UNDERSTANDING AND USING
YOUR MYOELECTRIC PROSTHESIS

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UNB Monographs on
Myoelectric Prostheses

2. Understanding and Using Your Myoelectric Prostheses

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Preface

Understanding and Using Your Myoelectric Prostheses represents the second publication in our series of UNB Monographs on Myoelectric Prostheses.

Although the booklet has been written principally with the patient or the user in mind, it should also prove invaluable to many other health care professionals who are either indirectly involved or have an interest in the subject of myoelectric prostheses.

The text of this monograph has been written collectively by a team of experts led by Professor Robert N. Scott of the internationally recognized Bio-Engineering Institute of the University of New Brunswick in Fredericton. This handy publication should serve as an owner's manual to patients as well as parents of small children. In addition to a common sense approach, this written and illustrated material provides the user with a clear and basic knowledge of not only the various components that are essential to fabrication and fitting, but also about the workings of the team behind you and your myoelectric prosthesis. Furthermore, it contains many simple and useful instructions for the day-to-day use and care of your new limb irrespective of the type of system utilized therein.

We wish you long and continued success with your myoelectric prosthesis.

Ashok S. Mazumdar

Series Editor
Acknowledgement

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The success of this research is due in large part to the contributions of my colleagues in the Institute, to students who have served as volunteer subjects, and especially to the many patients who have evaluated our experimental prostheses.

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R. N. Scott

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1. Introduction

The purpose of this booklet is to help you to understand your myoelectric prosthesis, so that you can care for it and use it most effectively.

The booklet as written by staff of the UNB Bio-Engineering Institute who have many years experience in all aspects of this field. The Institute was responsible for the first Canadian myoelectric prosthesis in 1965. Since then we have worked continuously to develop better myoelectric controls for adults and children.

In writing this booklet we have tried to avoid unfamiliar jargon. It was necessary, though, to use many words which some readers will not know. You will find explanations in Section 8 of all words printed in bold face in the text.

The booklet does not deal just with UNB systems. Rather, it is written so that it will help you to understand and get the best results from any myoelectric prosthesis.

If you have trouble understanding any part of the booklet, or have additional questions which are not answered in it, talk to members of your prosthetics team. If that doesn’t suffice, call or write to the Bio-Engineering Institute. We shall be glad to help.
2. Basics

This Section provides basic information about myoelectric prostheses. You might think of it as an "owner's manual".

2.1 What is a Myoelectric Prosthesis?

A myoelectric prosthesis is an artificial arm controlled by the very small electric signals from your muscles. It is powered by a battery, which must be recharged regularly. It is fitted directly to your residual limb* and you will not require any form of surgery to use it.

2.2 The Basic Elements of a Myoelectric Prosthesis

A myoelectric prosthesis includes the following elements:

- a socket, which encloses the residual limb, and suspends and stabilizes the prosthesis,
- a prosthetic forearm which provides an arm-like appearance, encloses electronic components, and supports (and positions) the terminal device,
- a battery, which stores energy (or operating the terminal device or other powered components),
- electrodes, which provide electrical contact between the skin and the electronic control unit,
- an electronic control unit, which senses the electrical activity of the muscle(s) and controls the flow of power to the terminal device accordingly, and
- a terminal device which replaces the normal hand.

These elements are illustrated in Figures 1 and 2.

![Figure 2: Mechanical Elements of a Myoelectric Prosthesis](image2)

2.3 Terminal Device Options

Most myoelectric prostheses use an electric hand as a terminal device. These are available in a wide range of sizes, suitable for anyone from about two years of age up. They offer only a simple open-close function, unlike normal hands which can perform very complex manipulations. But they grip very strongly, and can maintain a strong grip indefinitely without using any energy — something normal hands can't do. Appearance of these hands is quite good. The shape is as close to that of a normal hand as the mechanism allows. A cosmetic glove covers the mechanism to provide a skin-like color and texture.

For adults doing heavy mechanical work, or very dirty work, another terminal device is available. This is the "Greifer", made by Otto Bock. It is a very strong parallel-jaw gripping device, more like a pair of vise grips than a hand. A number of other powered terminal devices are available.

Sometimes for an above-elbow amputation it is preferable not to use an electric terminal device. If function still is desired, a conventional hook operated by body movement may be provided. If so, it may be helpful to have a cosmetic hand to replace the hook for social occasions where appearance is more important than function.

Several commercially available terminal devices are shown in Figure 3.

![Figure 3: Some Terminal Device Options](image3)

*Residual limb: we prefer this to "stump" as a term to identify the remainder of your limb, but you will encounter both terms and should not consider either in any sense derogatory

2.4 Control Options

While the basic idea of myoelectric control is very simple, selection of the best control scheme for each individual may be a challenging task for a team of professionals. This Section describes some of the options which are available.

The simplest myoelectric control option is to have the motor which runs the terminal device arranged so that it runs when a muscle contracts and does not run when the muscle is relaxed. This is fine except that you may want to reverse the motor: a hand must open and close. Perhaps the easiest way to do this is to use two muscles. Contracting one muscle will make the hand open; contracting the other will make it close. When both muscles relax the hand stays still. This control option, called two-muscle on-off control, is used more widely than any other. It does require two muscles which you can contract and relax independently, and sometimes that is a serious limitation.

The same function can be achieved in a one-muscle three-state control, but the idea is a bit more complicated. Typically it works like this: If the muscle is relaxed the hand stays still (the Off state). If the muscle contracts slightly the hand closes (the Closing state). If the muscle contracts moderately or strongly, the hand opens (the Opening state). Alternatively, the same result may be obtained by selecting the direction of movement (open or close) based on the basis of the speed with which the muscle contracts, rather than the strength of contraction.

Some myoelectric controls, most commonly used in above-elbow prostheses, provide an output (such as elbow movement) where speed or position depends upon the amount of myoelectric signal. These are called proportional control systems, and may require coordinated control of several different muscles.

Physical location of the electronic control system may be as varied as the control schemes themselves. Sometimes most of the electronic circuitry is put in one package, hidden away in the forearm; sometimes it is scattered through the system, some in the electrode assembly, some near the wrist, some in the hand. Section 2.6 illustrates a few of the more common possibilities.

Sometimes, especially for prostheses requiring more than one powered function, electrical devices may be controlled by more than one myoelectric signal. Possibilities range from simple switches operated by body movement to more complex servo controllers or touch switches.

2.5 Battery Options

All myoelectric prostheses use NiCad batteries, as these are the most efficient rechargeable batteries available at this time. Generally the idea is that the battery runs the prosthesis in the daytime and is recharged at night. There are three basic options for battery location. The battery may be built in, hidden within the prosthesis, providing ideal appearance. This does pose one big problem, though. If the battery becomes discharged it cannot be replaced easily. Some systems designers have responded to this problem by providing a "fast-charge" option, so that the battery can be charged in a few minutes.

A more common option is to place the battery at the surface of the prosthesis, where it is easily removed and replaced with a fully-charged battery as needed. This may interfere with the appearance of the prosthesis, but often the cosmetic loss is not significant compared to the advantage of a quick-charge battery. This is particularly true if your use of the prosthesis often exceeds the capacity of a built-in battery.

Finally, for infants and young children where there isn't room for the battery within the prosthesis, the battery may be clipped to clothing or placed in a pocket. This makes the prosthesis lighter, but the external battery is a nuisance and most people prefer to place the battery in the prosthesis as soon as sufficient space becomes available.
2.6 Common Configurations of Below-Elbow Prostheses

2.7 Above-Elbow Myoelectric Prostheses

For persons whose amputation level is above the elbow the requirements for a prosthesis are greater and the number of possible configurations is enormous. It would not be possible to list even the most common systems in a small booklet. Instead we have listed in Table 1 available options for each function, which may be assembled in suitable configurations for specific wearers.

<table>
<thead>
<tr>
<th>TERMINAL DEVICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive hand, various sizes, (primarily for cosmetic restoration)</td>
</tr>
<tr>
<td>Conventional hook, various sizes, operated by body movement via a mechanical cable</td>
</tr>
<tr>
<td>Electric hand, various sizes, from about two years of age to adult</td>
</tr>
<tr>
<td>Greiffer, (Otto Bock), heavy duty electric terminal device with parallel jaw action</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WRIST UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive friction wrist, permits rotation to any desired angle</td>
</tr>
<tr>
<td>Quick disconnect wrist, permits rotation to desired position and quick exchange of terminal devices</td>
</tr>
<tr>
<td>Flexion wrist, permits adjustments of flexion/extension and rotation to desired angle</td>
</tr>
<tr>
<td>Electric wrist rotator, (Otto Bock), provides powered rotation to any desired angle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELBOW UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional locking elbows, various types, controlled by body movement via a mechanical cable</td>
</tr>
<tr>
<td>Electric elbows, various types and sizes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SHOULDER UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive friction shoulders, various types, permitting positioning of the arm but no active function</td>
</tr>
</tbody>
</table>

Table 1 Some Options for Prosthetic Systems

It should be noted that several centres are working on new devices, so the list of options is increasing gradually and the task of selecting the best system for each individual is becoming more difficult. However you will see from Table 1 that we are severely limited, at this time, in our ability to restore function to persons whose complete arm and shoulder is absent.

2.8 Advantages and Limitations of Myoelectric Prostheses

Compared with conventional prostheses myoelectric prostheses offer greater power, reliable operation through a wider range of body positions, operation with less physical effort, and improvedcosmesis. For below-elbow prostheses, freedom from the need for a harness is especially important.

An obvious limitation is that myoelectric prostheses are more complex and therefore more expensive. Because generally they are available only in highly specialized centres, travel for fitting and followup, as well as repair, may be an obstacle. Training is required if you are to use a myoelectric prosthesis effectively, but the amount of training needed is not really much greater than for optimum use of a conventional prosthesis. Myoelectric prostheses require some routine care, but this is not difficult and will be covered thoroughly during your training. The most important aspect of this routine care is daily charging of batteries.

We believe that, for a great many potential users, the advantages truly outweigh the limitations.

Figure 4 Three Common Myoelectric Prosthesis Configurations

Figure 4 illustrates three of the most common configurations of below-elbow myoelectric prostheses. You will notice that all of these configurations use a socket which does not require straps or harness for suspension. A suspension harness is used very rarely in fitting below-elbow myoelectric prosthesis. Freedom from a harness is one of the most important advantages of myoelectric prostheses to many people.
3. The Prosthetics Team

Whether there is any formal group called a prosthetics team or not, provision and use of a myoelectric prosthesis must be a team effort. Sometimes the team works in a special relationship referred to as an amputee clinic or prosthetics clinic, and may be called a clinic team.

3.1 The Amputee*

If you, the ultimate user of the prosthesis, are not fully committed to making this venture a success, then the best effort by all other team members will end in failure. Getting a myoelectric prosthesis is not like getting a pair of shoes. There is a personalized fitting and training process in which you are an important participant. Your active collaboration is essential.

3.2 The Doctor

Provision of a prosthetic limb is generally regarded as a part of the rehabilitation process. Most centers require that a prosthesis be prescribed by a doctor. There are two groups of medical specialists who usually become involved in prosthetics — specialists in orthopaedic surgery and specialists in rehabilitation medicine.

If you are referred to such a specialist by your family doctor, he or she will want to do a thorough examination before prescribing a prosthesis. Probably specialists in other aspects of prosthetics will be consulted; that’s the basis of the team concept.

3.3 The Prosthetist

Providing the actual prosthesis is a complex procedure with many steps, as described in Section 4 below. All of this work is done or supervised by a highly skilled professional called a Prosthetist. As well, he or she will play an important role in the team decision as to what type of prosthesis best meets your needs.

3.4 The Therapist

The therapist — usually an Occupational Therapist but sometimes a Physiotherapist (Physical Therapist) — will have a primary responsibility for training you to use your prosthesis (see Section 5). As well, she or he also will provide valuable input into the decision as to the best type of prosthesis for your specific needs.

3.5 The Engineer or Technologist

Sometimes this team member is not seen at all by the amputee, but serves rather as a consultant to other team members on technical problems. We feel that this is not ideal, and that the engineer or engineering technologist should be involved as well in developing the choice of the most suitable prosthesis for the individual amputee. This is particularly most important for situations where a very complex prosthesis is needed.

3.6 Others

Many other specialists may be included in the team, the selection depending on the interests and availability of personnel and on your specific needs. A Social Worker or a Clinical Psychologist may be involved in helping new amputees to cope with social problems. A Rehabilitation Nurse may be involved in the care of patients immediately following amputation.

Usually, one team member, selected for organizational skills rather than professional specialty, is designated Clinic Coordinator, with responsibility for scheduling, followup and (often) for assisting you to arrange payment for prosthetics services. Each member of the team is chosen to fill an important role, with the overall objective of meeting your needs most completely.

3.7 Teamwork

All members of the team must work together, but all of this activity is focused on your needs and preferences. If the team is to succeed, your input is essential. If you don’t understand something, ask! Then participate in the discussion. Remember that prosthetics — and rehabilitation generally — differs from much of medical practice, because in rehabilitation you are the real expert on your needs.

4. Fitting the Myoelectric Prosthesis

4.1 Examination

A very careful examination of your residual limb is done, to identify all details which require special attention in designing the prosthesis. Measurements are made on the normal limb as well, because the prosthesis must match that limb as nearly as possible.

4.2 Control Site Selection

One of the team members, usually the prosthetist or the therapist, will spend some time measuring electric signals on the surface of your residual limb while you contract the muscles, in order to find the best electrode locations.

These locations, often called control sites, will be marked on the skin with a special pencil so that they can be located easily on the cast which is taken next.

4.3 Casting

In addition to electrode locations, other important details of the residual limb are marked on the skin, which is lubricated so that the cast will not adhere to the skin. The residual limb is then wrapped with moist plaster of paris bandage, which is molded by the prosthetist to the desired shape. When the plaster has hardened it is removed carefully, and reinforced with additional plaster. The resulting plaster cast can be used as a check socket to verify that the shape is satisfactory before further work is carried out.

4.4 Socket Fabrication

When the prosthetist is satisfied that the check socket fits satisfactorily he or she fills it with plaster of paris to create a positive model. This is modified further and used as a mold over which the inner socket is made using a fabric (dacron, fiberglass, cotton or nylon) with an acrylic or polyester resin.

4.5 Socket Fitting

Because it is important that the electrodes remain in firm contact with the skin at all times, the socket for a myoelectric prosthesis must fit very accurately. The use of stump socks, common with conventional prostheses, is not possible here.

Depending on several aspects of the residual limb, the prosthetist will choose one of two methods of putting the prosthesis on. A pull-in method involves using a thin nylon sock to draw all tissue firmly into the place in the socket. Alternatively, you may be able to push your residual limb into the socket without such assistance.

To make sure that the inner socket fits securely and comfortably, weight may be added to it temporarily, after which you will be asked to wear it for a few hours. If necessary, modifications may be made at this stage. Then, when the fit is satisfactory, the electrodes are installed. This point you may be asked to wear the socket during training sessions, using either a toy, a meter, or a prosthetic hand. Throughout this period, team members will be especially attentive to how well the socket fits, and alterations may be made repeatedly. This part of the fitting process is critical, and must not be rushed.

4.6 Completing the Prosthesis

With the inner socket finished, the prosthetist must make the remaining portion of the femur, usually with the same technique used for making the inner socket. All components are then installed, and the finished prosthesis is checked for proper function.

4.7 Checkout and Followup

Before the prosthetist’s work is finished a final check is made with the completed prosthesis, to make sure that all aspects of comfort, cosmesis, and function are satisfactory. It is important that you discuss with the prosthetist at this time any concerns you may have about the fit of the prosthesis, so that these can be resolved at the outset.

After the fitting has been completed and you are wearing the prosthesis regularly, the team will arrange for frequent contact with you to ensure that the prosthesis continues to fit well and work properly.

*Amputee is used in the North American sense to include persons with limb deficiencies due to amputation as well as those with congenital limb deficiencies.
5. Learning to Use a Myoelectric Prosthesis

Initially you may find this part of training quite tiring, but that problem usually just lasts a few days.

Training in signal production generally takes several hours. The next stage, which is long and ever more important is called functional training.

5.2 Functional Training

Functional or "use" training begins when the prosthesis is ready to be worn. You will learn to use the prosthesis to help perform the day to day activities which most people do with two hands. Because these activities vary depending on your age, employment and interests, the functional training program is designed for each individual. Training to carry out activities with both hands helps you to look natural, and allows you to do things which may have been difficult to do with one hand. It takes a long time to develop new two-handed habits, especially if you have not worn a prosthesis for long time, but most people find that the results are well worth the effort.

Some examples of two-handed activities which might be practiced during functional training follow.

Children
- riding a bicycle
- sharpening a pencil
- starting a zipper
- building with Lego

Adults
- cutting meat
- typing shoelaces
- playing cards
- sewing on a button
- putting up an umbrella

During training sessions, you will be instructed in basic care of the myoelectric prosthesis. This includes how to charge the batteries, how to clean the prosthesis and how to take care of the gloves. Also, you will be taught to recognize problems that should be brought to the attention of the prosthetics team.

Functional training can take from 10 to 30 hours. Skill in using the prosthesis will continue to improve for some time following the formal training period. Normally you will be asked to return to see the prosthetics team several times during the first year, to consolidate skills and ensure that good patterns of use are developing.

6. Care of a Below-Elbow Myoelectric Prosthesis

The following notes apply specifically to a below-elbow prosthesis. Your prosthetics team will be able to supply additional advice for more complex prostheses.

6.1 Wearing the Prosthesis

You may find that a myoelectric prosthesis is tight to put on at first. The snug fit is important so that the prosthesis will stay on securely without straps and so the electrodes will always maintain good contact with the skin. Putting a prosthesis on gets easier with practice. To help you slide into it, put a small amount of hand lotion, powder or water soluble jelly (Muko or KY) on your stump.

If you use powder, moisten your skin slightly in the vicininity of the electrodes, since the electrical impulses are more difficult to pick up from dry skin. Because powder can cause malfunction of the hand if it gets inside, take care not to use too much.

Put the prosthesis on first, then turn on the power switch or insert the battery. Before removing the prosthesis, turn off the switch, or remove the battery. By developing this habit, you will avoid the excessive power drain which may occur when the prosthesis is off the stump with the battery connected.

It is a good idea to increase your wearing time gradually. Typically you may be advised to wear the prosthesis for 3-4 hours the first day and add 1 hour each day. If redness or pressure spots develop in any area, contact your prosthetist. If you get a cut or sunburn on your stump, leave the prosthesis off for couple of days to give the stump time to heal. If you have questions, contact your prosthetics team.

6.2 Care of the Battery

If your prosthesis has a battery inside the forearm, it must be charged every night, using the battery charger supplied. Make sure the power switch is turned off, then simply plug the charger into the connector on the prosthesis and into any 120 volt household receptacle. Most chargers have a small light which indicates that the battery is charging. Never charge your battery while wearing the prosthesis.

If your prosthesis has an external battery which snaps into the side of the forearm, or clips to your clothing, you will be supplied with two or more batteries which you can alterate when one runs down. Charge the low batteries in the charger supplied. In most chargers a light indicates that the batteries are charging. Never leave the battery in your prosthesis when it is not being worn, since this will drain the battery.

Most battery chargers do not shut off automatically. As a general rule, recharge the battery approximately 10 hours each night, every night. A longer charging time (6-14 hours) occasionally will not harm the battery. With good care a battery should last 1.5 to 2 years. If for some reason you cannot wear your prosthesis for a week or more, charge the battery once a week anyway. If you have external batteries, make sure you give all of them approximately equal amounts of use. (It is helpful to mark each battery so that you can tell them apart).

Some battery chargers are designed to be used both on (North American) 120 volt circuits and on (European) 240 volt circuits. These chargers have a switch, marked 120v-240v, which must be in the correct position. As children may move this switch, it is advisable to tape it in the correct position.

You will notice that the battery and hand are less efficient when they are exposed to the cold, so your hand may not open and close as quickly or as wide when you are outside in the winter. They will recover quite promptly once you get back inside.

6.3 Care of the Socket and Residual Limb

Wash your residual limb off well every day to avoid a build-up of powder on your skin.

Never use oily creams on your residual limb since this impedes pick-up of myoelectric signals.

Wipe the inside of the socket out with a damp cloth daily. Never dunk the prosthesis in water, or let the electronic control get wet. Wipe the socket out with rubbing alcohol several times a week to reduce bacterial growth thereby decreasing the likelihood of skin irritation. Pay particular attention to cleaning the area between the electrodes because any build-up of foreign material can interfere with the myoelectric signal.

6.4 Care of the Cosmetic Glove

It is inevitable that the cosmetic glove on a myoelectric prosthesis will eventually become stained and torn with normal wear. On a relatively quiet person, a glove may last 8-12 months or more, while an active child or adult may
need the glove replaced in 2-3 months. Although care should be taken not to abuse the glove, activities should not be restricted for fear of damaging it. Once torn, gloves cannot be repaired, and should be replaced as soon as possible.

The glove may be cleaned by scrubbing it with soap and warm water, as long as the glove is not torn and water does not go over the top of the glove. The glove can be massaged with ‘Niven’ cream and wiped off with a clean cloth to provide a barrier to some stains.

Staining will occur if the glove comes in contact with newsprint, ball point ink, permanent markers, carbon paper, dye from new clothing and some food items like cherries, carrots and mustard. If the stain is noticed as soon as it happens you may be able to lighten it with rubbing alcohol or an alcohol-based product like Wash and Dry’s, which are also convenient to carry with you.

A light mitt, or even a plastic bag can be worn over the hand while doing dirty jobs.

6.5 Care of the Wrist Mechanism

If the glove binds and seems to restrict movement of the wrist unit, spray a little ‘Pam’ between the glove and the prosthesis. Never use talcum powder since this can get down inside the hand and damage the wrist mechanism.

6.6 Care of the Hand

The hand is the most expensive part of the myoelectric prosthesis, and care should be taken to see that the fingers are not forced or bent. Never use the myoelectric hand as a hammer or weapon and avoid activities which put pressure on the side of the index finger, eg using a shovel with a straight handle (a "D" type handle is better).

It is a good idea to develop the habit of keeping the hand slightly open when you are not holding something. This not only looks more natural but also prevents the finger tips from becoming flattened. Keeping the fingers slightly apart also avoids the chance of giving repeated close signals to an already closed hand, which causes excessive battery drain in the Otto Bock system.

If you have an Otto Bock hand, it is particularly important that you never force the fingers open or closed, since this can damage the gear mechanism.

If you have a Steeper Bock hand, there is a "break away thumb" mechanism which allows you to release your grip in an emergency. Don’t use this feature unnecessarily, as frequent use will cause undue wear. But do ask your prosthetist to demonstrate it, so that you will be aware of its correct function.

7. Problem Solving: When to Seek Help

There are a few common sense checks which you should do before seeking help if your prosthesis seems not to be working properly. Like all electrical systems, a common reason for the prosthesis to not work is that there is no power. Check to see that any switches in the system are "ON", and that removable batteries are in place firmly. Interchange batteries, if this is possible, as a check for a possible defective battery.

Erratic operation may be caused by poor contact between electrodes and skin. Check to see that your stump is into the socket properly. It may be advisable to remove the prosthesis and verify that there are normal impressions under the electrodes. If you have used skin cream, skin tanning lotion, or similar products, wash your stump carefully with a bit of alcohol.

If none of these simple checks solves the problem, call your prosthetics team immediately for assistance. Normally one member of the team will have been identified as the person to call for help: if not, we suggest that you call either the prosthetist or the therapist.

We cannot overemphasize the importance of seeking assistance promptly if you do have trouble. That's the only way to achieve the full benefit of your prosthesis.

Good Luck!
8. Unfamiliar Words
You May Want to Understand

above-elbow prosthesis (n) a prosthesis which replaces the hand, wrist, forearm, elbow, and part of the arm
amputation (n) removal of a body part
amputee (n) a person who lacks all or part of one or more limbs (in North American usage the term is applied to persons with congenital limb deficiencies as well as those who have lost limbs through surgical amputation)
battery (n) a device for storing electrical energy
NiCad battery (n) a battery using rechargeable nickel-cadmium cells (as used in myoelectric prostheses, tools, electric toothbrushes, cordless shaver, etc.)
below-elbow prosthesis (n) a prosthesis which replaces the hand, wrist, and part of the forearm
biomedical engineer (n) an engineer specializing in the application of engineering techniques to living systems
cast (n) in prosthetics, a plaster or par is wrap which, when hardened, defines the shape of the stump
charger (n) battery charger (n) a device which takes energy from an electric outlet and recharges a battery
check socket (n) a temporary socket, often of plaster or par is, used to check for proper fitting before a final socket is made
clinical engineer (n) an engineer concerned primarily with the safe and effective use of technology in health care
congenital (adj) present at birth
congenital limb deficiency (n) absence of all or part of a limb or malformation of a limb, at birth
congenital amputee (n) a person born with all or part of a limb missing
control harness (n) a harness used to operate a conventional prosthesis via body movements (may also provide suspension or stabilization)
control site (n) a location on the skin surface at which myoelectric signals are obtained for control purposes
control unit (n) the part of a myoelectric prosthesis which controls the flow of electricity from the battery to the terminal device, depending on the myoelectric signal
conventional prosthesis (n) a term generally used to describe a prosthesis powered by body movements
cosmetic (adj) pertaining to appearance
cosmetic glove (n) the outer covering of a prosthetic hand
cosmetic hand (n) a prosthetic hand intended solely to restore normal appearance
cosmetic prosthesis (n) a non-powered prosthesis intended solely to restore normal appearance
electrode (n) a metal object which makes an electrical connection to the skin; in some myoelectric control systems this term refers to an electronic unit which also includes an amplifier
engineer (n) a professional whose specialty is application of physical principles to design and analysis; in prosthetics, engineers are involved with design and development of prostheses, and with adaptation of devices for specific patients
biomedical engineer (n): an engineer specializing in the application of engineering techniques to living systems.
clinical engineer (n): an engineer concerned primarily with the safe and effective use of technology in health care.
rehabilitation engineer (n): an engineer specializing in rehabilitation.
engineer technologist (n): a person with training and specialization similar to an engineer except with less theoretical and more practical emphasis.
fraction wrist (n): a wrist unit in which the position of the terminal device is maintained by friction.
griever (n): a heavy-duty powered terminal device.
harness (n): a system of straps used to support, stabilize or operate a prosthesis.
control harness (n): a harness used to operate a conventional prosthesis via body movements (may also provide suspension or stabilization).
suspension harness (n): a harness used to support the prosthesis.
Hepp-Kuhn socket (n): a socket, for a below-elbow prosthesis, which does not require additional suspension (such as a harness).
hook (n): a terminal device, usually operated by body movement, which provides a simple grasp function and does not look like a hand.
split hook (n): see hook (this is the British terminology).
inner socket (n): the part of the prosthesis which actually comes in contact with the stump.
Munster socket (n): a socket, for a below-elbow prosthesis, which does not require additional suspension (such as a harness).
myoelectric (adj): pertaining to muscle (myos) and electricity.
myoelectric control (n): control by means of electricity from a muscle.
myoelectric prosthesis (n): artificial limb controlled by electricity from a muscle.
myoelectric signal (n): the electrical signal produced by a muscle when it contracts.
NiCad battery (n): a battery using rechargeable nickel-cadmium cells (as used in myoelectric prostheses, tools, electric toothbrushes, cordless shavers, etc.).

occupational therapist (n): a professional whose speciality includes use of selected activities and equipment to enhance or restore performance in aspects of daily living such as self care, vocation and recreation.
orthopaedic surgery (n): The surgical specialty dealing primarily with problems of the skeleton and of the muscles which control it.

orthotist (n): a professional whose specialty includes restoration of function through such procedures as exercise, massage, or the use of various forms of energy.
powered wrist (n): a wrist unit which provides powered rotation of the terminal device.
prosthesis (n): a replacement in this context an artificial limb (plural - prostheses).

above-elbow prosthesis (n): a prosthesis which replaces the hand, wrist, forearm, elbow, and part of the arm.
below-elbow prosthesis (n): a prosthesis which replaces the hand, wrist, and part of the forearm.
conventional prosthesis (n): a term generally used to describe a prosthesis powered by body movements signal.

cosmetic prosthesis (n): a non-powered prosthesis, worn primarily for appearance.
myoelectric prosthesis (n): artificial limb controlled by electricity from a muscle.
passive prosthesis (n): a prosthesis which has no moving parts.
powered prosthesis (n): a prosthesis powered by a battery or compressed gas.
prosthetic (adj): pertaining to a prosthesis or to prosthetics: substitute.

prosthetic forearm (n): the part of a prosthesis which replaces the forearm.
prosthetics (n): the profession dealing with artificial limbs.
prosthetics (adj): pertaining to the fitting of artificial limbs (as in ‘prosthetics team’).
prosthetist (n): a professional who makes and fits artificial limbs.
prosthetics loan (n): the person responsible for selecting, fitting, training and follow up care involving an artificial limb.
quick-disconnect wrist unit (n): a wrist unit which permits rapid interchange of a variety of terminal devices.

rehabilitation engineer (n): an engineer specializing in rehabilitation.
rehabilitation medicine (n): the medical specialty dealing primarily with rehabilitation (also called physiatry, not to be confused with psychiatry).

residual limb (n): the part of a limb remaining after amputation.
servo control (n): a control system in which a mechanical output is proportional to a mechanical input.
socket (n): the part of a prosthesis which encloses the residual limb and suspends and stabilizes the prosthesis.
check socket (n): a temporary socket, often of plaster of paris, used to check for proper fitting before a final socket is made.
Hepp-Kuhn socket (n): see supracondylar socket.
inner socket (n): the part of the prosthesis which actually comes in contact with the stump.
Munster socket (n): see supracondylar socket.
supracondylar socket (n): a socket, for a below-elbow prosthesis, which does not require additional suspension (such as a harness).

split hook (n): see hook (this is the British terminology).
stump (n): the part of a limb remaining after amputation (residual limb).
myoelectric stump sock (n): a fabric "sock" worn between the residual limb and the socket (not used with myoelectric prostheses).
supracondylar socket (n): a socket, for a below-elbow prosthesis, which does not require additional suspension (such as a harness).
suspension harness (n): a harness used to support the prosthesis.
terminal device (n): the part of a prosthetic arm which replaces the hand.
touch switch (n): an electronic switch which requires no physical pressure for operation.

wrist unit (n): the device which attaches the terminal device to the prosthesis, usually permitting passive rotation of the terminal device.
quick-disconnect wrist unit (n): a wrist unit which permits rapid interchange of a variety of terminal devices.
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