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Cosmetic Covers for Upper-Limb Prosthesis

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Cosmetic covers for upper-limb prostheses have improved significantly over the past few years. Today, people have several choices when selecting a cosmetic cover for their prosthetic hand and arm. These range from durable Polyvinyl Chloride (PVC) production gloves to realistic high-definition custom silicone cosmetic covers. Traditionally, prosthetic gloves were offered in relatively low-definition PVC material with a limited range of colors. These production gloves gave the prosthesis a more natural appearance and provided protection for the components against moisture and dirt. Manufacturers offered gloves to fit specific sizes of passive, mechanical or electric hands.

Production gloves are generally purchased from the supplier of the prosthetic hand itself. However, after-market suppliers also offer these. Most have reasonable detail and uniform color. Some are now available with greater detail (high-definition production PVC) and some have color variation for a more realistic look (TrueFinish™). Unfortunately, there is no standard for cosmetic colors, so each supplier has its own collection of skin colors. Prosthetists can obtain color swatches from the supplier and match these as best they can to the user's skin tone. Due to the limited number of colors, this process does not assure a perfect color match.

color swatches

Manufacturers began offering various vinyl compounds to improve durability, stain resistance and appearance. Silicone was also introduced as an alternative to PVC. Silicone is not more durable, but it resists stains better than PVC and since cosmetic gloves are frequently exposed to newsprint and other common household materials, the silicone alternative is appealing to many. Unfortunately, not all production gloves are offered in silicone.

High pinch force associated with powered prosthetic hands can also damage silicone gloves. High-strength electric hands cause the silicone to break-down at the pinch-points between the fingers and thumb. This is particularly true of production silicone gloves. Custom silicone gloves can be manufactured with more resilient materials and with reinforcement at the finger tips to withstand these forces. To avoid the problem altogether, some prosthetists have decided to limit the hand's grip force through the prosthetic controller or choose a hand with less a less powerful grip. State-of-the-art prosthetic controllers can be set to limit the hand's pinch force. This is a trade-off users may be willing to make for the superior appearance and stain resistance of silicone.

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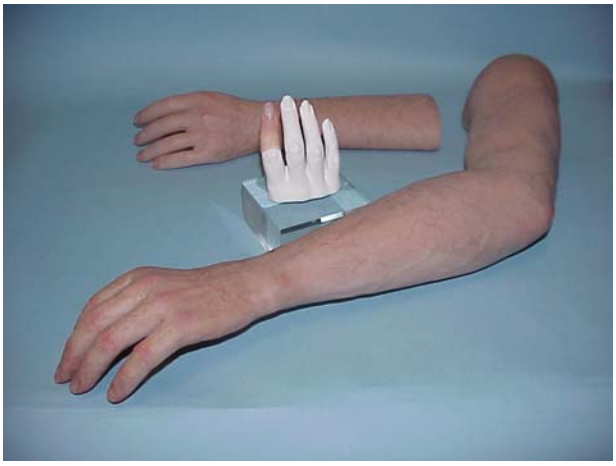

High-Definition Custom Silicone Covers

The most advanced cosmetic covers are custom high-definition silicone. These match the size, shape and features of the individual's sound-side limb in every detail. A mold is taken of the sound-side limb and used as an anatomical model to craft a matching cover. To assure proper color match, photographs or digital images of the user's hands are taken against a background template. These images are re-calibrated by the silicone facility using a graphics color-matching system. Artists and technicians then use this information to produce a realistic cosmetic cover to place over the prosthesis.

There are two methods for producing these high-definition silicone covers; creating a clear shell with a painted interior surface or, blending pigment into the silicone. Painting the interior surface has been used for a number of years, but more recently two companies have started blending color into silicone. This provides a durable surface because the color is uniform throughout and it produces natural "depth" of the skin surface.

High-definition covers can be supplied with extraordinary detail such as freckles, veins, special skin pigmentation, human hair and even tattoos if necessary. Females may want to apply nail enamel to their finger nails and this can be accomplished by substituting acrylic for the silicone nails normally supplied with these covers. The goal is to match the unaffected limb as closely as possible for a natural look. One of the limitations however, is that people's skin color changes seasonally with exposure to the sun and with certain activities that bring more blood to the surface of the extremities. Therefore, users must have realistic expectations regarding cosmetic covers for their prosthesis.

In addition to complete prosthetic covers, the custom high-definition silicone process is also suitable for partial hand restorations. Individual and multiple finger restorations are produced with amazing results. Individual fingers normally have a feathered edge to blend with the interface to the hand. These are normally attached through a suction fit. Partial hands are fit to the residual limb on a glove with holes for the remaining fingers. Watches and rings can be used to conceal joints and to draw attention away from the cosmesis itself.

Partial Hand Restoration

High-definition custom covers are time consuming to make and therefore are considerably more costly than off-the-shelf production gloves. Production gloves cost a few hundred dollars whereas custom high-definition silicone gloves cost thousands. But if appearance is critical, there is no comparison. Because of the cost, people should treat these as they would their own hands. Any of these covers can be damaged. Contact with harsh chemicals, abrasive surfaces, sharp objects and fluids that stain should be avoided. When appropriate, rubber or work type gloves should be worn to protect the cosmetic cover as one would protect the natural hand.

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Powered Gripper

When performing work tasks or hobbies that might damage hands and gloves a powered gripper should be considered as an alternative to the prosthetic hand. These devices are more functional than cosmetic. They have mechanical fingers for grasping and hooks for carrying objects. Often, they have jaws that open wider than hands and resilient grasping surfaces for greater friction. They are durable and not as easily damaged by the hazards that may affect prosthetic hands. The prosthesis can be built with a quick disconnect wrist allowing the user to substitute one terminal device for the other. The powered gripper can be worn for work-related tasks, then quickly replaced with the prosthetic hand for participating in social activities. These grippers are an excellent alternative to functional hands and should be considered as part of the total prosthetic system.

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