Tel.: 1 877 622-2472
Fax: 1 855 860-5595
info@waramps.ca

Hip Disarticulation and Hemipelvectomy

Hip disarticulation (HD) – amputation through the hip joint – and hemipelvectomy (HP) – amputation through and including part of the pelvis – are high level amputations that can be difficult to fit with an artificial limb. Some amputees choose not to have an artificial limb. For those who decide to have a fitting, the requirements are:

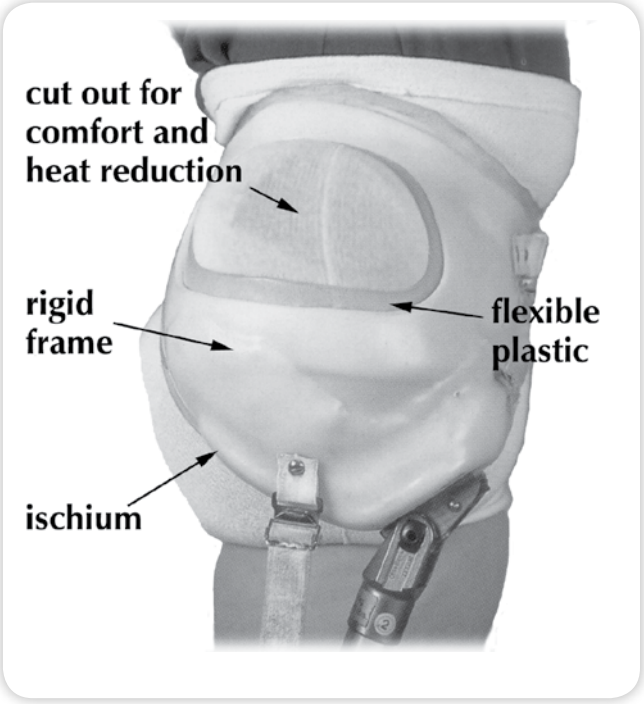
- A prosthetist experienced with these less common types of fittings
- The proper socket and choice of components
- An experienced physical therapist to work with the amputee in the rehabilitation phase
- A great deal of hard work and patience on the part of the amputee

The Socket

A rigid or semi-rigid socket is fabricated to enclose the lower torso and is held in place by Velcro or buckle straps. A fine balance must be met to provide maximum security and stability for the amputee while at the same time providing as comfortable a socket as possible (if the socket is too high, it will dig into the waist and rib cage, for example). Sockets are usually made with laminates from resins and fabric, but more and more, as for other levels of amputations, flexible thermoplastics are also being used. A more recent approach involves incorporating silicone rubber into the socket to provide more flexibility, with more rigid materials used only for the weight-bearing portion of the socket.

How amputees transfer their weight down through the artificial limb is a key factor in fitting both HD and HP amputees. HD amputees still have and can use their "sit bone" (ischium) for weight bearing; it is very important that the socket properly captures the ischium to provide maximum stability for the amputee. HP amputees, however, do not have this bone on the amputated side, so their weight is transferred through the soft tissue around the hip area and perhaps also through the pelvis on the sound side.

The prosthetist starts with a preliminary socket and works closely with the amputee to fine-tune the fit of the socket to ensure the fitting is snug and that the soft tissue enclosed in the socket is not pinched or pressured, which could cause tissue breakdown.



The Components

Hip Joints

In the 1950s, advances were made in the design of a prosthesis for HD amputees by a Canadian named Colin McLaurin. This "Canadian" design featured unlocked hip, knee and ankle joints. Previously, the joints of artificial limbs for high level amputees were kept in a locked position for walking to keep the amputee stable. This was the first design to allow flexion at the hip and knee through the swing phase of the artificial leg. The prosthesis, however, needed to be shorter to allow the amputee's toe to clear the floor when swinging the artificial leg forward.

The hip flexion bias system was developed to overcome the limitation of toe clearance. It consists of a spring-loaded hip joint that, in effect, shortens the length of the leg during the swing phase; this means the amputee does not have to vault (tiptoe on the sound limb) to ensure the toe of the artificial limb does not stub against the floor.

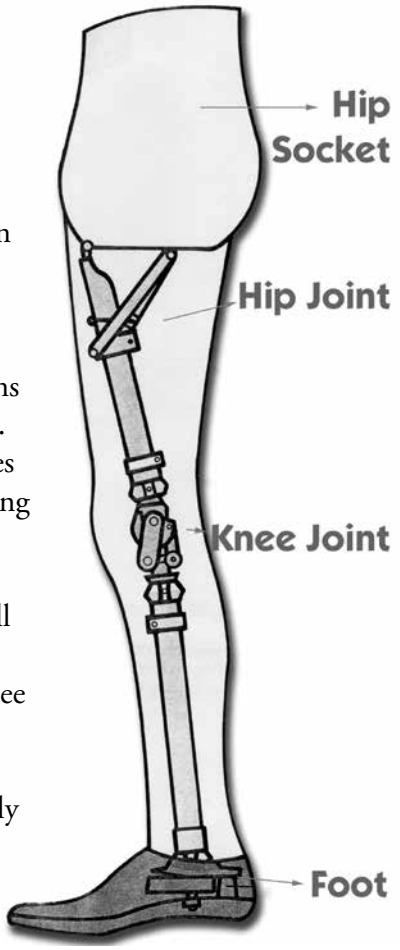
Examples of hip joints are: the **Modular Hip System**, the **7E9 Monocentric Hip Joint** and the **Helix 3D Hip Joint System** by Ottobock, DAW Industry's **Graph-Lite Hip Joint**, Hosmer's **Northwestern Hip Joint** and **Canadian Hip Joint** and Seattle Systems' **Littig Hip Disarticulation System**. Other hips for children's prostheses include the Ottobock **7E8 Modular Pediatric Hip Joint** for children weighing up to 99 lb., Trulife's **Child's Play Littig Hip** for children weighing up to 132 lb. and the **Child's Hip Joint** by DAW Industries for children weighing up to 80 lb.

Knee Joints

Considerations for knee joints are similar to those for above knee amputees. For high level amputees, the most important factors to consider when choosing a knee joint are weight, stability, reliability and ease of use.

Knee joints used for HD and HP prostheses fit into five main categories:

- Single-axis
- Safety knee
- Polycentric, four-bar/five-bar
- Hydraulic/pneumatic
- Microprocessor-controlled (MPC) knees



Single-axis knees remain widely used because they are lightweight and durable; however, more sophisticated mechanisms are gradually being used. The **safety knee** provides enhanced stability, making it a good choice for new amputees, but the amputee must remove all weight from the limb to initiate flexion of the knee (this weight shift to the sound limb can present some problems, especially when going to sit). The **polycentric knee** offers excellent stability and allows a shortening of the limb during the swing phase, which helps achieve better clearance of the foot. This knee is, however, heavier than the two mentioned previously. **Hydraulic** and **pneumatic** knees, which offer more range of motion at the hip and allow for a more natural gait, are becoming more widely accepted as a good choice for high level amputees. It is recommended that **manual-locking knees** be used as a last resort, where additional medical disabilities warrant.

Locking the knee for walking and unlocking it for sitting can be cumbersome for some amputees, and should the amputee fall backwards, he/she may not be able to bend the trunk of the body to protect the head. **MPC knees** use computer technology to enhance the function of basic mechanical knee designs, including single-axis and hydraulic/pneumatic functions. MPC knees also create a more natural gait, as changes in speed and terrain occur more quickly, making the knee function more naturally.

Additional Components

A knee rotator or turntable unit can be placed above the knee to make it easier and more natural to do certain things, such as put on shoes and socks or sit cross-legged. A torque absorber can also help the amputee function more naturally, as it allows the artificial foot to rotate outward and inward in relation to the socket, mimicking the rotation of a normal hip joint.

Feet

A large number of feet would be appropriate for a high level amputee. However, the choice of foot should match the other components in the limb, all of which should be chosen in consideration of the amputee's lifestyle. The range may be from a SACH foot to an energy-storing foot. The goal is to choose a foot that will help provide as normal a gait as possible with minimal weight and good energy conservation.

Socks

HD and HP prosthetic socks are available in the latest materials, such as those by Royal Knit, which are seamless and made of Coolmax fabric (which wicks perspiration away from the skin), and also those by Knit Rite.

Conclusion

Important factors for HD and HP amputees to consider are the provision of a good socket – the cornerstone of the fitting – and the choice of appropriate components. Because HD and HP are high levels of amputation and the prosthesis encloses more of the body, the limbs are heavier (possibly weighing 10 lb. or more) and require more energy and training to walk on. The weight factor should also be taken into consideration when choosing footwear, as it is more difficult to carry weight near the foot than it is closer to the hip. The key to a successful fitting is always a good team, including the prosthetist, therapist and, of course, a motivated amputee.

Sources for this article include: *Fitting for Hip Disarticulation and Hemi-pelvectomy Level Amputations* by G. Edward Jeffries, MD, and *Hip Disarticulation: Prosthetic Management* by Tony van der Waarde, CP(c), FCBC, and John W. Michael, MEd, CPO.