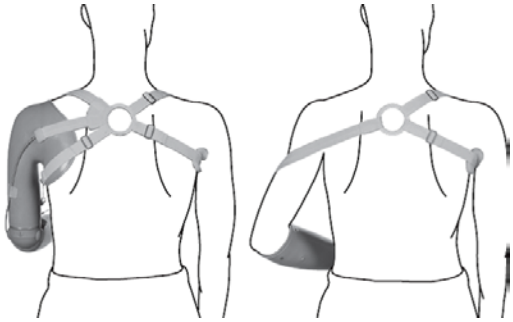
Justification for a Myoelectric Device
Ruling out a Body-Powered Prostheses

Coverage Criteria for Myoelectric Devices

One of the main coverage criteria found in upper extremity prosthesis medical coverage policies is “body-powered prosthetic devices cannot be used or are insufficient to meet the functional needs of the individual in performing activities of daily living.” This guide is designed to help you document if your patient meets this criteria.

Generally a harness is used with a body-powered prosthesis. The harness cable connects the prosthesis to the opposite side of the body. Using the sound side, the amputee applies exaggerated movements, which the harness cable captures, and in turn operates the prosthesis, opening and closing the prosthetic hand or terminal device (TD) and/or bending and locking the elbow. The gross movement that is captured is called “excursion.”



Above Elbow
Figure 8
Harness

Below Elbow
Figure 9
Harness

A body-powered prosthesis is primarily controlled via movement of the shoulders, chest and residual limb. In order to generate enough excursion to operate a body-powered prosthesis, the amputee must have sufficient control, range of motion, and strength.

ottobock.

Justification for a Myoelectric Device
Ruling out a Body-Powered Prostheses

Gross/Exaggerated Body Movements Required for Excursion

- Biscapular abduction
- Glenohumeral flexion
- Shoulder depression and elevation

Excursion Requirement for Upper Extremity Prostheses

- **Below Elbow Body-Powered:** The amount of excursion required to open a terminal device is only 2 inches; however, both glenohumeral flexion and biscapular abduction movements are required.
- **Above Elbow Body-Powered**: The amount of excursion required to fully flex a body powered elbow and open a hook fully at the mouth is 4.5 inches. Gross body movements required include biscapular abduction, glenohumeral flexion shoulder depression, and shoulder elevation.
- **Below/Above Elbow Body Powered with presence of neck or shoulder pain:** Amputees with neck/shoulder pain cannot do the necessary excursions and/or produce the necessary force due to pain. Forcing them into a body-powered prosthesis could further increase damage and pain.
- **Shoulder Disarticulation Body-Powered** amputees only have biscapular abduction in the range of 1.5 to 2.5 inches. They physically cannot produce the amount of excursion required to operate a fully body-powered system.
- **Above Elbow Hybrid** systems reduce the excursion requirement by operating some components with cable excursion and others with myoelectric input. Controlling one of the components myoelectrically allows the excursion to be used to control other components. Gross body movements required will depend on patient's capability.
- **Full Myoelectric Systems** require no excursion or cable pulling of any kind and are a good option for someone who either lacks excursion to capture gross body movements or is not strong enough to produce the excursion required to operate their terminal device to perform their required activities.

Justification for a Myoelectric Device
Ruling out a Body-Powered Prostheses

Grip Force Requirement (independent of the patient's strength or ROM)

- **Body-Powered:** Grip force using a body powered prostheses is dependent on the patient's input to the harness with up to a 50% loss of efficiency as an acceptable situation. In other words, if the patient needs 10 lbs. of pinch force routinely, he/she may have to pull constantly against 20 pounds of force because of efficiency loss.
  - Maximum grip of hook = number of rubber bands x 1 lb.
  - Maximum grip of myo hand = 22 lbs. of grip force regardless of patient ability
  - Maximum grip of Greifer = 36 lbs. of grip force
- **Full Myoelectric Systems:** A weak patient can achieve full graded grasping (prehension) using a myoelectric hand, because grip force can be adjusted to the patient's signal, so it is possible to achieve maximum output with minimal input.

Expanding the Functional Envelope.

- **Body-Powered Prostheses** can only be used in a limited space around the person where they are physically able to pull on the harness. Compensation movements are therefore required to position their body in front of the object to be manipulated. Due to the constraints of harness and cable control, there are positions in which the prosthesis can be placed where it is impossible for the user to activate the device
- **Full Myoelectric Systems:** The wearer of a myoelectric prosthesis can operate the prosthesis in any position where the muscles can be contracted (i.e., above the head or behind the back), eliminating the need for compensation movements.

Justification for a Myoelectric Device
Ruling out a Body-Powered Prostheses

Control Patterned after Natural Body Functions.

- **Body-Powered prostheses** require gross body movements for control that have little association with opening/closing of a hand.
- **Myoelectric System:** The basic trans-radial myoelectric system with two site control will use the wrist flexor and extensor muscle to close and open the terminal device. In the case of a trans-humeral system, the elbow flexors and extensors can be used to operate a powered elbow. These muscles are fully associated with opening and closing a hand, or flexing and extending an elbow, respectively.
- **Myoelectric with Proportional Control:** In the proportional DMC system grip force and strength are directly related to the strength of muscle contraction. This is the same in the natural hand.

Control of the Terminal Device

- **Myoelectric Terminal Devices** hold position and maintain grip strength after the control signals are relaxed. This grip force has very fine adjustability throughout the mechanical possibilities of any particular terminal device.
- **Body-Powered Terminal Devices:** To hold position and maintain grip strength in a body powered terminal device, the person must keep constant tension on the harness. The terminal device will only close once controls are relaxed. Without constant tension, full grip force may be achieved when relaxed in a voluntary opening system.
- **Body-Powered Terminal Devices** are either Voluntary Opening or Voluntary Closing but not both.
- **Myoelectric Terminal Device** are both Voluntary Opening and Voluntary Closing, which is dictated by the patient via myoelectric control.

Justification for a Myoelectric Device
Ruling out a Body-Powered Prostheses

Less Energy Consuming

- **Myoelectric:** The energy required to cross the "ON" threshold of .54V electrode output is considerably less than the exertion used to activate a body-powered prosthesis through its harness. Additionally, this level of signal is much smaller now in comparison to myoelectric systems commercially available in 2002. Due to advanced amplification technology, even very low levels of signal can now be used to operate a myo system.

Health Benefits of Myoelectric

- Less compensatory movements resulting in less injury and joint damage.
- Sound side limb is healthier due to absence of a harness, or allowance for a looser fitting harness when required for suspension alone.
- Residual limb musculature remains active and toned and therefore does not atrophy, especially when using a proportional system that requires higher muscle input than a digital system.

Contact information:
Ottobock US • P 800 328 4058 • F 800 962 2549
Ottobock CA • P 800 665 3327 • F 800 463 3659
professionals.ottobockus.com • professionals.ottobock.ca.com
reimbursement911@ottobock.com