

Upper-Limb Prosthetic Components Function vs. Appearance

by William Hanson



People with upper-limb differences have several choices of prosthetic terminal devices. In deciding which type of device is best for them, however, they must decide whether their primary objective is function or appearance.

This is a trade-off associated with upper-limb terminal devices. Some of the most attractive prosthetic hands are passive devices, and some of the most functional devices are mechanical and powered “split hooks” or “grippers.” Passive hands are not considered very functional except for stabilizing an object. Conversely, mechanical and powered hooks and grippers are very functional, but they are not considered cosmetically appealing because they do not look like a human hand.

Between the functional hook/gripper and the passive hand are various mechanical and electric prosthetic hands. These are more functional than passive hands but less functional than grippers. Cosmetically, they are superior to the gripper but are often less attractive than the passive hand because they require a glove that is more flexible so that it does not restrict movement of the hand. These mechanical and electric hands appeal to many users, however, because they provide a reasonable compromise between functionality and appearance.

Many people want “realistic” components to avoid drawing attention to their prosthesis. Since hands are always visible, this is an important consideration. Passive, mechanical and electric hands are offered with cosmetic covers

or gloves. These gloves range from simple single-color polyvinyl chloride (PVC) with little definition to custom high-definition silicone covers. The glove material (PVC or silicone) determines the durability, stain-resistance, degree of definition and cost. The most-advanced custom high-definition cosmetic covers and partial-hand restorations are sophisticated and realistic. They attempt to match the user’s sound-side limb, both anatomically and in skin color. Some are even supplied with human hair or with acrylic fingernails so that nail polish can be applied.

More functional terminal devices generally allow users to perform tasks more effectively and often independently, and this is an important issue. Skilled upper-limb prosthetic users learn to do many things with their prostheses and often become efficient at performing bimanual (two-handed) tasks. If they can perform common activities of daily living, they might require less support from a spouse or caregiver. They might also be able to live and travel alone or participate in more activities, such as hobbies and sports. This is extremely satisfying and important to both the user and the caregiver. It is also good for the user’s self-esteem.

Upper-limb prosthetic manufacturers have attempted to further satisfy their

clients by offering various wrist units. A “quick change” wrist allows users to conveniently interchange their terminal devices. As a result, a person can use a functional prosthetic hook or gripper while at work, while working at a hobby, or while participating in a sport. Then, he or she can remove the hook and substitute a cosmetic hand to attend a social event or when going out in public. This is desirable for people who want both functionality and appearance.

Since vision must replace the sense of feeling for a person missing a hand, it is important that users be able to see the object they intend to grasp as well as the gripping surfaces of the terminal device. Prosthetic hands with five fingers tend to obscure the user’s vision while hooks and grippers have slender jaws and provide a clearer view. Additionally, some wrists provide flexion/extension and ulnar/radial deviation, which enable the user to bend the terminal device at the wrist and position it optimally for specific tasks, such as grooming or eating. This function further improves visibility because the terminal device can be offset.

The final consideration is the weight of the terminal device, which is an important factor for many users. Passive hands and split hooks generally weigh about one-third of the weight of electric hands and powered grippers. As a result, users must decide if the increased functionality of an electric terminal device justifies the increased weight. ■

About the Author



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