

Last time, we looked at Part 1 of hearing aid fabrication and considered the pros and cons of why we may want to fabricate our own hearing aids.

To read Part 1 [Click Here](#)

## Hearing Aid Fabrication Part 2

### Casting the Impression

Using an investment cup, stick the waxed impression to the cup bottom using a drop of wax. An investment cup is a clear plastic cylinder which is disposed of after the curing process. The cup snaps into a base which is reusable. As far as cup size, you generally want about 1/8" clearance around the circumference of the impression when placed in the cup.

Now it is time to cast the impression. There are several methods, and a couple of different materials you can use for this step. Preference largely depends on the size of the lab you have. We'll look at two popular materials and how to dispense them in a small and large lab.

Hydrocolloid is a popular impression material because it is easy to use, and fairly inexpensive. It is a one-part material that needs to be liquefied before use by melting. If you have a small lab, putting some material in a glass beaker and heating with a microwave oven works well once you experiment a little and figure out how long to cook it. This will vary widely depending on the type of microwave you use.

If you are setting up a larger lab you might consider dispensing with a colloid machine, which will heat a large batch of hydrocolloid material and have it ready for you when you need it. The machine is a little pricey, but will save a ton of time in a busy shell lab.

Another material that works well for impression casts is Klarsil-H. This is a 2-part material that can be dispensed from a mixing gun for small labs or a Dosper machine for larger labs. Klarsil-H is more expensive material, but it is very easy to use and doesn't need to be heated.

Now that you've figured out which casting material you would like to use let's get back to our investment cup and impression.

Slowly pour the casting material into the investment cup. Fill the cup all the way to the top, completely covering the impression. And when I say pour slowly - I mean slowly. You want to avoid making any bubbles in the material which could interfere with the curing process later.

Once the casting material has cured and hardened, remove the impression from the investment cup and from the hardened casting material, or investment. A dental hook works well for impression removal. Stick the pick into the impression base and pull out with a slow turning motion. Also remove any wax from the investment that may have dislodged from the impression from the investment.

### About serial numbers

The FDA requires all hearing aids to possess a serial number for identification. Now if you want a slick and inexpensive way to put a serial number into your shell, here it is. For small labs, or if you want to print the labels yourself, you will need a laser printer and a sheet of clear Mylar. Simply print your serial numbers onto the Mylar sheet and cut with scissors to the appropriate size. You can even make your labels with a red or blue dot to help determine right or left. Then, dip into clear UV material and position inside the hearing aid shell, making sure the serial number is facing outward from the shell. Then cure for a few seconds using a spot cure gun, or place under UV lamps.

If you are setting up a large lab, you might consider having the labels printed for you from a local print shop. Or, if you have a really big lab and you have \$30,000 to spend you could go with a YAG laser and print them right onto the outside of the finished shell.

Once the serial number is cured in place it is time to pick your color and fabricate the actual shell.

Finally, the UV Material

Fill the investment with UV shell material of the appropriate color. Fill very slowly to avoid any air bubbles getting into the shell material. Fill the investment right up to the top and cover with a cover plate. If you don't cover the top of the investment, it will cure and you will end up with a plug instead of a shell.

Place the filled investment into an UV cure chamber for the appropriate time and remove. Now, how do you know how long to cure the investment? Initially you are going to need to experiment with different models and colors to determine your times. There are several factors to consider when figuring out how long to cure:

- 1) Color: The color of the shell you are making is going to be a big factor in determining how long to cure. The darker the shell, the longer the cure time.
- 2) UV Cure Oven intensity: The model of cure chamber you use is going to be another factor which will effect cure time.
- 3) Lamp age: The age of your UV lamps will have another time effect. Lamps loose intensity over time, so if you notice your shells are getting thinner over time you will want to lengthen cure times slightly, or replace the lamps.
- 4) Hearing aid model: The type of hearing you are making will also impact cure times. A full shell unit will take longer than a CIC just due to the amount of material being cured.

Once you determine your cure times, it is helpful to make a table displaying shell models and colors and corresponding cure times. The process is very repeatable, so once you figure your cure times you will only need to refer to the table in the future.

Once the shell material has cure for the appropriate time, remove it from the UV cure chamber. Now underneath the cover plate you are going to have uncured UV material, which can be reused. Remove the cover plate and dump the uncured material back into its original container. If you have a busy lab, you might find it better to have a recovery jar for the uncured material, which can be returned to its original container later. Just make sure you use an amber colored jar which blocks UV light or your material will cure in the container.

After the cover plate has been removed you will find the beginnings of a shell in the investment. You will also find a sticky coating on the inside of the shell called an oxidation layer, or smear layer. The best way to remove this layer is by curing again with a filler. So, fill the inside of the shell with Glycol or Glycerin and place back into the UV chamber for curing. A great way to fill the shell is by using a syringe with no tip. Time will vary depending on UV chamber used. This will take some initial experimentation, but once you've figured out how long to cure the inside of the shell this will be that same for all shells in the future.

Once the inside of the shell has cured, remove from the UV oven and dump the Glycol or Glycerin back into its container for reuse. Once you've drained as much material as possible, turn the investment upside down on a paper towel to absorb any remaining material.

Remove the shell from the cast and clean in alcohol. Using a paper towel.

At this point the ends of the shell are going to look a bit ragged so we need to flatten them. Using a surface grinder with 220 grit sandpaper, sand the shell opening flat by pressing against the right side of the sandpaper wheel. Turn the unit around and sand the canal of the shell flat. Make sure to keep the sanded flat surface of the canal perpendicular to the direction of the canal.

#### Venting

If you are going to install a vent, now is the time to do it. Using a silicone coated wire of the appropriate size, lay the wire along the inside of the shell where you want the vent to be. Hold the shell so the wire is positioned at the lowest gravity point. Using UV material of the same color as your shell, pour over the vent wire and cure using a UV Spot Cure gun, or place under UV lamps. Once cured, wipe with alcohol to remove any smear layer.

#### Finishing the Shell

Now, the shell surface is still going to look a bit rough. Using a buffing wheel on a Redwing lathe, smooth the surfaces of the shell. Make sure to use a buffing compound on the wheel for best results. After buffing, take off any excess height depending on hearing aid model using the surface grinder and 220 grit sandpaper.

Your shell is now ready!