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Upper limb.
Documentation guide.

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Upper limb documentation guide.

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March 2026

If you need help:

Contact the Ottobock reimbursement team

- Call 800-328-4058 and ask for reimbursement, or
- Email your request to reimbursement911@Ottobock.com

Ottobock North America, Reimbursement

P 800 328 4058 F 800 962 2549

US professionals.ottobockus.com

CA shop.ottobock.ca

reimbursement911@ottobock.com

UL documentation checklist (add to chart).

Patient name: ....

Date: ....

completed By: ....

From physician

a. **History of amputation**
- ❑ Cause, date, affected side and level of amputation(s)
- ❑ Past medical history relevant to functional limitations

b. **Physical examination**
- ❑ Height, weight, recent loss
- ❑ Cognitive ability to use and care for prosthesis
- ❑ Cardiopulmonary, musculoskeletal, neurological, arm & leg strength & ROM, balance, coordination
- ❑ Condition of residual Limb

c. **Current functional limitations** caused by current prosthesis, current condition or comorbidities

d. **Ambulatory aids/personal assistance used**

From physician or prosthetist

e. **Clinical evaluation to determine functional level.**
- ❑ Past and current functional activities
- ❑ Impact of functional limitations identified
- ❑ Realistic activities patient would like to resume
- ❑ Desire and Motivation
- ❑ Current/potential functional level (time frame to achieve it, rationale, and treatment plan)

f. **Current Prosthesis (if applicable)**
- ❑ Condition of each component
- ❑ Reason for replacement
- ❑ Has patient's condition Changed? Or is there an issue with the current prosthesis?
- ❑ Damage or Loss? Describe the incident.

g. **Environment**
- ☐ Patient's environment does not inhibit use of prosthesis

h. **New Prosthesis**
- ☐ Document recommendation for new prosthesis/prosthetic components (type and brand)
- ☐ State rationale based on prior activities, current condition, and motivation.

i. **Additional for myoelectric device**
- ☐ Reason why a body-powered prosthetic device cannot be used or is insufficient to meet the functional needs of the individual in performing daily activities. *See "Justification for a Myoelectric Device" in this publication.*
- ☐ The remaining musculature of the arm(s) contains the minimum microvolt threshold to allow operation of the selected myoelectric prosthetic device.

j. **Additional for pattern recognition**
- ☐ Reason why a standard myoelectric device cannot be used or is insufficient to meet the functional needs of the individual in performing daily activities. *See "Justification for Pattern Recognition" in this publication.*

k. **For Repair, Replacement or Liner/Socks Refill**
- ❑ Continued need (MD), continued use (prosthetist)

Standard written order (SWO)

- ❑ Patient name on ea. Page (MBI okay for Medicare)
- ❑ Date (on/before delivery date okay for Medicare)
- ❑ Description of items being ordered
- ❑ Quantity
- ❑ LT/RT for each component -recommended
- ❑ Physician demographics (NPI okay for Medicare)
- ❑ Physician's signature
- ❑ Meets your state & credentialing requirements for orders

Proof of delivery (delivered at office)

- ❑ Delivery Date
- ❑ Patient's Name
- ❑ Delivery Address
- ❑ Quantity, RT LT
- ❑ Description of items delivered
- ❑ Signature and Printed name of signee
- ❑ Relationship to patient, and reason why patient cannot sign the ABN

❑ Beneficiary authorization
❑ ABN if required

Physician demographics or NPI.
Signature, credential & date on each note.
Signature Log/Attestation if illegible.
Patient's name or MBI on each page.
Chart notes for each visit.

Fax to:		**Fax from:**	
Company:		**Company:**	
Phone:	**Fax:**	**Phone:**	**Fax:**
Patient Name:		**Date of Birth:**	**No. Pages:**

Documentation request for upper extremity prosthesis.

Physician documentation:

History of amputation:

- Cause, date(s), side(s) and level(s) of amputation(s)
- Past medical history relevant to functional limitations

Physical examination:

- Weight, height, recent loss/gain
- Cognitive ability to use and care for prosthesis.
- Cardiopulmonary, musculoskeletal, neurological, arm & leg strength & ROM, balance, coordination
- Condition of residual limb**:** pain, wound healing, skin irritation, breakdown, infection; limb volume changes; swelling, weight fluctuation, muscle atrophy, contractures, arthritis.

Functional limitations: List any medical conditions caused by current prosthesis, current condition or comorbidities. Are these conditions stable enough to allow the patient to attain the desired functional state?

Ambulatory aids or personal assistance used

Physician or prosthetist may document the following:

Define the patient's functional capability:

- Clinical evaluation to determine functional level: include past and current functional activities; impact of functional limitations; activities patient would like to resume; desire and motivation; current (or potential) functional level; if potential – time frame, rationale, and treatment plan.
- Current prosthesis (if applicable): condition of each component, reason for replacement (Change in patient's condition? Issue with current prosthesis? Damage or Loss? (describe incident).
- Environment: Patient's environment does not inhibit use of prosthesis

New prosthesis

- Recommendation for new prosthesis/prosthetic components (type and brand)
- Rationale based on prior activities, current condition, and motivation.

Additional if ordering myoelectric prosthesis

- Reason why body powered device cannot be used or does not meet patient's needs
- Document that patient has minimum microvolt threshold to operate device

Additional if ordering pattern recognition

- Reason why standard myoelectric device cannot be used or does not meet patient's needs

Additional if ordering a repair, a replacement or liners/socks

- Continued need (MD), and continued use (prosthetist)

Please FAX the signed and dated Medical Necessity documents to:

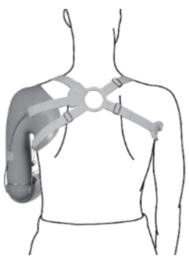
____ at (_________)__________________________

Justification for a myoelectric device.
Ruling out body-powered prostheses.

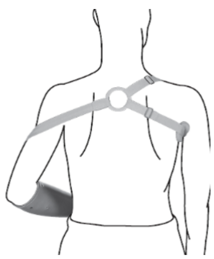
Coverage criteria for myoelectric devices

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 these 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 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.

Gross/exaggerated body movements required for excursion

- Bi-scapular abduction
- Glenohumeral flexion
- Shoulder depression and elevation

Excursion requirement for upper extremity prostheses

- **Below elbow body-powered prosthesis:** The amount of excursion required to open a terminal device is 2 inches; however, both glenohumeral flexion and bi-scapular abduction movements are required.

- **Above elbow body-powered prosthesis**: 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 bi-scapular abduction, glenohumeral flexion, shoulder depression, and shoulder elevation.

- **Below/above elbow body-powered prosthesis with presence of neck or shoulder pain:** Amputees with neck/shoulder pain cannot do the necessary excursions and/or produce the required force due to pain. Forcing them into a body-powered prosthesis could further increase damage and pain.

- **Shoulder disarticulation body-powered prosthesis:** Amputees only have bi-scapular 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 the 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.

Grip force requirement (independent of the patient's strength or ROM)

- **Body-powered prosthesis:** Grip force using a body powered prosthesis 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 (most patients can routinely operate no more than 5 lbs.)
    - 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 patient can achieve full graded grasping (prehension) using a myoelectric terminal device regardless of muscle strength, because grip force is determined by the mechanical strength of the device's motor, so it is possible to achieve maximum output with minimal input. Additionally, a patient can maintain constant grip force without constant muscle exertion, thus reducing fatigue and inadvertent movements such as crushing or dropping grasped objects.

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. Compensatory 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 such as above the shoulders or below the waist.

- **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 compensatory movements.

Control patterned after natural body functions

- **Body-powered prostheses** require gross body movements of the shoulder and contralateral side for control that have little physiological 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 muscles to close and open the terminal device and/or operate powered wrist rotation. In the case of a trans-humeral system, the elbow flexors and extensors can be used to operate a powered elbow. These muscles are more closely associated with opening and closing a hand, rotating a wrist, or flexing and extending an elbow, respectively.

- **Myoelectric with proportional control:** 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 through the mechanical capabilities 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 once controls are relaxed. Without constant tension, full grip force may be inadvertently exerted in a voluntary opening system.

- **Body-powered terminal devices** can either be voluntarily opened or voluntarily closed, but not both.

- **Myoelectric terminal devices** can be both opened and closed voluntarily, as dictated by the patient via myoelectric control.

Less energy consuming

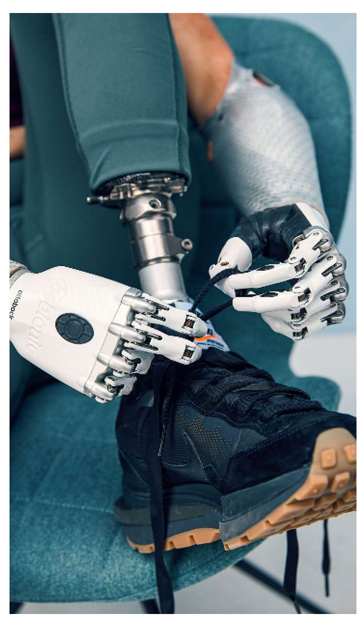
- **Myoelectric:** The energy required to cross the "ON" threshold of .54V electrode output is considerably less than the exertion used to activate a body-powered prosthesis through its harness. Additionally, this level of signal is much smaller now in comparison to myoelectric systems commercially available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

Health benefits of myoelectric

- Fewer 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.

Justification for a myoelectric device.
Ruling out body-powered prostheses.

	Why body-powered control might not work.	**How myoelectric control meets the need.**
Patient cannot tolerate a harness: 1. Upper limb pain in one or more joints. 2. Nerve impingement or pain in cervical spine. 3. Trunk or upper body adherent scar tissue. 4. Fragile or hypersensitive skin.	– Requires a harness for prosthetic suspension and control. – Harness fit must be tight to capture cable excursion. – Harness causes pain or discomfort. – Harness causes nerve impingement in axilla.	– Eliminates or reduces the need for harnessing. – Allows a looser fitting harness – Enables easier donning and doffing.
Patient has limited range of motion in one or more joints: 1. Elbow joint ROM limitations in flexion or extension. 2. Glenohumeral joint ROM limitations in flexion, extension, and rotation. 3. Scapulothoracic ROM limitations in elevation, depression, abduction. 4. Cervical ROM limitations in flexion, extension, and rotation.	– Significant upper body joint ROM is required for cable excursion to operate a body-powered prosthesis ○ **Transradial**: The amount of excursion required to open a terminal device is 2 inches. Glenohumeral flexion and biscapular abduction movements are required. ○ **Transhumeral**: The amount of excursion required to fully flex a body powered elbow and open a hook fully at the mouth is 4.5 inches. Biscapular abduction, glenohumeral flexion, shoulder depression, and shoulder elevation are required. ○ **Shoulder disarticulation**: Cannot physically produce the amount of excursion required to operate a fully body-powered system. Only biscapular abduction in the range of 1.5 to 2.5 inches is available. – Donning/doffing is difficult or impossible due to ROM required to don/doff harness.	– Myoelectric control systems do not require joint movements to drive prosthesis operation. – Hybrid myoelectric control systems reduce the joint movements required to operate a terminal device by using some cable-driven operation and some myoelectric operation. – Reduced or eliminated harnessing requires less mobility for donning/doffing.



	Why body-powered control might not work.	How myoelectric control meets the need.
Patient has limited strength in one or more upper limb joints: 1. Elbow flexion or extension weakness. 2. Shoulder flexion, extension, or abduction weakness. 3. Scapulothoracic weakness in elevation, depression, abduction.	– Grip force is dependent on the patient's force generation captured by the harness and there is typically up to 50% loss of efficiency through the harness and cable. Example: 10 lbs. of pinch force through the terminal device may require 20 pounds of muscular force. – User cannot generate enough muscular force to overcome the opposing force (rubber bands or spring) to operate the terminal device. – User is unable to maintain enough muscular force for prolonged time to prevent dropping or crushing grasped objects.	– Requires no muscular force generation to drive prosthesis operation. – Users with muscle weakness can achieve full grip strength since grip force can be adjusted to the user's EMG signal. – Residual limb musculature remains active and toned and therefore experiences reduced atrophy. – Hybrid systems reduce the muscular force generation required to operate a terminal device by combining cable-driven operation and myoelectric operation. – Myo terminal devices hold position and maintain grip strength without constant muscle exertion from the user.
Patient requires greater functional capabilities because: 1. ADLs include tying shoes or other bimanual activities required for personal independence. 2. Household or work tasks require reaching overhead, crossing body midline, reaching behind the body. 3. High activity levels produce fatigue throughout the day with repeated prosthesis use. 4. Household or vocational activities require a high grip force.	– Use of body-powered prostheses is limited to the user's functional envelope and compensatory movements are required to position one's body in front of the object to be manipulated. – Due to constraints of harness and cable control, there are positions where it is impossible for the user to activate the terminal device, such as above the shoulders. – Gross body movements required to operate a harness-driven device requires large energy expenditure. – Extended exertion is required to keep constant tension on the harness to control grip force and elbow position. – Grip force is limited by the tension of terminal device. The user must be able to overcome this to operate the device. This is usually less than 5lb of grip force.	– The wearer of a myoelectric prosthesis can operate the prosthesis in any position where the muscles can be contracted (e.g. above the head or behind the back). – Myoelectric control reduces gross motor movements when completing tasks. – Energy required to cross the "ON" threshold of electrode output is considerably less than the exertion required to activate a body-powered prosthesis. – Myo terminal devices hold position and maintain grip strength without constant muscle exertion from the user. – Myoelectric terminal devices are capable of up to 36 lbs. of grip force (name specific device grip forces here).

	Why body-powered control might not work.	How myoelectric control meets the need.
Patient requires intentional control of device for both opening and closing because: 1. Specific activities such as holding soft items, paper cups, eggs, children's hands, etc. require the device to only close when intentionally operated, to prevent crushing said objects. 2. Sustained gripping activities such as carrying a water bottle, plate, or grocery bag are difficult or impossible, due to energy required to maintain grip force for a prolonged amount of time. 3. Fatigue increases throughout the day, but the patient still needs a responsive and controllable prosthesis as muscle fatigue sets in. 4. Specific activities require maintaining grasp even while moving the prosthesis through space.	– Terminal devices are either Voluntary Opening or Voluntary Closing but cannot be both, so unintentional movement is always a risk in one direction if constant harness tension isn't maintained. – To hold position and maintain grip strength in a body powered terminal device, the user must keep constant tension on the harness. The terminal device will always return to default position if controls are relaxed. o Without constant tension, full grip force will be applied when the user relaxes in a voluntary opening system, causing damage or injury depending on activities. o Without constant tension, full opening will occur when user relaxes in a voluntary closing system, causing grasped objects to be dropped. – When moving a body-powered prosthesis through space, gross body movements can unintentionally operate the elbow or terminal device.	– Myoelectric systems can hold position and maintain grip force after the control signals are relaxed. – Both Voluntary Opening and Voluntary Closing operations are possible in a single terminal device and are operated by the patient via myoelectric control. – Myoelectric device grasp is not affected by gross body movements, so the user can maintain grip force as they move their prosthesis through space. 

	Why body-powered control might not work.	How myoelectric control meets the need.
Patient requires minimum possible cognitive load because: 1. Bimanual activities require focus on both upper limbs. 2. Specific activities require performing multiple movements simultaneously, which increases cognitive demands. 3. Complex activities require dexterity and therefore increase the cognitive load	– Body-powered prostheses require gross body movements for control that have little association with opening/closing of a hand, and therefore require additional focus to operate, making it difficult for the user to perform activities that have a high inherent cognitive demand.	– A transradial myoelectric system with two-site control will use the wrist flexor and extensor muscle to close and open the terminal device. These muscles are fully associated with opening and closing a hand and therefore allow the user to operate a prosthesis more naturally and with reduced cognitive demand. – A transhumeral myoelectric system with two-site control can use the elbow flexors and extensors to operate a powered elbow. These muscles are fully associated with flexing and extending an elbow and therefore allow the user to operate the prosthesis more naturally and with reduced cognitive demand. – In a proportional DMC system, grip force and strength are directly related to the strength of muscle contraction. This emulates the anatomic hand, enabling the user to utilize proportional control more naturally and with reduced cognitive demand. – A pattern recognition system captures the myoelectric signals generated by natural, intuitive movements of the phantom limb and interprets them to create matching movements in the prosthetic device. Artificial, unnatural movements are not needed, and cognitive load is therefore reduced.

	Why body-powered control might not work.	How myoelectric control meets the need.
Patient requires minimized compensatory motion because: 1. They experience (neck, back, shoulder, elbow) pain from overuse injuries. 2. They have a history of overuse injury, surgery, etc. 3. Performing (name specific activities) is difficult due to compensatory movements. 4. Compensatory movements make (name specific activities) slow and inhibit efficient performance of ADLs.	– Operation of a body-powered prosthesis requires shoulder excursion which leads to overuse injury – To operate a prosthesis outside of the small functional envelope permitted body-powered devices, additional compensatory movements are necessary. – Compensatory movements are required to preposition the terminal device.	– No control harnessing is required, so compensatory movements are reduced. – The prosthesis can operate in a large functional envelope, reducing compensatory movements – Electric wrist rotators allow correct positioning of the terminal device for activities, reducing compensatory movement.
Patient requires powered wrist rotation because: 1. They perform bimanual activities which leave the contralateral limb unavailable to rotate a prosthetic wrist. 2. They struggle with compensatory movements to pre-position the prosthesis. 3. They have bilateral upper extremity impairments.	– The contralateral limb is required to passively rotate the wrist – Utilizing passive wrist rotation is inefficient, causing patients to default to use compensatory movements to pre-position the terminal device – Friction required to prevent unintentional wrist rotation is difficult to overcome when rotation is desired	– The contralateral limb is not required to actuate wrist rotation – Myoelectric rotation allows pre-positioning of the terminal device for function or to achieve line-of-sight without compensatory movements – Electric rotation responds quickly and efficiently

	Why body-powered control might not work.	How myoelectric control meets the need.
Patient requires multiple grips because: 1. They perform (list a variety of activities here which require multiple grip patterns) 2. They are unable to perform (list specific activities here) with a single-grip hand in tripod pinch. 3. They avoid performing critical activities (list activities here) with single-grasp hands due to difficulty of the activity. 4. They struggle with compensatory movements to position the prosthesis.	– Single-grasp hands require compensatory movements to pre-position the device for activities, increasing difficulty and reducing efficiency of operation. – Single-grasp terminal devices only provide 1 grip, the tripod pinch, which is most suitable for heavy physical tasks but not tasks requiring fine motor control. – Single-grasp hands block line-of-sight for grasped objects.	– Lateral grasp provides larger surface area for increased grip security and improves line-of-sight to a grasped object. – Having a variety of grips available reduces the need for compensatory movement to preposition the terminal device. – Lateral grasp is not just common, but often the predominant grip selected during daily activities with advanced prosthetic hands. It is particularly favored for tasks requiring precision + stability. In clinical evidence for the Ottobock Michelangelo Hand, users demonstrated a 77% preference toward lateral grips during functional tasks, making it the most frequently used grip pattern in that dataset. [shop.ottobock.ca]

Pattern recognition vs. conventional myoelectric control.

Conventional one-or two-electrode myoelectric control for upper-limb prostheses severely restricts the amount of information an amputee can transmit to their device, much like relying on Morse code when smartphones exist today.

By contrast, pattern recognition systems use advanced algorithms and modern processing power to enable intuitive, functional control of prosthetic limbs. It translates the user's natural muscle activity into seamless movements and is rapidly becoming the preferred standard of care for all externally powered upper-extremity prosthetic users.

Natural, intuitive prosthesis control

Pattern recognition enables users to operate their myoelectric prosthesis using natural muscle signals. For example, typical hand-opening and closing motions control the prosthetic hand, while wrist rotation signals control the prosthetic wrist, mirroring the body's natural movements.

Unlike pattern recognition, traditional myoelectric systems often require unnatural muscle contractions. Patients might need to flex or extend their wrist to open or rotate the prosthetic hand—actions that don't align with how the body naturally moves, making control less intuitive.

Less cognitive effort required

Using pattern recognition reduces the mental effort needed to operate the device. This ease of use can improve device acceptance, enhance functionality, and lead to greater satisfaction. Users may find it easier to reintegrate socially and professionally, thanks to a prosthesis that responds reliably to their intent. Research by Deeny et al. (2014) demonstrated that pattern recognition control requires less cognitive effort than traditional methods. Brain activity measurements showed users found the system more intuitive, which could help reduce the likelihood of prosthesis abandonment.[2]

Reduced mode switching

Pattern recognition removes the need for cumbersome mode switching in powered prostheses. Instead of toggling between functions like hand and wrist control, users can intuitively command each component directly using natural muscle patterns. This leads to smoother, faster, and more intuitive operation such as faster, more natural control of multiple prosthetic functions, reduced cognitive load and physical effort greater acceptance, consistent use of the prosthesis, improved performance in daily activities and potential removal of bulky harnesses used in traditional systems. A study by Hargrove (2010) demonstrated reduced mental and physical load in amputees using pattern recognition versus traditional methods and showed that users overwhelmingly preferred pattern recognition over traditional control methods, specifically due to their dislike of mode switching during real-time tasks.[8]

Conventional myoelectric systems, on the other hand, rely on a limited number of isolated EMG signals, which restricts the number of control sites. As a result, patients must use switches, like muscle co-contractions or physical toggles—to cycle through prosthetic functions. This process is time-consuming, awkward, and mentally demanding, often leading to frustration or abandonment of the device.

Strong, isolated muscle contractions are not necessary

Pattern recognition offers a major advantage in prosthesis control by effectively using muscle signals that are weak, overlapping (due to crosstalk), or unbalanced. A study by Deeny et al. (2014) found users exerted less EMG effort with pattern recognition.[2]

Unlike traditional myoelectric control, which typically relies on one or two electrodes that require strong, well-isolated signals, pattern recognition systems analyze more comprehensive muscle activity data. This allows them to interpret a user's intent even from low-intensity, less fatiguing contractions. Traditional systems often force users to produce strong muscle contractions, leading to fatigue and sometimes making prosthetic control impossible if suitable signals can't be located. Additionally, signal interference between muscles (co-activation) can make traditional control unreliable. In contrast, pattern recognition benefits from this co-activation, using it as valuable input for identifying intended movements. This has significant implications. It enables users with weak or inconsistent signals—such as those affected by neuropathy or muscle control issues—to successfully operate a prosthesis.

Enhanced proportional control

Pattern recognition can fully utilize a patient's ability to vary muscle contraction intensity, translating these nuanced signals into precise motor speed adjustments and smoother prosthetic movements. This enhanced proportional control allows for more refined speed modulation, enabling users to handle delicate objects with care while still accessing rapid, forceful movements when needed. The result is a prosthesis that operates more naturally, efficiently, and with greater energy conservation. Over time, this leads to reduced mechanical strain on the device and a more fluid, intuitive experience for the user.

Unlike traditional myoelectric control, which requires isolating EMG sites and applying signal thresholds to filter out noise and crosstalk, pattern recognition captures the entire dynamic range of muscle signals

This means subtle contractions—often ignored in conventional systems—can now be used, and patients aren't forced to suppress strong muscle signals that might otherwise cause interference. Simon (2011) showed that this approach outperformed traditional on/off control during tracking tasks, highlighting its superior responsiveness and precision.[16]

Pattern recognition simplifies electrode placement

Pattern recognition reduces the need for precise electrode placement over specific muscles. Instead, it gathers EMG signals from the limb in a broader, more generalized way, eliminating the need for sustained, isolated signal "hot-spots." Electrodes can be positioned for comfort and optimal socket fit, rather than being restricted to isolated control sites. This flexibility allows for consistent prosthetic function across various socket positions.

This also allows for flexible electrode placement, avoiding problematic areas like scars or hardware. As a result, pattern recognition can support earlier fittings, less physical effort, reduced fatigue, and overall improved user comfort and health. With pattern recognition, clinicians spend less time locating muscle control sites, freeing up more time for functional training with the prosthesis. Increased practice time in the clinic supports better patient adaptation and encourages more frequent use of the prosthesis at home.

In contrast, traditional myoelectric control often relies on myotesting to identify optimal EMG sites, a process that can be both time-consuming and difficult. These ideal sites may shift over time and integrating them into the prosthetic socket to ensure consistent contact during wear is a major challenge. Even minor socket movements—like rotation or displacement—can disrupt signal detection, compromising control.

Enhanced control and reduced fatigue

Pattern recognition technology offers users a more intuitive and less fatiguing experience. This ease of control translates into better functional outcomes, allowing patients to perform tasks more naturally and efficiently.

In contrast, traditional myoelectric prostheses often rely on non-intuitive control schemes that restrict functional performance. To compensate, patients may overuse their unaffected limb, use their mouth or teeth for tasks, or avoid certain activities altogether. These compensatory behaviors can lead to long-term health issues, such as joint strain, dental damage, and posture-related complications.

Pattern recognition is not just a technological upgrade—it's a meaningful advancement in prosthetic care that empowers users to live more fully and functionally.

Pattern recognition clinical evidence.

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