MATERIALS AND EXTERNAL PROSTHESES II

Alginate

Alginate is used to take a cast or negative model of a bulbous end, a partial hand stump , or a stump with undercuts whereby a plaster wrap cast cannot be removed without distortion.

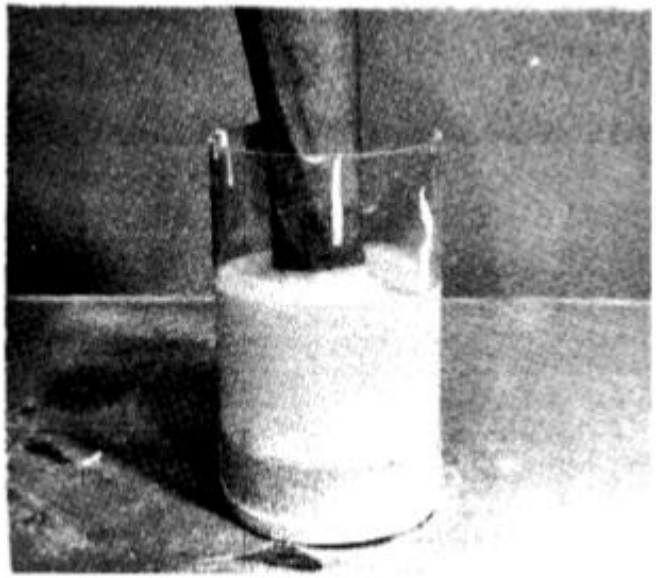
Alginate is white, light powder made from algenic acid, an extract from marine kelp. When mixed with water it sets into a flexible material which will not only form a cast but will allow undercut shapes to be removed without permanently distorting the cast.

Alginate is used by dentists to obtain gum impressions for dentures; it may be obtained in a prosthetic grade at a lower cost than the dental grade. Like plaster, alginate should be stored in a dry place.

Alginate is mixed into water in a proportion of 40 percent alginate to 60 percent water by volume. The alginate is put into the water in a mixing container and stirred quickly because the setting time is approximately two minutes. When stirred, the alginate and water form a lumpy slurry mixture which should be quickly poured into a casting container. The patient? stump should then be put into the alginate slurry in the desired casting position. Shave any hair on the stump or use a parting agent before casting in alginate.

The alginate sets firmly in approximately five minutes; remove the stump gently with a freeing movement to allow air to enter and break the suction. The positive plaster model must be poured from the alginate cast as soon as possible because alginate will shrink and distort if it stands for a few hours.

The photographs on the following page illustrate the use of alginate.



Stump Positioned in Casting Container

Stump Removed Showing Negative Model

Plaster Node1 Being Poured

Plaster Model Being Removed From Alginate Cast

Fillers for Polyester Plastic

Fillers are used to lighten weight and prevent cracking of polyester plastic for buildups. The most commonly used fillers in upper extremity prosthetics are pyrogenic cilica, cellulosic fibers and phenolic micro-spheres

Under a microscope pyrogenic silica resemble tiny sponges

Under a microscope cellulosic fibers look like tiny feathers

Any of the above fillers can be used for plastic buildups. They are lighter than pure resin. I

The filler is stirred thoroughly with the resin until a homogeneous mixture of the desired consistency is attained. The more filler used, the thicker the mixture. Ordinarily, a paste is made that can be applied with a spatula.

Under a microscope phenolic microsphers resemble tiny balloons

Poly-Vinyl Alcohol (PVA)

PVA film is used as a parting agent between the laminating model and the plastic; it is also used as a pressure sleeve for control of the resin during lamination.

PVA film used in upper extremity prosthetics is clear, 0.003 inch thick, and ordinarily shiny on one side and dull on the other. It is available in rolls. As a parting agent or pressure sleeve, PVA film is made into open-ended bags or used as a sheet and pulled down over the laminating model or the reinforcement layer. PVA is soluble in water; dampening, therefore 9 produces a pliable bag or sheet, convenient for stretching over the model or layup. Dampening helps control the thickness of lamination. A dry bag is strong and pulls tightly on the layup, resulting in a thin lamination. A wet bag is weaker and pulls less tightly, resulting in a thicker lamination.

PVA glue, generally used on PVA bags, is made by dissolving PVA film in hot water. (Water with the application of heat is sometimes used instead of PVA glue.)

Polyurethane Foam

Rigid polyurethane foam is used to make forearm and humeral extensions and socket buildups. Flexible polyurethane foam is used to make cosmetic buildups, as for endo skeletal arms.

Polyurethane foam is made from a polyurethane plastic resin by adding to the resin catalyst a liquid with a low boiling point. Such liquids are usually halocarbons, such as Freon. When the mixture becomes warm from the exothermic reaction of the catalyst, the halocarbon turns into gas, forming small bubbles and greatly increasing the volume of the material. The result is a lightweight foam, which is flexible or rigid depending upon the type of resin used.

The foam can be made in varying densities. The most commonly used rigid foam has a density of ten pounds/cubic foot; this is lightweight but strong enough to shape and laminate over, Flexible foam with a density of two pounds/cubic foot is ccmmonly used for cosmetic buildups.

When the foam is hardening or being cured, the catalyst and resin release toxic vapors which cause eye irritation, headaches, or symptoms similar to asthma. Foaming should therefore be done in a well ventilated room. Exposure should be as brief as possible.

The resin and catalyst can cause dermatitis if they contact the skin. Methyl ethyl ketone solvent can be used to wash the resin and catalyst from the body or tools.

The resins and catalyst should be stored in cool places. The resin can be stored for approximately six months at 70^{o} F. The catalyst should be stored at 55^{o} F. because of its halogen with the low boiling point.

The resin and catalyst must be thoroughly mixed to produce a complete foaming. Each portion must be carefully weighted; incorrect proportions will produce a nonhomogeneous and weak material. See the manufacturer% instructions for the correct proportions.

The amount of resin and catalyst needed to produce a foam to fill a specific volume can be obtained from the manufacturer% instructions. The resin and catalyst must not be shaken when the foaming action takes place because the cellular structure will collapse. (Foaming action moves upward; if this action is restrained, the foam will exert pressure on the container, resulting in a denser material.) if an insufficient amount of foam is prepared, more can be mixed and added; it will bond to itself.

Flexible and rigid foams have skins" produced by pressure against the foaming container. Flexible foams may be shaped, but strength and appearance are affected; the skin, therefore, should remain intact. Rigid foams may be easily shaped using a rasp, wire screen, and sandpaper