



ASSEMBLING THE PHOENIX UNLIMBITED HAND

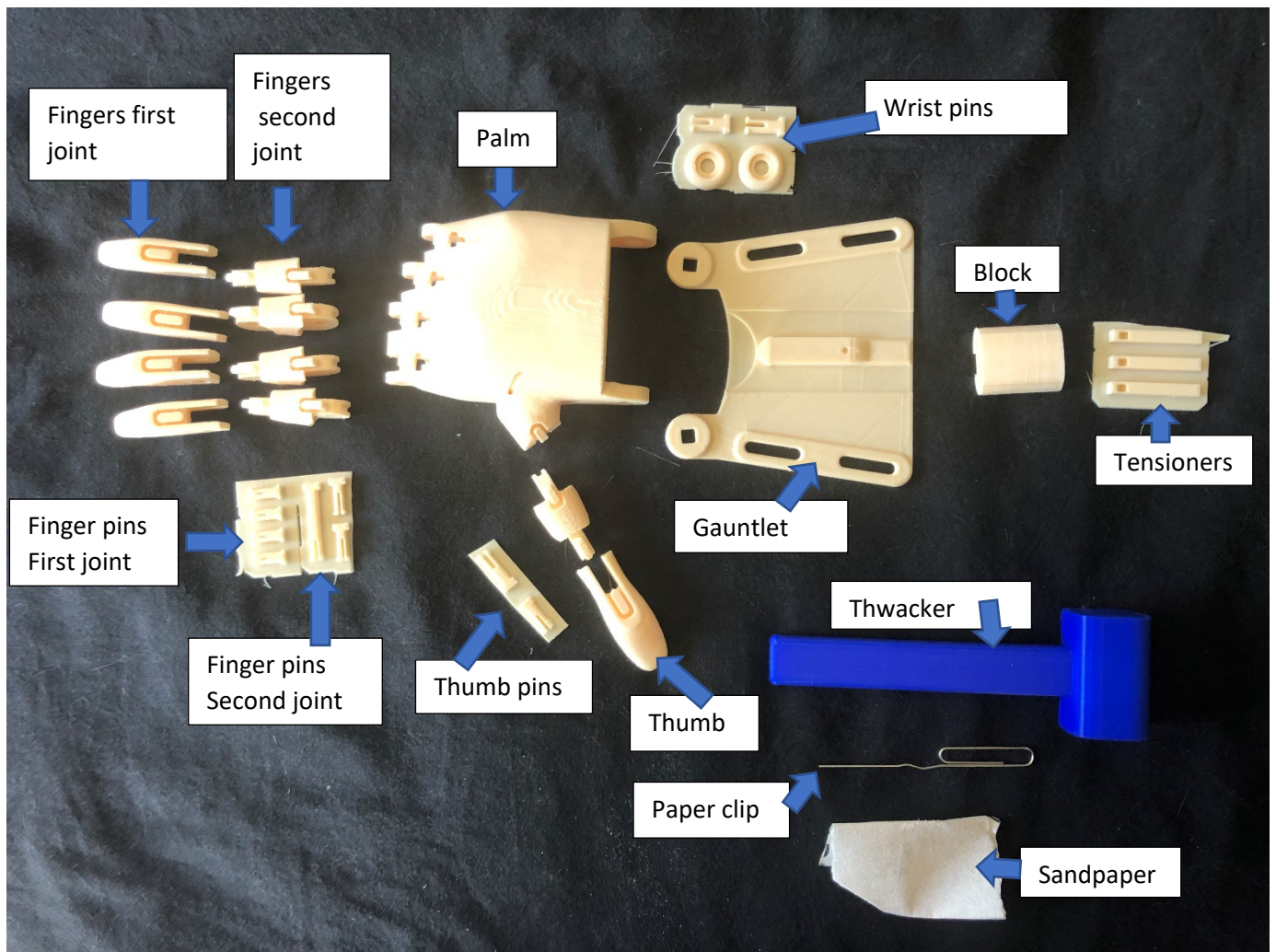
A classroom resource

PURPOSE

This manual is to assist with the assembly of the Phoenix Unlimbited hand in a classroom or tutorial environment when watching a video tutorial is not convenient.

Angelle Hughes
Macksville High School, Australia

Getting ready



1. Layout your hand like the above picture.
 - a. Notice there are two longer fingers. It is important that they are in the middle.
 - b. Leave the pins attached to their float. They are harder to lose that way.
2. Check each piece of your hand for rough edges. If there is a rough edge, sand it smooth and then put the piece back in position.
 - a. There is always a daggy bit in the upper part of the palm. Be sure to smooth that out with the sandpaper.
3. Trace around the palm twice, and once for the gauntlet on paper. This will help guide you when you are shaping the comfort foam later.



You can see I have traced around the gauntlet, then I have drawn a red line inside the trace. That will be the shape of my foam so that the strap slots are open.

Thermoform the palm and the gauntlet



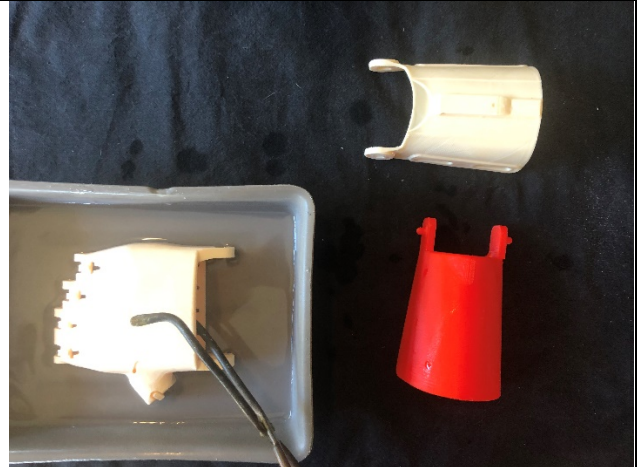
Lay out your thermoforming equipment and half fill a tray of hot water from the kettle. You'll need tongs so you don't burn your hands.



Place the gauntlet in the hot water for 10-15 seconds so that it softens. Mould the gauntlet over the jig, pressing the wrist onto the jig buttons. Be careful not to damage the slider on the top!



This palm is too flat to be comfortable.



Sit it in the hot water, so it's just the bottom that gets wet.

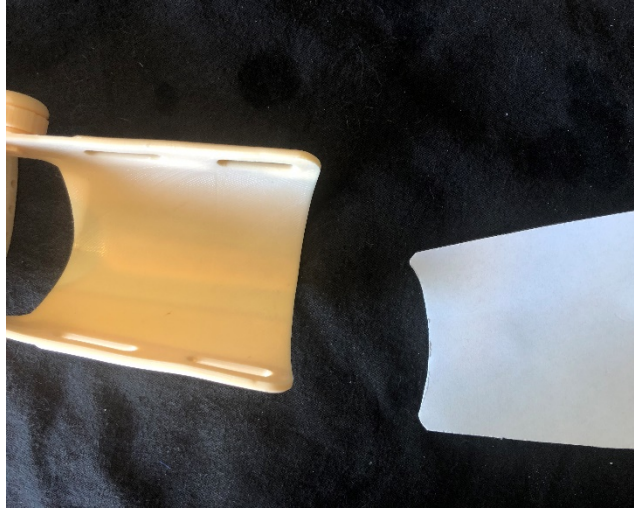


Use your fingers to push down on the bottom of the palm to make it curved.

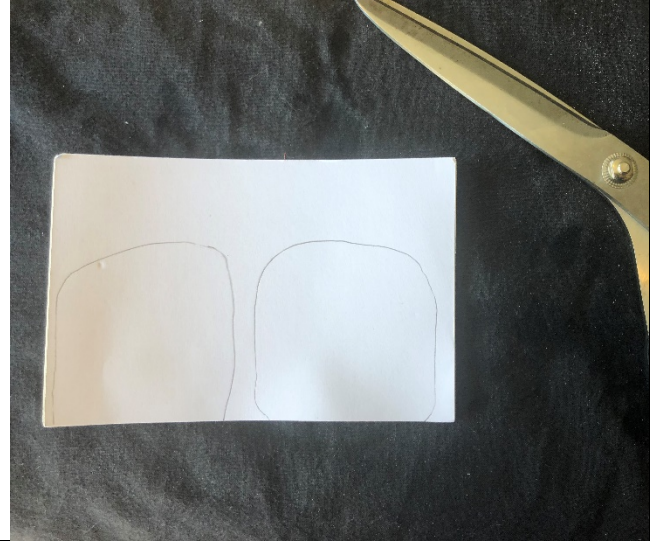


Please ensure you have adult supervision when thermoforming

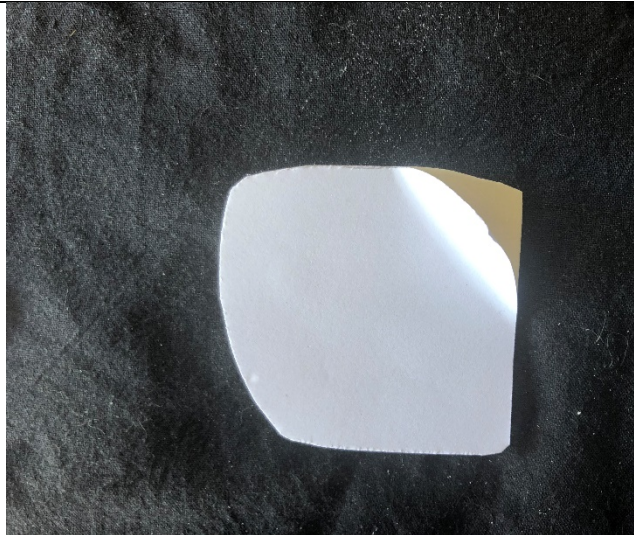
Comfort Foam



Cut out two paper traces of the palm, and one for the gauntlet. Trim these so you have a neat fit for the upper and lower palm and for the gauntlet.



Lay your shapes on the paper backed side of the foam and trace around them. Because you are tracing on the back of the foam you need to put your shapes face down.

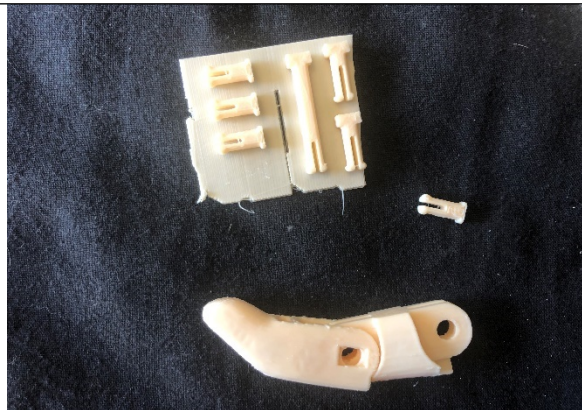


Once you have cut your foam pieces, check the fit and do any last-minute trims before peeling the paper back to reveal the adhesive side of the foam.

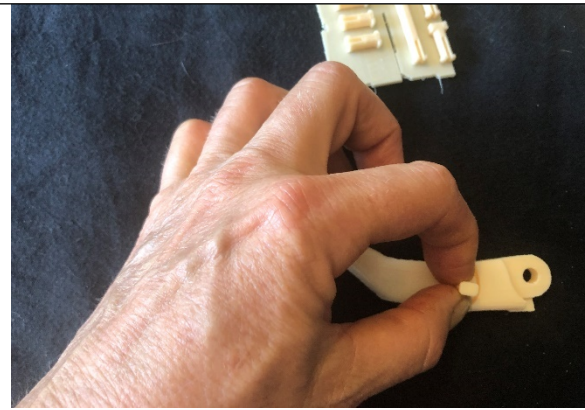


Apply the foam to the upper and lower areas of the palm, and to the gauntlet. Take the time to get it just right as it is important for the comfort of the wearer.

Assembling the fingers and the thumb



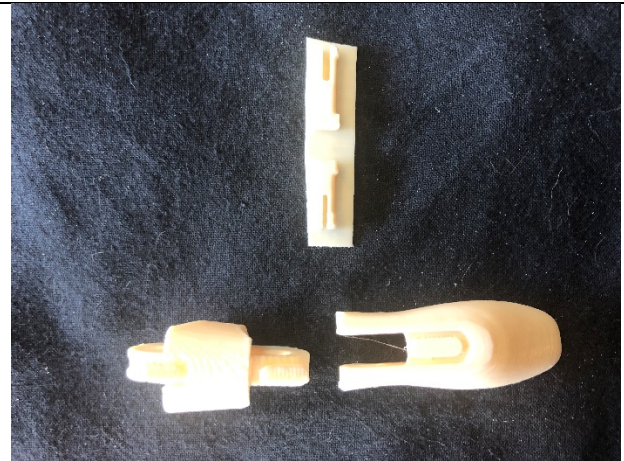
Lay the finger with the rectangular hole facing up. Select a small pin from the finger pins.



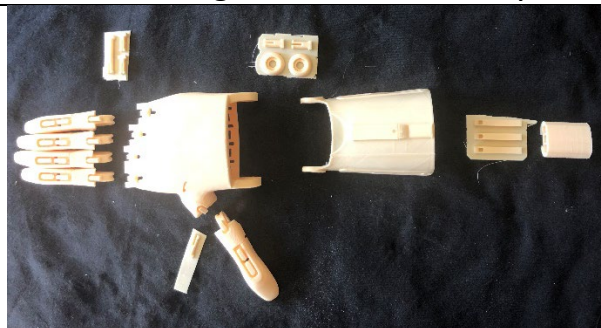
Line the pin up to the rectangular hole, and use the thwacker to bang it in.



The pin should fit flush both sides. The joint should swing freely. If it's sticky, work the joint to loosen it. Assemble the rest of the fingers in the same way.

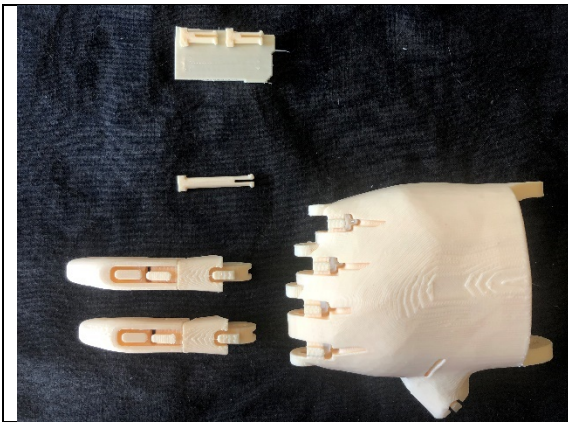


Select the smaller thumb pin to assemble the thumb.



Put your pieces back in place. Double check that the two longer fingers are situated in the middle.

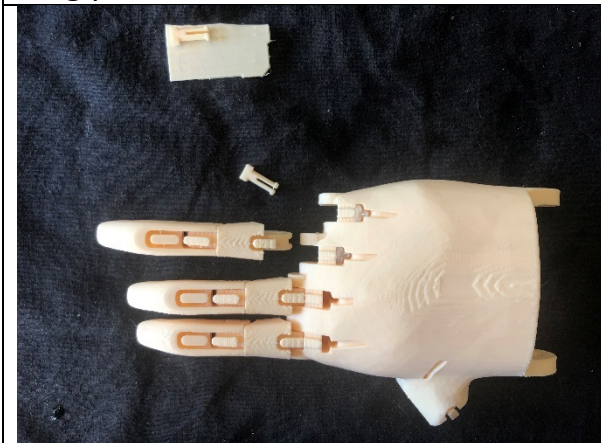
Attaching the fingers to the palm



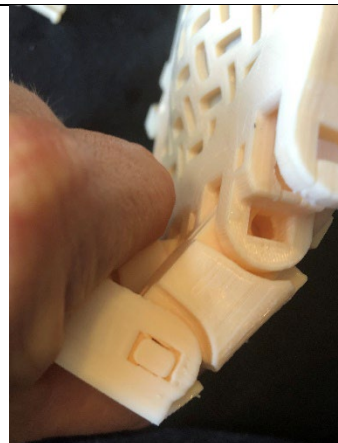
Line up the first two fingers closest to the thumb. A small one is on the outer edge, followed by a longer one. These fingers are held in place with the one long pin.



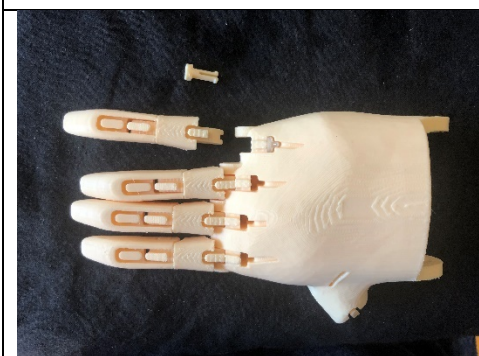
With both fingers in place, and the rectangular hole facing up, push the long pin through to secure both fingers.



Select one of the shorter pins and the next long finger.



Hold the finger in place and insert the pin in the rectangular hole so that it sits flush.

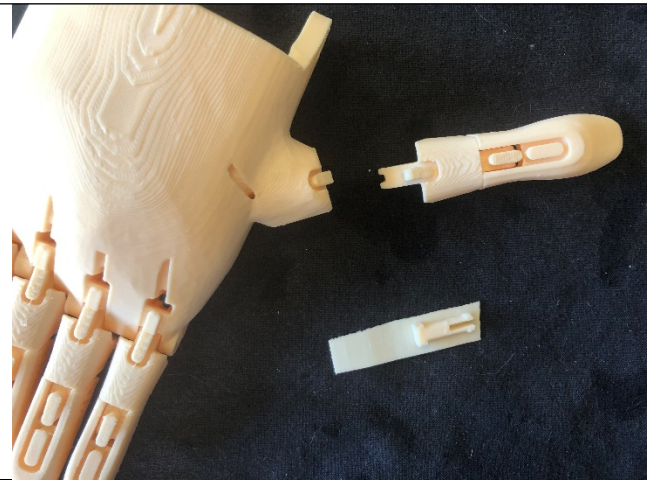


Use the last of the finger joint pins to attach the pinkie finger.

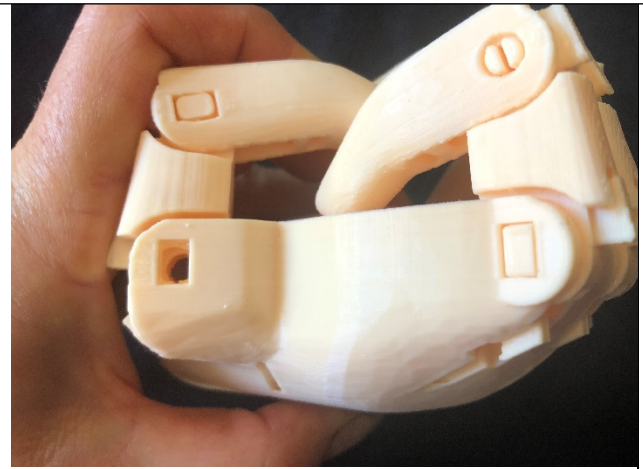


With all the fingers in place, the joints should swing freely.

Attaching the thumb to the palm



Use the last thumb joint pin to attach the thumb to the palm.



I find that its easiest if I hold the hand like this when inserting the thumb pin.

Attaching the palm to the gauntlet



Prepare the pieces ready for attaching the gauntlet.



Push the pins through the gauntlet from the inside out

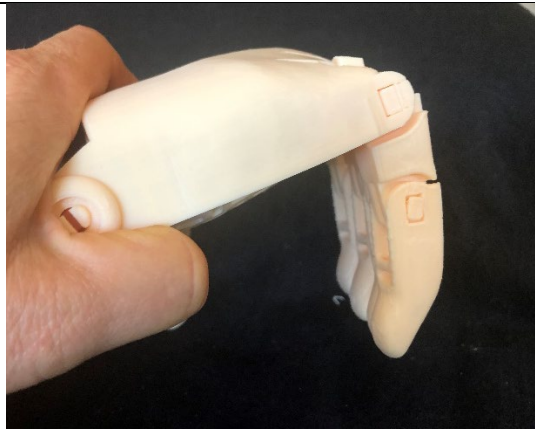


Push the pins through the palm so that a short end sticks out the side of the palm



Push the button over the part of the pin that sticks out. Repeat for the other side

Adding the ligaments (dental elastics)



If you hold your hand by the wrist and gently shake it, the joints should swing freely. The hand is limp



Each joint needs a dental elastic. Loop an elastic over the grooves to join the two pieces of finger together. You will need 10 elastics all up. If you find it fiddly, use your paper clip to help hook the elastics over the joint.



With all the elastics in place, your fingers and thumb will be at full reach. If you bend them, they should snap back.

Adding the tensioner



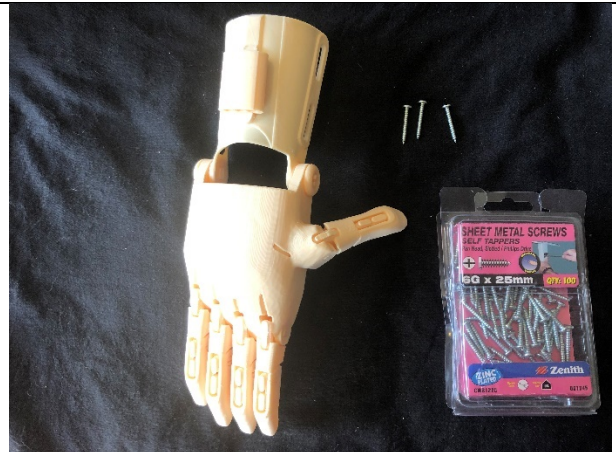
Check that there are no random print threads blocking the square holes in the tensioner block. The other end has small round holes for the tensioner screws



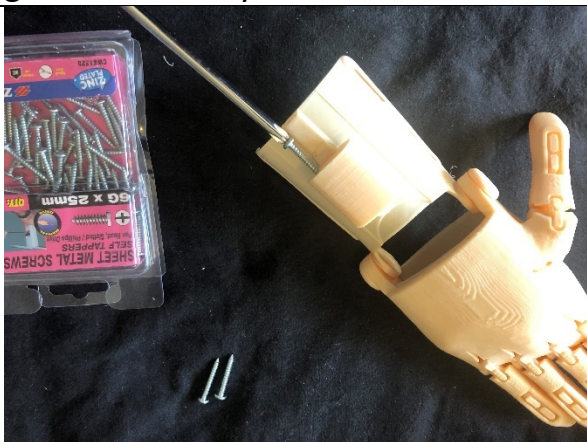
Slide your tensioner block on square ends first. Your tensioner block needs to slide all the way to the front, so it is locked in and flush with the D.



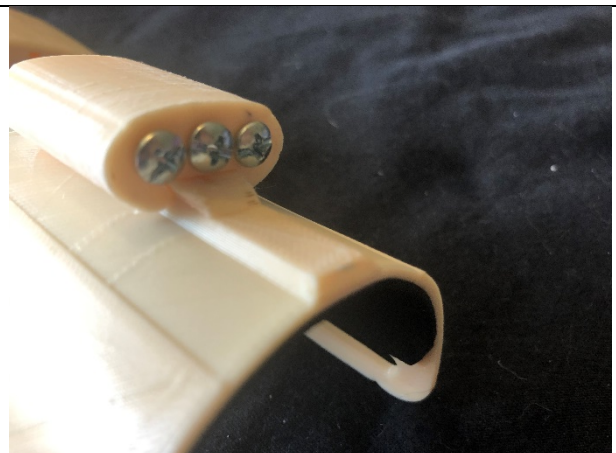
Sometimes you must whack it hard to get it all the way on.



Next you need to add the tensioner screws


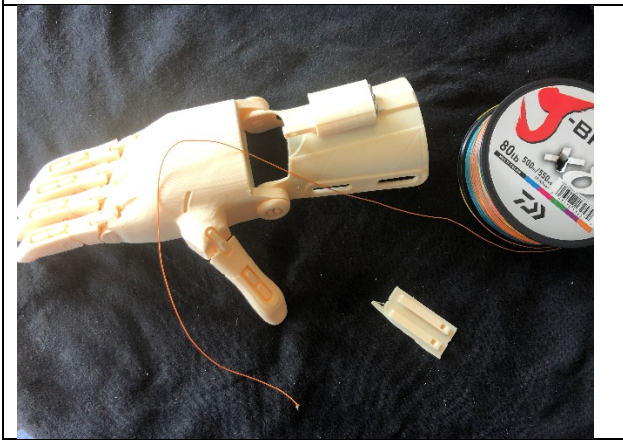

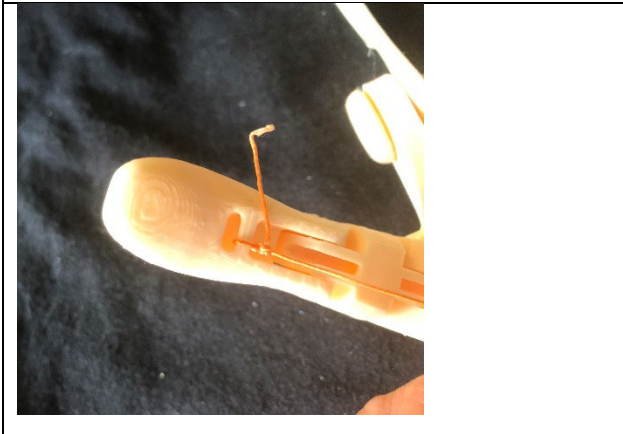
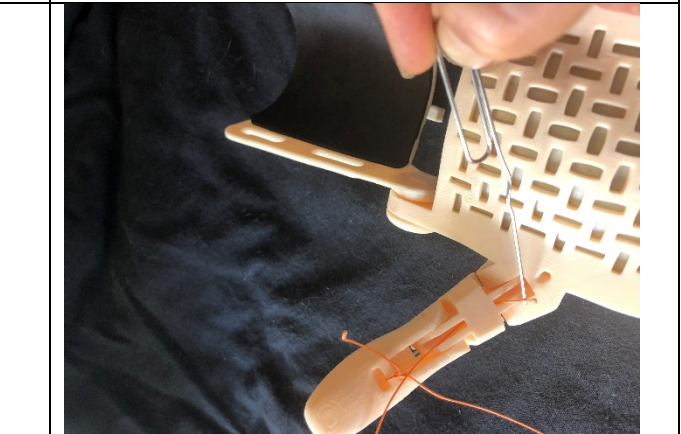


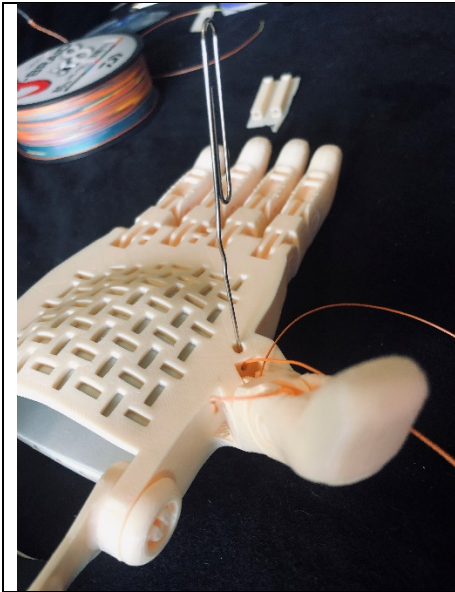
Screw all three in through the small round holes



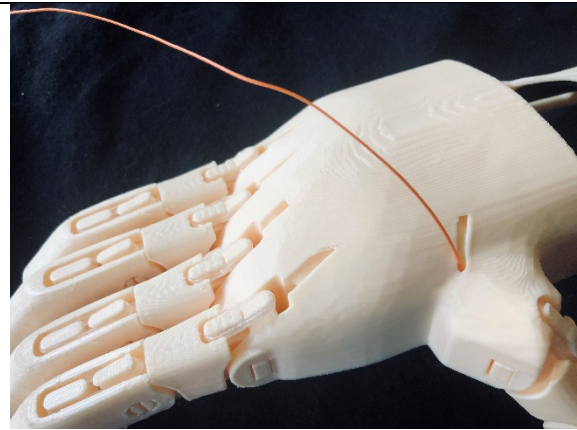
Screw them in until they are flush

Adding the thumb tendon (fishing line)

	
<p>Slide a tensioner in the square hole in the tensioner block nearest the thumb</p>	<p>Use a screwdriver to screw into the tensioner. Tighten it until it is level with the edge of the gauntlet</p>
	
<p>Cut a piece of fishing line longer than the path from the thumb to the tensioner</p>	<p>Tie the fishing line onto the thumb using 3-4 alternating knots</p>
	
<p>Pull the knot tight. Make sure it holds</p>	<p>Thread the line through the groove and scoop out the end</p>



There is a little hole inside to thread the line through. You can use the top hole to poke your paper clip through to encourage the line to feed through the channel



When your line comes out here, continue to poke it through the channel towards the tensioner

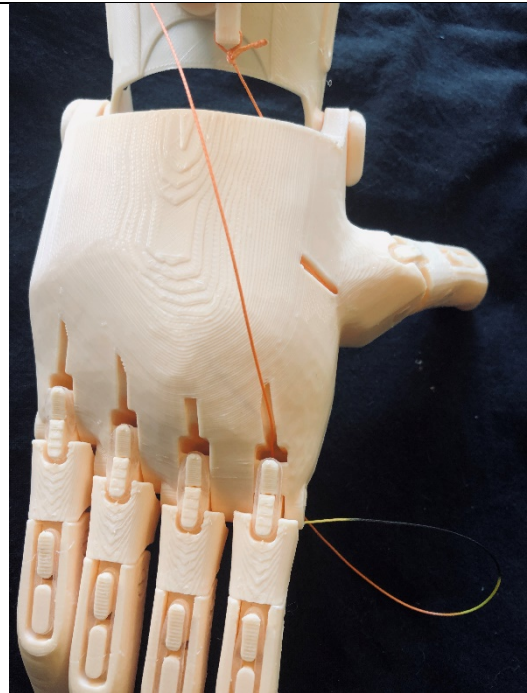
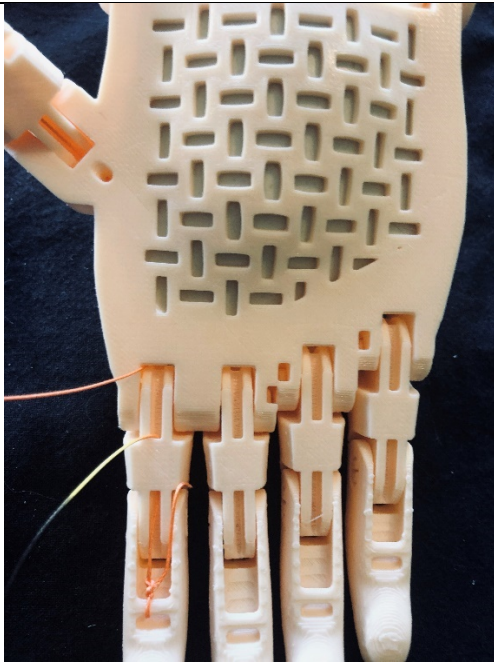


Pull the line through the tensioner and tie it off



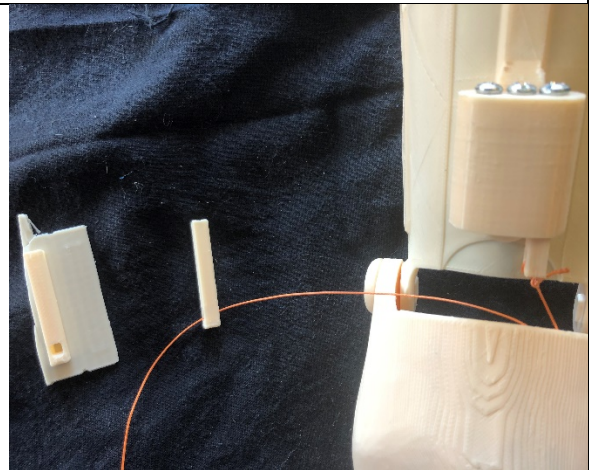
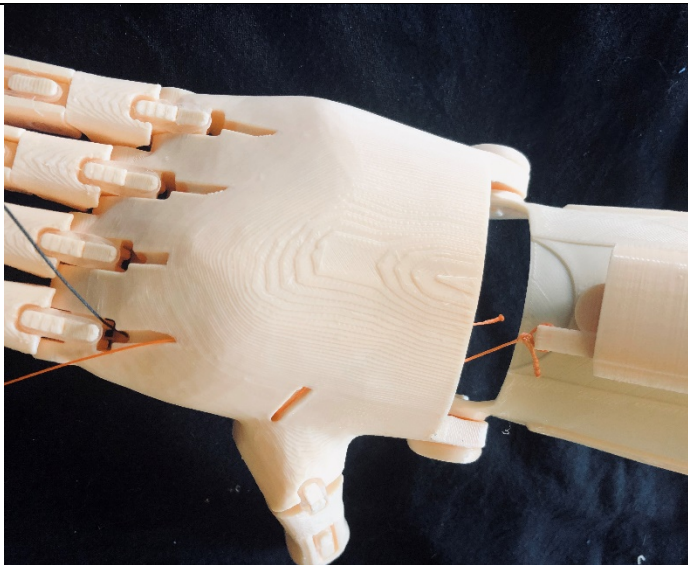
The wrist should be at an angle like this. I am using the braid reel to hold it at this angle while I tie it off

Adding the finger tendons (fishing line)



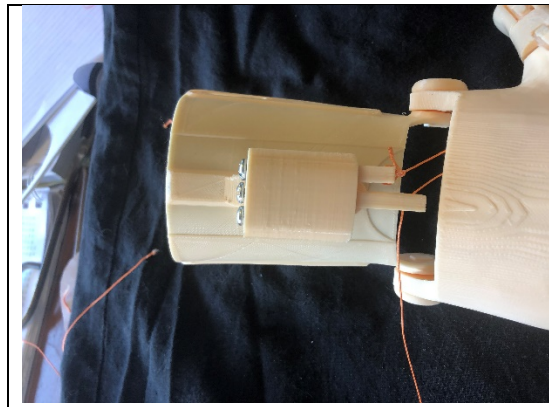
Measure a piece of line long enough to go from the pointer finger, up to the tensioner and back to the middle finger. Tie the end of the line to the pointer finger with 3-4 knots and pull it tight to ensure it holds. Feed the line through the groove at the back of the finger, then poke it through to the back of the hand.

Pull the line through the back of the hand, then feed it through the channel towards the tensioner

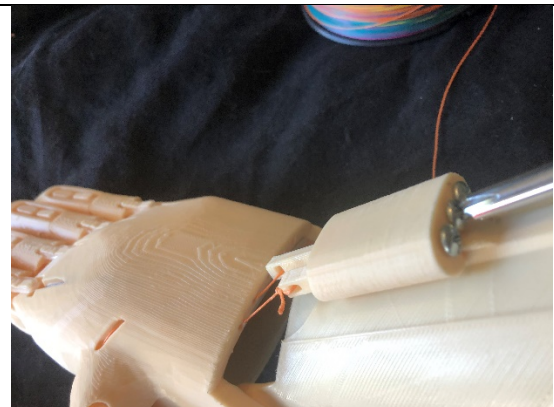


The end of the line emerges from the channel near the wrist. Pull it all the way through

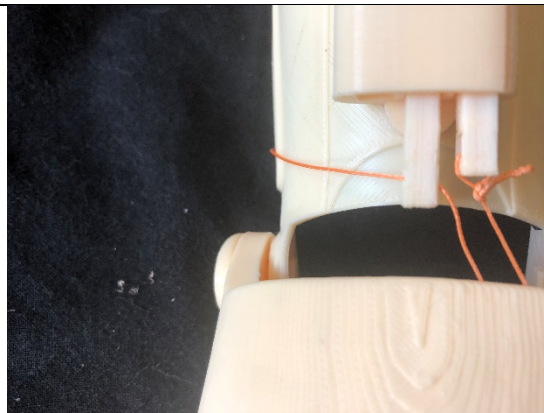
Thread the second tensioner block onto the line



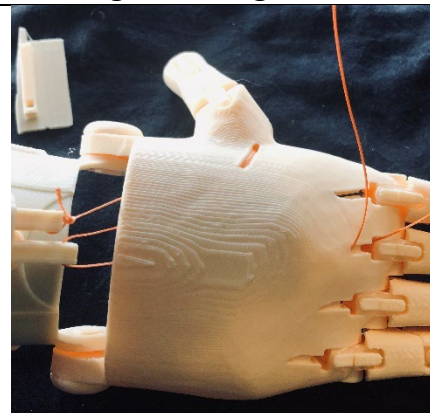
Insert the tensioner block in the middle hole



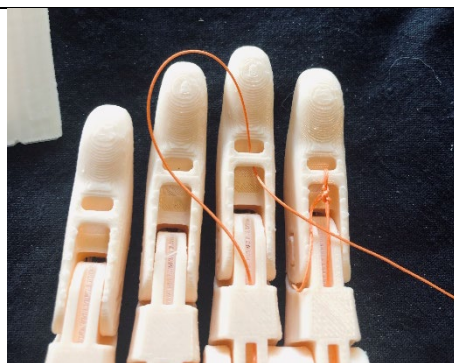
Use a screw driver to tighten the tensioner block until it is in line with the edge of the gauntlet



The tensioner block should be in line with the edge of the gauntlet. This ensures the tensioner block is engaged but gives plenty of scope for later adjustments.



Feed the line through the next channel until it comes through near the knuckles. Feed the line through the knuckle to the other side of the hand

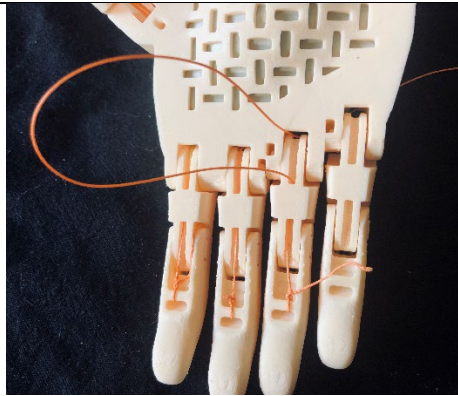


Pass the line through the middle finger groove and tie off on that finger. I have found the knots easier to tie if I loop over the top of the tie off bar as shown. Remember to have the wrist bent when tying off and be sure the thumb is open

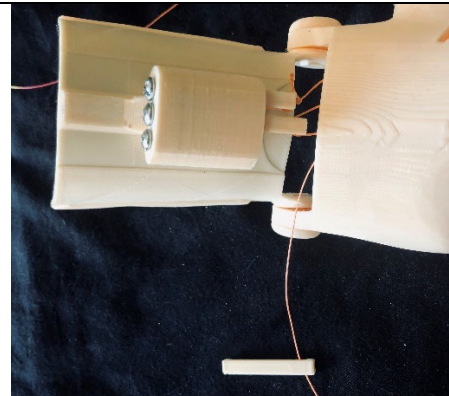


Now when you bend the wrist, the first two fingers should curl in. We will fine tune that later.

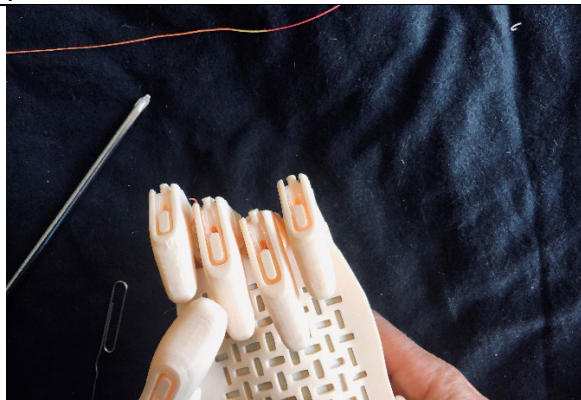
The finishing touches



String the last two fingers the same way, starting with the ring finger, and feeding through the tensioner, back to the pinkie



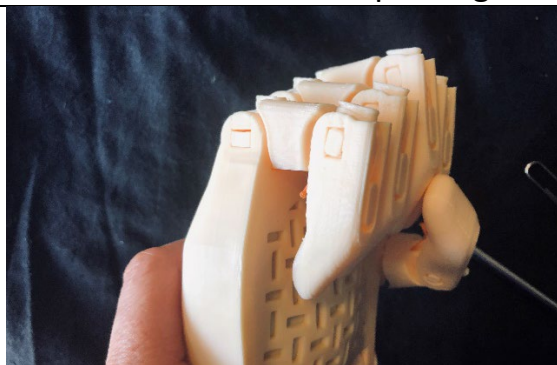
It is easier to thread the tensioner onto the line before putting the tensioner in place



When you have finished stringing the fingers, bend the wrist to check the fist formed. This one is not quite right.



Use the tensioners until the fist formed on bending the wrist looks like your own.



This is a good fist



Feed the straps through the gauntlet, scratchy side down, then thread through the buckle to finish