CHAPTER 9

COSMETIC COMPONENTS

Introduction

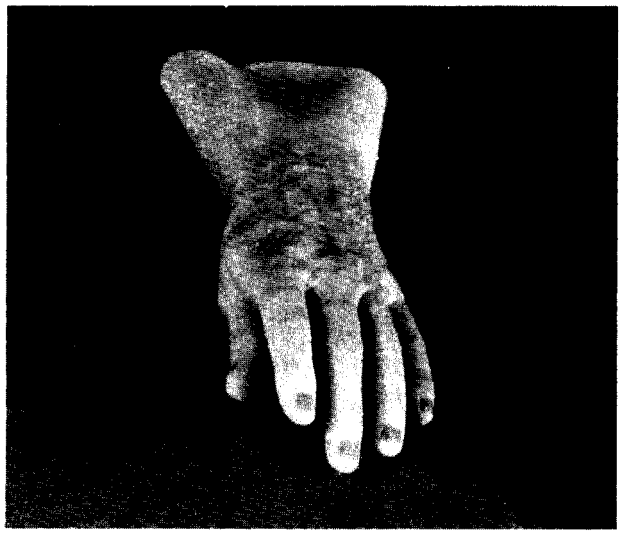
Although an artificial limb is not a perfect replacement for a human limb, the patient and public alike expect it to replace the human limb as closely as possible in both function and appearance. Unfortunately, the most efficient and effective functional prosthetic components are not pleasing in appearance because they are obviously mechanical, not human. It is now possible, however, to enhance the appearance of a prosthesis, or at least to mask the machine-ry, with the use of cosmetic components.

At present, cosmetic terminal devices consist largely of passive hands and various types of mechanical hands. None of these has been developed to the point where it can reproduce the unique movements of the human hand, and most amputees agree that these devices cannot even duplicate the efficiency of a metal hook. It is therefore important to remember that cosmesis is attained only through the sacrifice of at least some degree of function. The amount of function sacrificed for appearance depends upon the vocational and avocational requirements of the individual amputee. A woman, for example, may desire maximum cosmesis, preferring a soft passive hand with a cosmetic glove, despite the fact that all function is sacrificed. A laborer, however, needing maximum function, may sacrifice appearance and use a hook. A salesman, on the other hand, may require both function and appearance, and would choose a mechanical hand and cosmetic glove.

With the present use of polyester plastic resins, the entire prosthesis can be improved in appearance through shaping and coloring. The color of the amputee% skin can be matched as closely as possible with pigment in the resin. If atrophy of the amputated side is evident, the prosthesis can be shaped to match the normal side by using polyurethane foam buildups.

Cosmetic Gloves

Cosmetic gloves are installed on mechanical and. passive hands to improve their appearance. The gloves are made of polyvinyl chloride (PVC) plastic and are made in molds taken from human hands. As a result, fingernails, lines, knuckles, bone and vein prominences have a realistic appearance.



Glove Sizes

Cosmetic gloves are made in many different sizes and fit standard types and sizes of mechanical and passive hands. Normal hand size is determined by measuring the circumference of the hand over the heads of the metacarpals. Most mechanical and passive hands are measured the same way. Manufacturers of mechanical and passive hands and cosmetic gloves have not fully standardized sizing but have charts from which the correct hand and glove size can be selected.

The prosthetic hand is most natural in appearance if it is a half-size smaller than the normal hand. Plastic surfaces reflect more light than skin does, causing the prosthetic hand to appear larger.

Glove Coloring

Because it is impossible to exactly match the color of the human hand, coloring of cosmetic gloves is difficult and requires a certain amount of skill. Not only does the normal hand vary in color from one area to another, but it changes color with varying climate temperatures, lighting, blood supply, and sun exposure. The artificial hand retains a constant color while the patient's own hand may change color frequently.

Nevertheless, it is possible to color gloves to provide an acceptable appearance for most people. At present, prosthetic facilities either submit a color data chart to the manufacturer of the gloves to have the coloring done, or purchase a coloring kit from the manufacturer and the prosthetist does the coloring with the patient present,

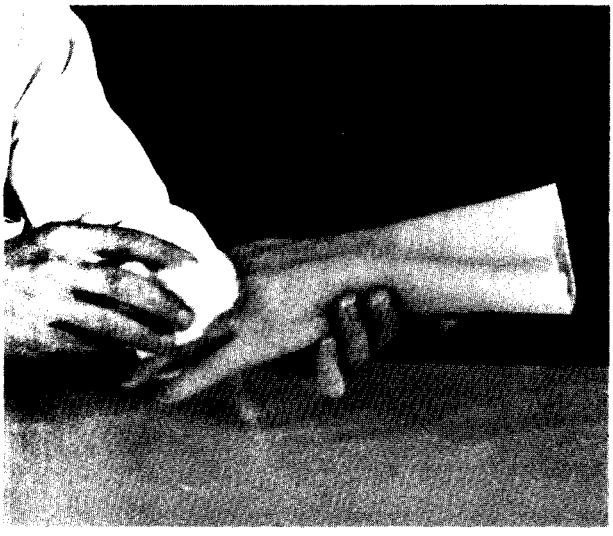
Whether the work is done by the manufacturer of the gloves or at a prosthetic facility, the method and tools for coloring gloves are the same. The basic color of a glove is cured into the plastic. These basic colors come in a variety of shades, from Caucasian to Negroid, and can be selected from shade guides available from the manufacturer. The shade guide must be applicable to the type of glove, as there are different shade guides for the different types of cosmetic gloves. When choosing the color, match the sound hand while it is hanging at the patient's side, and in natural lighting.

A coloring kit is used first to tone or "characterize" the color of the glove. Cosmetic gloves are usually long enough to permit a small portion to be trimmed from the top to test the tone coloring if desired.

Using a brush, make blue lines on the hand to simulate vein color. Wipe off excess color with a cloth when the natural color tone of the patient is reached.

Using a spray gun or brush, apply red color to the knuckles, finger pads and palm. Wipe off excess color with a cloth when the desired shade is attained.

To simulate freckles, open the nozzle on a spray gun and press intermittently on the trigger; stipple the glove on the dorsal side with red or brown color. Dab the excess color off with a cloth. Do not rub the stipples.

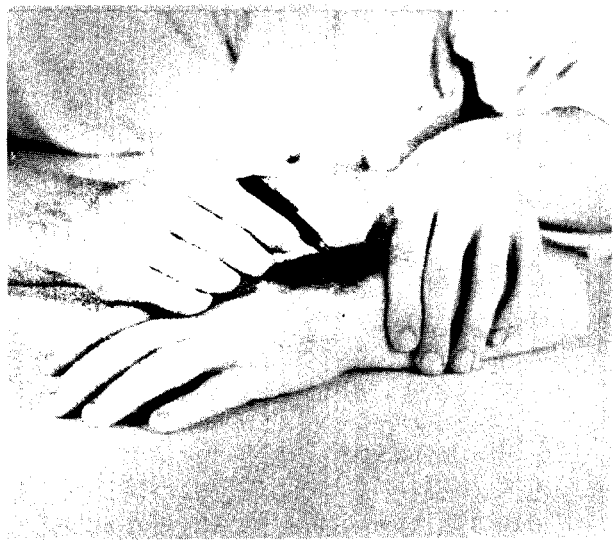


The entire glove is now ready to be sprayed with color to match the skin of the sound side. Even if the glove of the color swatch is carefully chosen, some change in color tone is usually required. Compare the color of the glove to the sound side. Natural skin appears deeper in tone and ruddier under incandescent light than under fluorescent light or in daylight. In addition, skin absorbs light whereas plastic surfaces refract it; hence, a cosmetic glove that matches well in daylight may be too light at night. In general, because a cosmetic glove darkens with age, the color of the glove should be slightly lighter in shade than the sound side.

When the coloring of the glove is completed, some touch-up or reapplication of color may be necessary. Red color gives a ruddy complexion; green- neutralizes the color if red is predominant; and brown or suntan color produces a tanned effect. The oil in which the dye is suspended is a plastizer to keep the plastic soft. The color therefore penetrates the glove. In time the color will disperse throughout the glove, and a new application of color must be made.

Women may apply ordinary fingernail polish to the gloves. First, however, a coating of "Hard-as-Nails," "Strong-Nail," or a similar commercially available base should be applied to the nails to prevent softness.

To put hair on the dorsal side of the hand and forearm of the glove, use hair from the sound arm of the patient. A needle-like tool may be obtained from the manufacturer for poking the hair into the glove. Put cloth or some other filler in the glove for backup; lay the hair on the glove and simply poke the hair into the glove (at an angle for greatest realism).

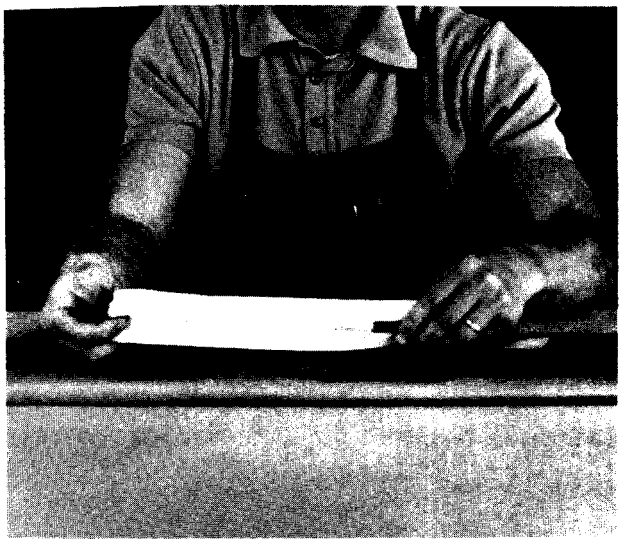


The coloring of cosmetic gloves is difficult. It requires practice, a good eye for color, a familiarity with mixing colors, and a knowledge of the patient 's needs.

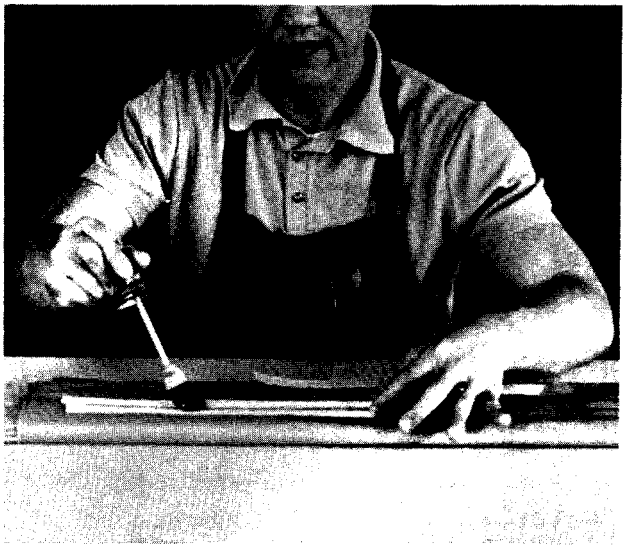
Glove Zipper

Some prostheses are constructed in such a way that a zipper is needed in the cosmetic glove for ease in application and removal. "B" - tape is used with the installation of a zipper; it is a cloth tape with adhesive on one side which attaches to the cosmetic glove. Zippers and B-tape can be obtained from the manufacturer of the gloves. (The manufacturer will also install the zipper upon request). Detailed instructions for installing a zipper with B - tape are given below.

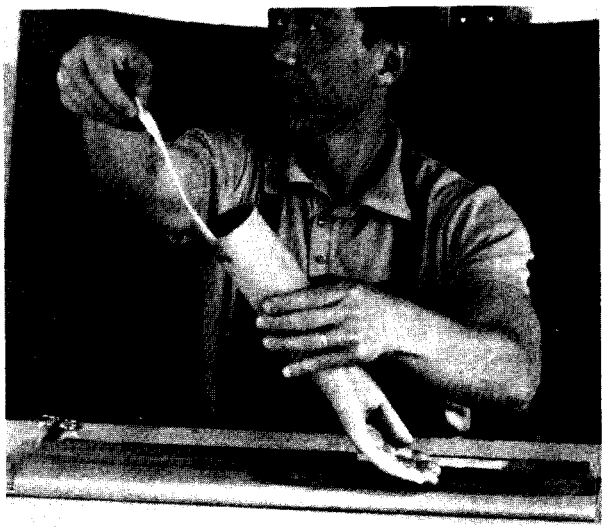
Take the slide and the lower stop off the zipper. Mask the zipper teeth to prevent rubber cement from gumming the teeth. Apply rubber cement to the cloth along the zipper on the top side.



Apply rubber cement to half of the non-glossy side of two lengths of l-inch wide B-tape. Allow the rubber cement to dry for a few minutes Attach the B-tape to each side of the zipper, leaving space for the zipper slide to move.



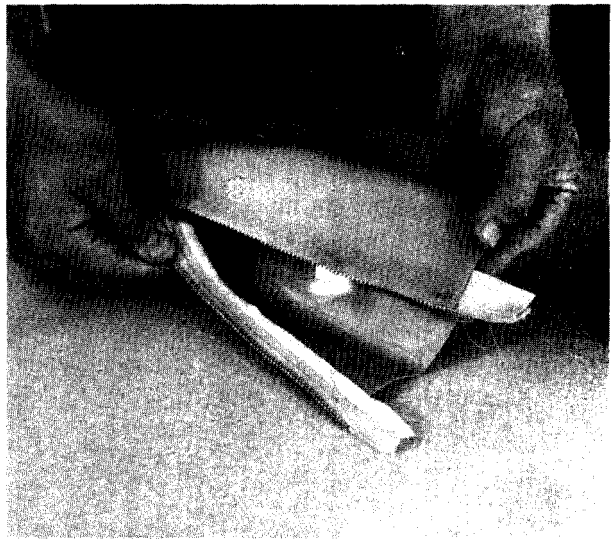
Apply methyl ethyl ketone (MEK) to the B-tape on the glossy side. Carefully position the tape on the palmar surface to the thenar crease inside the glove. The MEK activates the adhesive on the B-tape so it will adhere to the glove. (Lean the zipper toward the back of the hand to prevent it from sticking until it is ready and in the correct position)



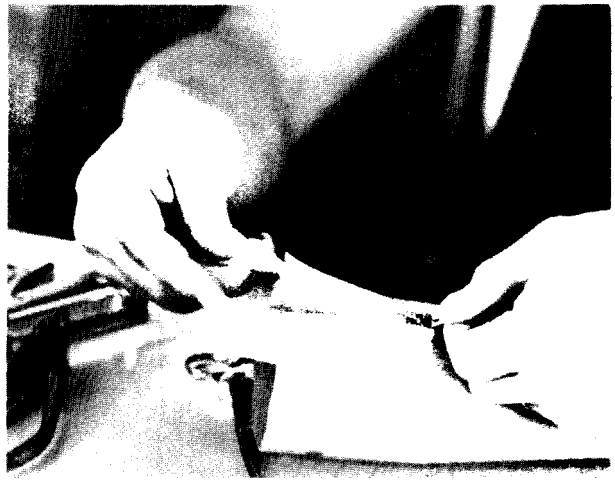
When the B-tape with zipper has adhered to the glove, hold the glove up to the light and mark the centerline of the zipper.

Cut the glove along the centerline of the zipper and carefully open the zipper all the way. The B-tape must have adhered to the glove; reapply MEK if necessary.

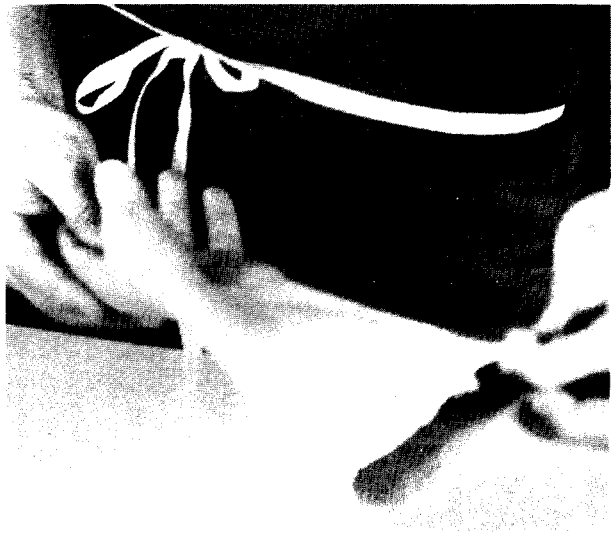
Sew the zipper to the glove by sewing along both sides of the zipper; the stitching should go through both the B-tape and the cloth. Cut the end of the zipper even with the end of the glove.



Pull up the zipper with a zipper puller and attach the slide. Now pull down the slide, open the zipper, and attach the lower stop.

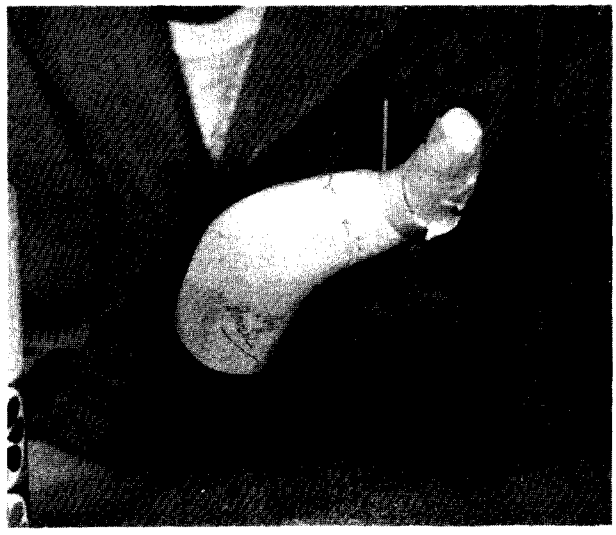


The zipper is now ready to use.

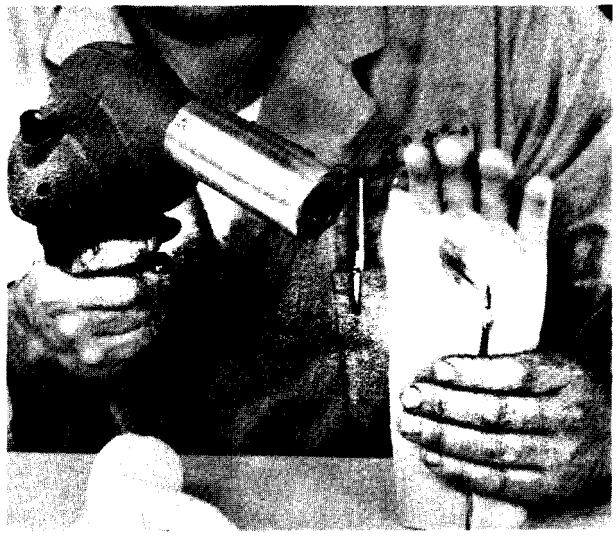


Glove Installation

The thumb of the glove must be enlarged to allow it to slip easily onto the hand. Enlarge the thumb of the model (for a partial hand amputee) or the mechanical hand by wrapping it with cloth or stockinette.



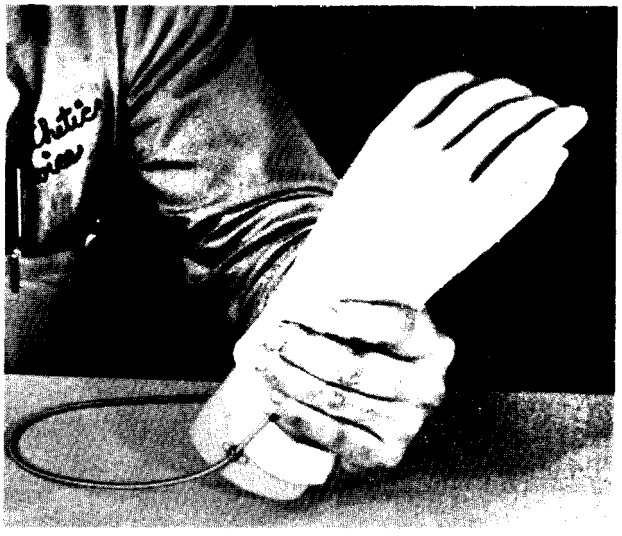
Heat the thumb of the glove and pull it over the enlarged thumb of the hand or model. Allow it to cool on the hand or model so it will not shrink back to its former size.



Next, heat the wrist and palm areas of the glove without reheating the thumb. Full the glove over a glove stretcher or other wedge shaped object, and stretch the glove. Again, allow it to cool in this stretched position.

Finally, heat the fingers of the glove and pull the entire glove over the hand. Use powder, silicone, or some other parting agent to help slip the glove onto the hand.

If any bulges in the glove exist, heat these areas and allow the glove to shrink to a tighter fit.



Glove Care

The PVC plastic stains easily, particularly because it absorbs grease and ink. The patient should therefore cautiously handle such staining materials, or wear a clear polyethylene glove over the cosmetic glove when working with carbon paper, ball-point pens, mimeograph, or fatty foods. In addition, a barrier coating is used to put a protective coating on the surface.

Glove Cleaning

A cream cleanser is used to remove grease, ink, or dirt from the surface of the PVC. The cleanser is not a solvent and will not remove stains.

A renovator is used to clean the glove and dissolve foreign material in the PVC so that the plasticizer can be absorbed and thus soften the glove.

Glove Conditioners

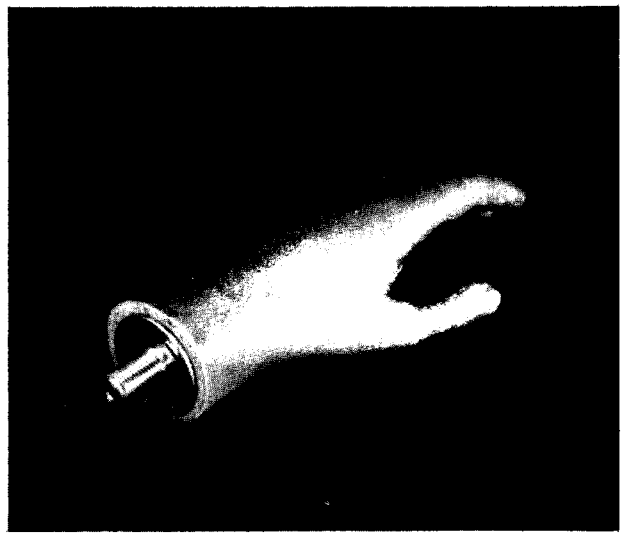
Oil plasticizer is used to soften the PVC material. Oil plasticizer in the gloves is normally absorbed or rubbed off and therefore must be replaced periodically. A cream conditioner, which contains both oil plasticizer and lanolin; is used to soften the PVC material and to put a somewhat protective coating on the surface.

Passive Hands

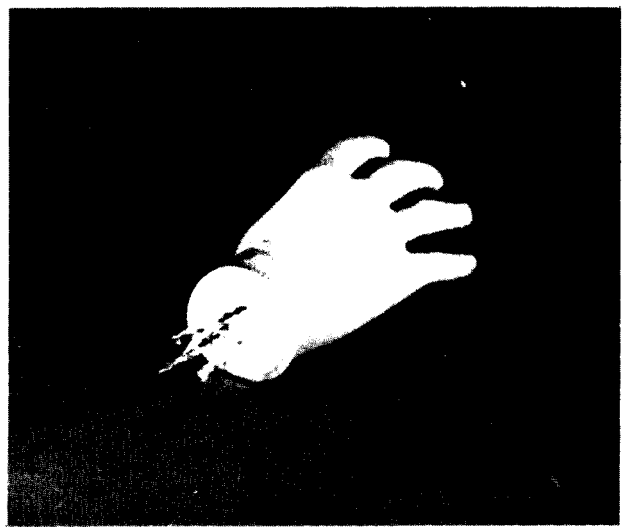
Passive hands are made of PVC foam over a flexible steel wire skeleton. The fingers and thumb can be positioned and repositioned by pressing the hand and bending the wire. Various sizes of hands are commercially available. Cosmetic gloves fit over the passive hands.

The passive hand is lighter than a mechanical hand, and looks and feels more like human flesh. The passive hand, however, has no prehension. Even the passive hand, though, can be used for limited function in assisting the sound hand.

Passive hands are available with threaded shafts that can be inserted into any standard wrist unit.

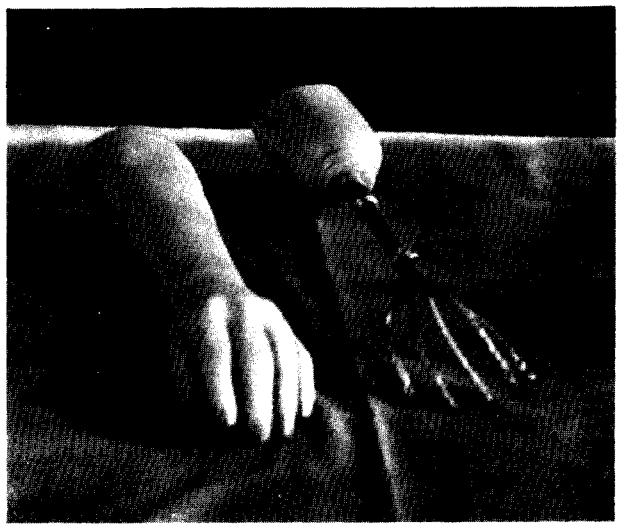


Passive hands are also available without the wrist block; they can then be fitted directly to a socket, a forearm extension, or a partial hand amputation.



Passive Lower Arms

The passive lower arms illustrated here are commercially available. Cosmetic gloves fit over them.



Some arms are made of PVC foam over an aluminum tube forearm skeleton and a flexible wire hand skeleton. These are connected to a socket by means of an attachment plate.

Others are made of a stiffened PVC forearm shell with a hand of PVC foam over a flexible wire skeleton. These are attached by heating the shell and pulling it over the socket or stump.

Elbow flexion function can be provided for an above elbow or shoulder amputee by attaching an elbow saddle to the aluminum tube of the forearm and the mechanical elbow unit. The elbow saddle is commercially available.

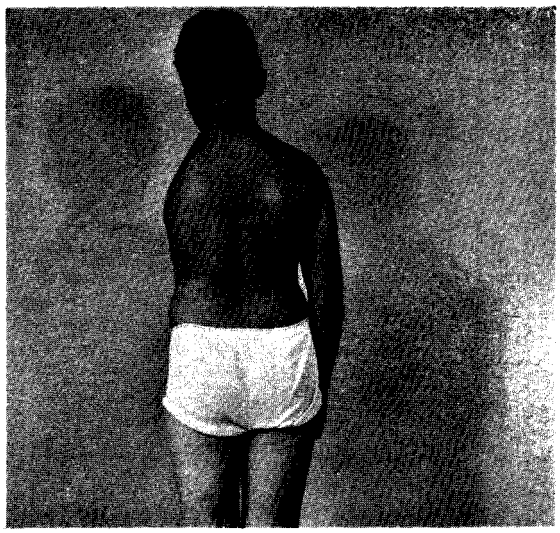
Passive Upper Arms and Shoulders

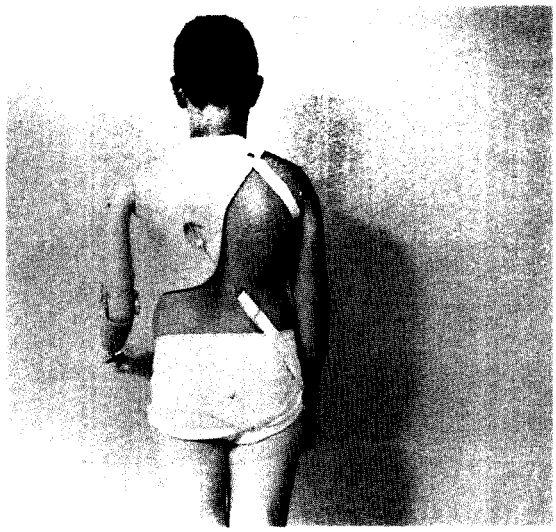
There are no commercially available passive upper arms or shoulders. Passive upper arms are very seldom used. Passive shoulders, however, are used, especially with interscapulothoracic amputations for the fitting of clothes.

The most common way to make a passive shoulder is to build up a polyester plastic shoulder socket with polyurethane foam to match the sound side. Another technique is to make a passive shoulder of a copolymer (half rubber and half plastic) material; this method is presently done only at facilities specializing in cosmetic restoration.

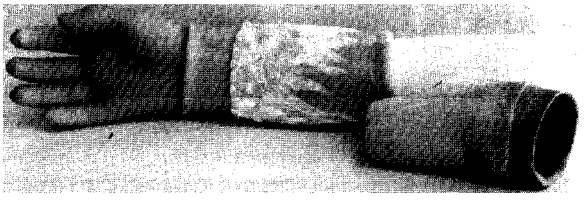
The polyester plastic passive shoulder can be weighted to compensate for the loss of weight from the absent arm. This is important for balance as well as the prevention of scoliosis (lateral deviation of the spine). The average weight of the entire upper limb of the human body is 4.9 percent of the body weight. If a patient weighs 150 pounds and the passive shoulder is to be weighted, the total weight of the passive shoulder should be approximately 7-1/2 pounds with the center of gravity at the head of the humerus.

The pictures below illustrate how a shoulder cosmesis is attained by using a foam or wax buildup and polyester plastic.

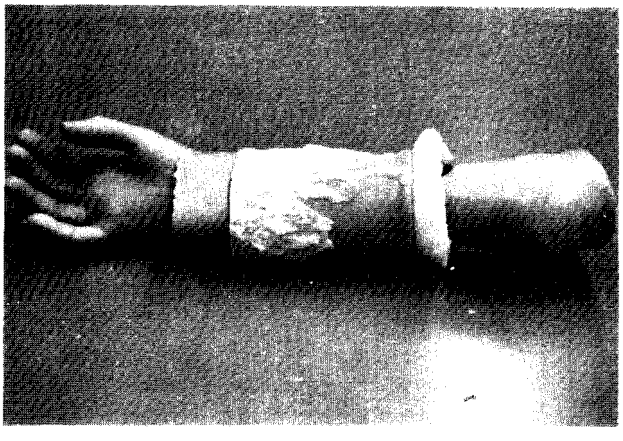




For a short below elbow passive prosthesis, a Muenster type socket can conveniently be used to retain the prosthesis and eliminate the need for the epicondyle cuff. Some range of motion is lost, however, but the hand is not functional anyway.



The prosthesis described above is illustrated below left, with the glove rolled back to show the socket. The completed prosthesis on the patient is shown at right.



For an above elbow prosthesis with a passive lower arm, active elbow flexion prevents the appearance of a flail arm. In addition, active elbow flexion enables the patient to use the lower arm to help carry a grocery bag or a purse, In such a case, standard above elbow harnessing would be used with the control cable running to and ending at the elbow flexion attachment.