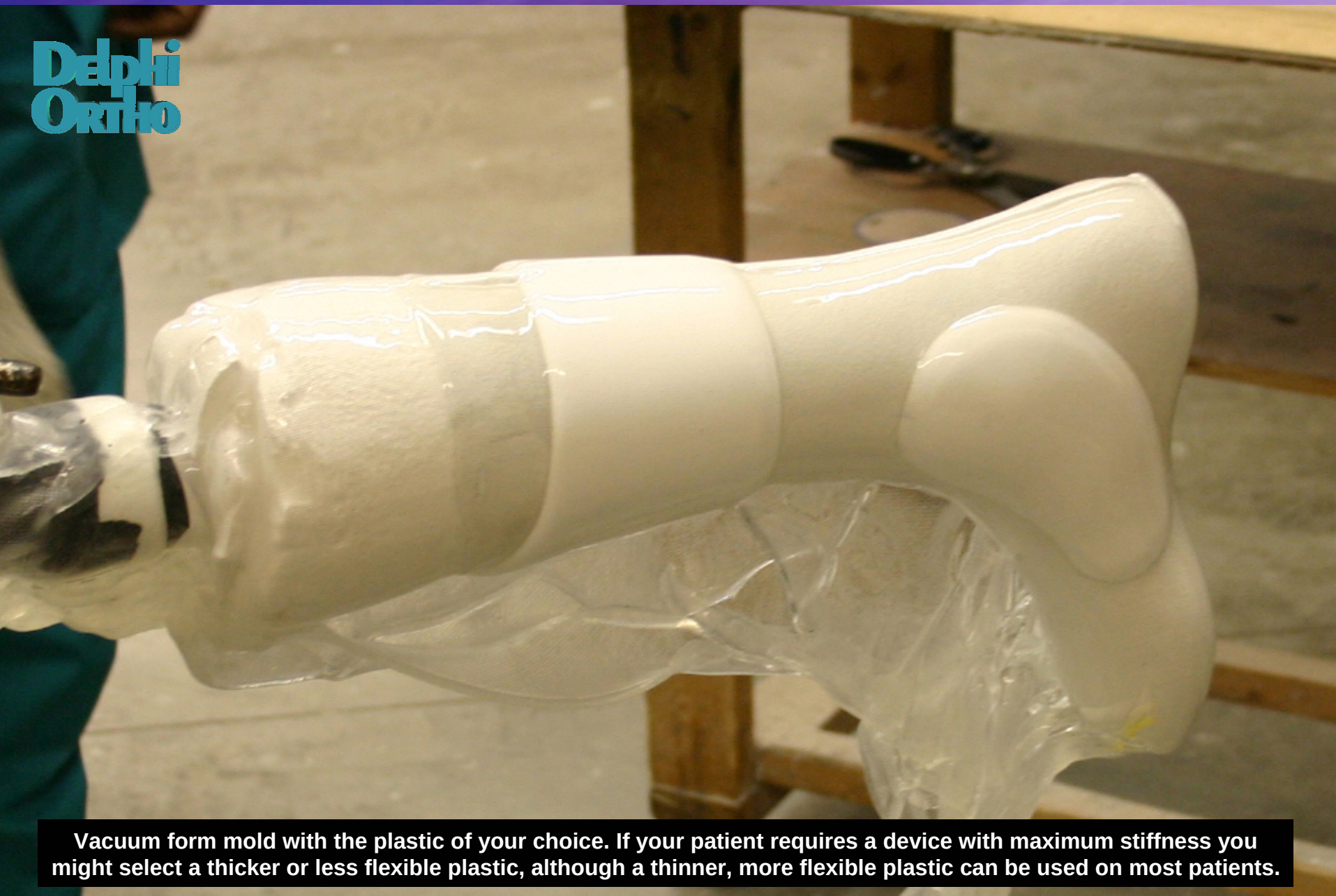
The pads at ankles and navicular should be beveled all the way around while the proximal flair pad should only be beveled at the distal tip.

Fabrication



Apply two stockings to facilitate vacuum forming. Spray a small amount of parting agent, such as silicone, to the stocking to make sure that the plastic does not stick to foam pads.

Fabrication



Vacuum form mold with the plastic of your choice. If your patient requires a device with maximum stiffness you might select a thicker or less flexible plastic, although a thinner, more flexible plastic can be used on most patients.

Fabrication

Another way to influence the amount of control the device will offer is by changing the plastic trim lines. Use solid ankle trims lines as shown for maximum control or cut out the posterior seam altogether to allow rotational movement. Removing the plastic over the “Y” shaped seam at the heel will provide more patient comfort.

Fabrication

Cut plastic off of mold. Be sure to cut it off at the extreme edges to avoid damaging the leather underneath.

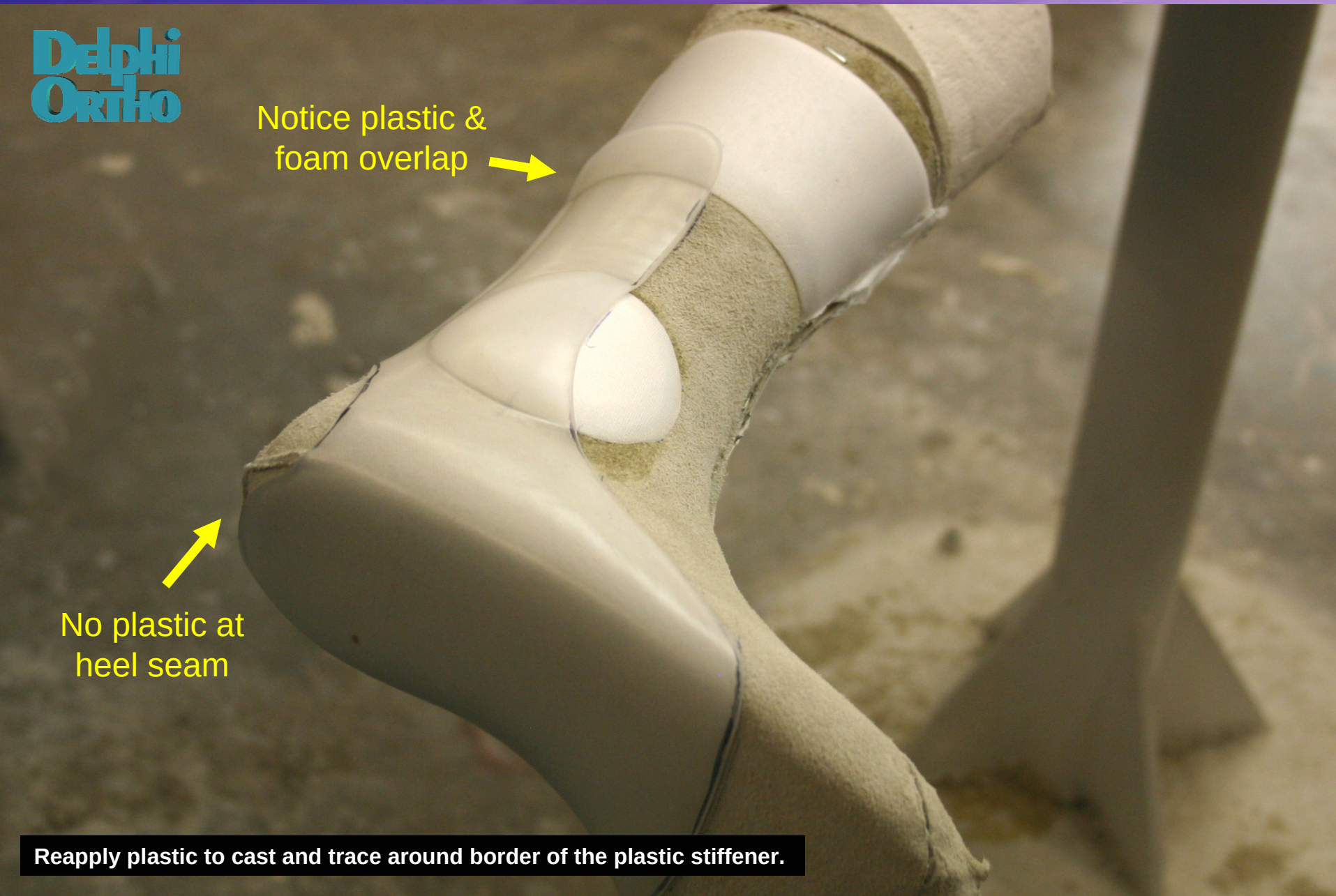
Fabrication

Remove the plastic shell from mold. Cut it down to the desired trim lines and sand it smooth.

Fabrication

Staple the leather and foam shell back onto the mold. Remember to stretch it back on as much as possible while avoiding wrinkles. Care should be taken with regard to keeping the pads in place.

Fabrication



Reapply plastic to cast and trace around border of the plastic stiffener.

Fabrication

Apply glue underneath plastic AFO section only and glue it onto mold.

Fabrication

Warm mold a piece of foam equal to the thickness of the plastic and shape it over the heel.

Fabrication

Contour foam to fit into heel recess and glue in place. This small detail will enhance patient comfort immeasurably.

Fabrication

Now it’s time to apply the outer layer of leather. Measure and cut the leather you want to use for the outside skin. Staple the corner as you did for the first layer. The outside skin is usually of a stiffer and more durable leather than inner layer.

Fabrication

With the finished side towards the cast, apply the outer layer as you did for the inner layer.

Fabrication

Staple posterior seam as you did before. Remember to contour it to the cast along the way.

Fabrication

Sew leather behind the staples as in the first layer and cut off excess. Also sew in a “Y” shaped seam at heel.

Fabrication

Apply a thick coat of contact cement at the posterior section.

Fabrication

Reverse leather shell so that the finished side is exposed and pull it onto the cast. For best results get another set of hands to help you. Stretch and pull it into place.

Fabrication

As you stretch the leather, staple it to the cast to secure the shape. Work in all corners and grooves to the shape of the mold. Because we're not using molding leather we will be relying on the stretching and glue to give us the desired contours.

Fabrication

Apply more glue as needed during the process. Don’t allow the contact cement to dry before adhering the final layer of leather.

Fabrication

Gradually the leather will begin to take the shape of the mold. Keep working the leather in and stapling it in place.

Fabrication

Trim off all excess leather carefully with a razor knife as you go.

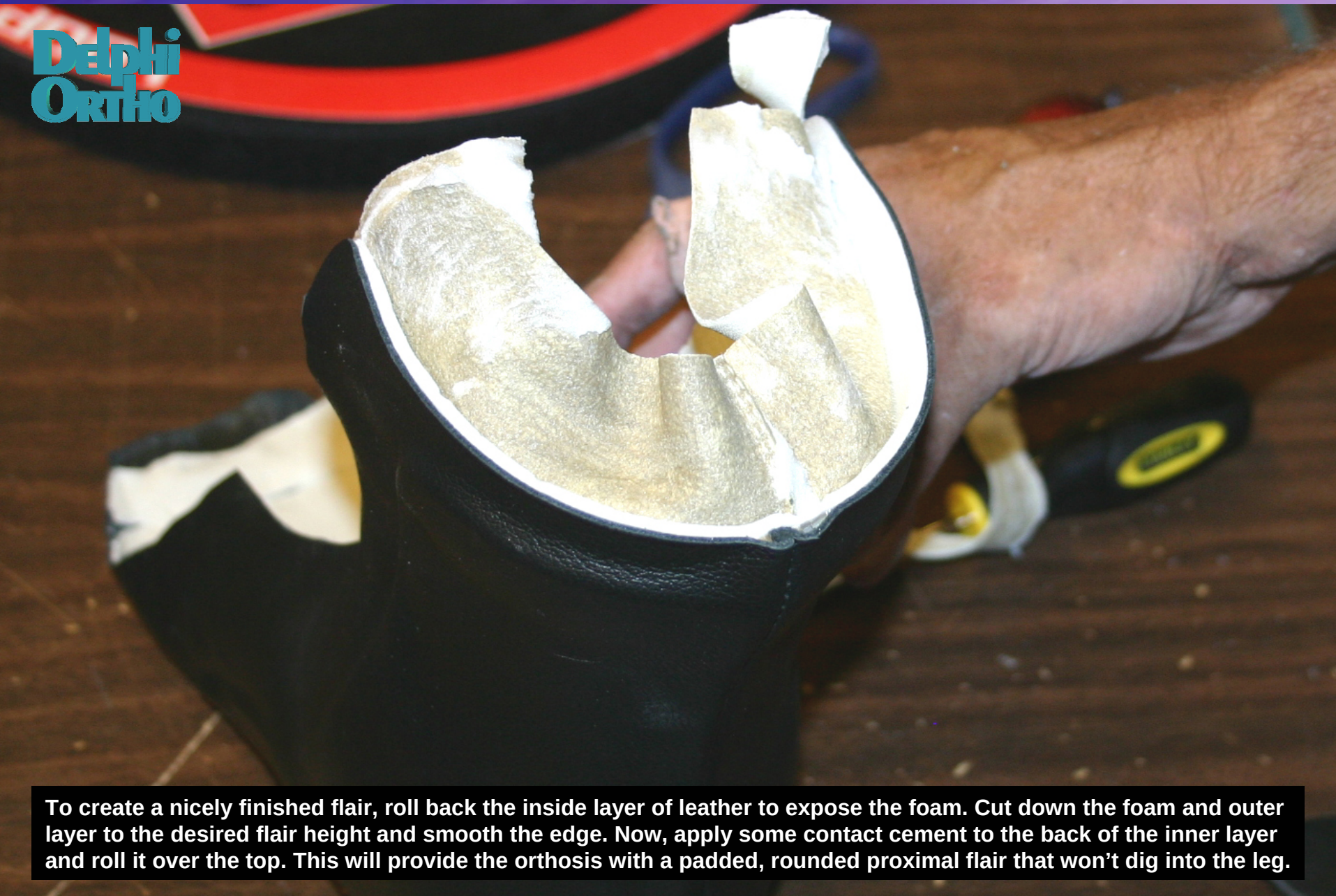
Fabrication

After the leather has been stapled and glued in place, continue to work in the details then allow the glue to dry.

Fabrication

Once the glue has cured sufficiently cut if off of the mold using a razor knife. Cut along the extreme edges only.

Fabrication



To create a nicely finished flair, roll back the inside layer of leather to expose the foam. Cut down the foam and outer layer to the desired flair height and smooth the edge. Now, apply some contact cement to the back of the inner layer and roll it over the top. This will provide the orthosis with a padded, rounded proximal flair that won't dig into the leg.

Fabrication

Sew the proximal flair along the glued edge and cut off excess leather.

Fabrication

Continue to sew along the edges of the developing AFO to the desired trim lines. Be sure to allow a sufficient anterior opening. Trim off all excess leather from the trim lines all around orthosis.

Fabrication

Draw out the proposed shape of the tongue and anterior opening. Again, check to be sure that the patient will be able to don and doff orthosis.

Fabrication

Create a pattern and then cut out a piece of flexible leather for the tongue.

Fabrication

On the side the tongue will be attached, measure back about an inch from the trim line and mark where the tongue will be connected.

Fabrication

Glue the tongue to the side it's to be attached to and then sew it in place.

Fabrication

The plastic in leather AFO is now nearly complete. All that is left is to select the desired closures and apply them. Many of these gauntlet type of AFOs use laces or boot hooks but they sometimes have Velcro for patients with diminished hand function. Whatever type you use take care at the dorsal aspect where the orthosis will fit inside a shoe.

Finished!

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