Advances in Hip Disarticulation Socket Design

by Erik Schaffer, CP

While hip disarticulation (HD) amputees constitute only 2 percent of the amputee population, they have the same basic prosthetic need as every other amputee: a comfortable, hygienic socket that allows them to control their prosthesis in an energy-efficient manner.

Unfortunately, heavy, uncomfortable, and uncosmetic HD sockets are still the norm rather than the exception. However, socket designs like that shown in the photos here can establish a new norm that offers HD amputees exciting improvements in energy-efficient function, comfort and hygiene.

This new design "locks" the prosthesis onto the wearer on three planes: front-to-back, side-to-side, and top-to-bottom. The intimate fit resulting from this three-tiered approach to suspension prevents pistoning (that is, movement up and down and side to side in the socket), improving the HD amputee's ability to efficiently control the prosthesis. Since HD amputees expend 200 percent more energy than able-bodied individuals, creating an energy-efficient prosthesis should be one of the prosthetist's primary goals.

Achieving this lock requires the prosthetist to detail the socket closely around the anterior pubic bone, the posterior sacrum, the ischial tuberosity, and the ileac crest. This intimate molding of the socket to each HD amputee's unique anatomy permits a dramatic reduction of the angle between the hip joint and knee. Whereas prosthetists traditionally mounted the hip joint onto the front of the socket and then angled it back sharply underneath the socket to the knee, the new socket design permits a more vertical alignment, reducing that angle by at least 50 percent.

In addition, by using ultralight materials for the socket, its weight drops to less than one-quarter that of traditional acrylic or silicone sockets. Reduced weight translates directly into less energy expenditure.

Moreover, despite the exceptional strength of these materials, they also have flexible properties. This hybrid of rigidity and flexibility, when married to the three-tiered locking system, allows the HD amputee to achieve pelvic tilt, which further lowers energy expenditure and permits a more anatomically correct gait.

All of the preceding factors also permit another important improvement: The prosthetist can now equally match the length of the prosthetic side to the sound leg. This stands in contrast to traditional socket designs, which forced prosthetists to leave the prosthesis 1/2-inch short to achieve adequate ground clearance.

The new socket design further differs from traditional models in that it actually consists of two parts: the ultralight frame and a flexible inner socket. This softer inner socket increases comfort and improves the hygienic properties of the prosthesis. (Unlike traditional acrylic and silicone sockets, which are porous and trap bacteria, the flexible inner socket is nonporous and easily cleaned.) Additional hygienic improvements result from the highly customized trim detail. By carefully contouring the socket in the areas previously discussed, HD amputees can perform normal activities of daily living (like toileting) in a more sanitary manner.

All of these advances represent a significant step ahead for HD amputees. Every amputee should have the opportunity to live life without limitations. Fortunately, new socket designs like this one are improving HD amputees' ability to do so. ■

About the Author

Erik Schaffer, CP, president of A Step Ahead Prosthetics, treats a large number of hip disarticulation, Van Ness rotation plasty, PFFD, and bilateral amputees. He has created prostheses for Paralympic athletes, marathoners, federal agents, and members of the U.S. Special Forces.