

# PROSTHETIC CONSIDERATIONS AND RUNNING



## Amputee running coaching workshop

*Running is an activity that allows the runner to set their own goals and challenges. It can also be the start of building confidence and trust in a prosthetic leg to enable participation in other sports like badminton.*

*“Sport is part of every man and woman’s heritage and its absence can never be compensated for” Pierre de Coubertin (1863-1937).*

# Prosthetic considerations and running

## AMPUTEE RUNNING COACHING WORKSHOP

### THE MASTER CLASS CONCEPT

PORT-ER master classes are about bringing people together with the right expertise and experiences to share and build knowledge and understanding of a topic. PORT-ER holds the view that every limb user or professional involved in prosthetic rehabilitation or sports is a Master in their own right and Master Classes therefore provide an effective forum for learning about running because it is assumed that every person has the opportunity to learn and also to teach. Both the novice and the expert should be enriched by a Master Class.



We have an active learning approach where everyone (limb users and professionals) gets involved in both theoretical and practical exercise circuits and coaching sessions together. This approach seems to work well and we have had strong feedback that the positive and open atmosphere of a Master Class is motivational. One limb user wrote:

*"It was most certainly one of the best days I've had since my new life started and it has returned a bit of my self-respect and confidence. I took my eleven year old son to his footy match on Sunday where we had running races to help him cool down afterwards. There aren't words to describe how I felt, mind you my son just said "not bad for an old man", praise indeed".*

### WHAT IS RUNNING?

Running is a cyclic movement that involves both feet being off the ground at the same time – even if it is just for an instant. The runner essentially becomes airborne for a moment. The runner in the picture above is an experienced long distance runner and can be seen to have both feet off the ground. Novice runners might have much less of an airborne phase and sprinters have a much higher and longer “flight”.

There are different kinds of running ranging from jogging (slow running) to sprinting. Runners often compete against themselves by either running the same distance more quickly or by building up the distance they are running so that they run longer and longer distances. Specialist prostheses are not normally needed to learn how to run and indeed recreational running and participation in some sports can be done without specific prosthetic components. People with limb amputations who want to take part in more intensive sports should talk to their prosthetist about prosthetic prescription choices so as to determine the most appropriate prosthesis for their needs.

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A useful way to describe normal walking patterns was devised by Jacqueline Perry (1992) who described walking being divided into stance phase and swing phase:

**Stance phase** = initial contact, loading response, midstance, terminal stance, preswing

**Swing phase** = midswing, terminal swing

These descriptions can also be used when analysing running patterns for people running with prosthetic limbs. Alternative or additional descriptions of the phases of running are used by sports professionals and are useful to help us understand the requirements of a prosthesis during running:

**Propulsion phase** = acceleration = drive

**Recovery phase** = swing phase

**Absorption phase** = deceleration = support

The runner below is shown in the different phases of running when considering the pattern related to his left leg. Evidently the whole body is involved and the trunk, head and arms have a part to play in the running gait as well.



left propulsion



left recovery



left absorption

## THE RUNNER

People with limb amputations motivated to run for the first time may want to run for lots of reasons. Starting to learn to run after a limb amputation can be a bit daunting.

Why run? Running is useful if you want to catch a bus or catch up with your small children or grandchildren. It is useful if you want to take part in some sports like badminton or tennis. Running as a hobby or a sport in itself is evidently more demanding.

## RUNNING WITH LEG AMPUTATION

Usually people who have limb loss or limb absence of one or both legs, who have a stump that can tolerate pressure from a prosthetic socket, and who walk without a walking aid can learn to run with a prosthetic leg (or legs).

If you want to take up a sport that doesn't involve running on a prosthetic leg but involves speed, you could choose to use crutches (for example football) or wheels (for example wheelchair basketball).

## Want to learn to run?

The first time you learned to run as a child you would have just had a go. You will have fallen over and dusted yourself off and tried again. Adult runners who have had a leg amputation are more likely to be more cautious about trying to run because of a fear of falling. This is only natural, but you can do some things to help build up your confidence to give you the best chance of being able to run. Simple things will help –like making sure you know how to get up off the ground if you fall (ask your physiotherapist if you are unsure).

Remember that as a child you learned to walk before you learned to run and walking exercise is a great way to start, especially if you have been a couch potato lately!



## Your health and fitness

You may have had a leg amputation, but are well and have no other health problems, or you may have come to have an amputation because of health related lifestyle choices that over the years have led to poor circulation and ultimately to amputation. If you have been inactive for a while then it will take time for you to build up your fitness levels

If you are planning to increase your activity levels then the following questions may help you identify whether you should check with your doctor first.

### Physical Activity Readiness Questionnaire (PAR-Q)

Exercise is a form of physical activity which can be fun and healthy and very safe for most people. Common sense is your best guide when you answer these questions.

Please read the questions carefully and answer each one honestly.

#### Questions

1. Have you sought medical advice for a heart condition?
2. Do you experience chest pains?
3. Do you have a bone or joint problem?
4. Do you have low or high blood pressure?
5. Are you pregnant?
6. Do you have diabetes?
7. Do you have asthma?
8. Are you over 60 years of age?
9. Have you had an injury in the last 6 months?
10. Do you know of any reason why you should not increase your physical activity?

**If you can answer YES to ANY of the questions then you should first talk to your doctor before increasing your activity levels.**

You may be able to participate in running even if some of your involvement is restricted. Talk with your doctor about the kinds of activities you may be involved in that would involve running.

## YOUR STUMP AND YOUR SOCKET

At normal walking speed, the forces that transmit through our legs when we strike the ground are equivalent to three times our body weight. When we run these forces are magnified in proportion to our speed. In order for someone with a leg amputation to be able to run, their socket should be well fitting so that it can effectively transfer force to the amputation stump.

The socket fit is the most important part of the prosthetic leg. Special prosthetic components are not needed for someone to begin to learn to run, but a well-fitting socket is important. Rather like a comfortable running shoe, the socket should be closely fitting and yet comfortable.

There are two kinds of forces exerted on the skin by the socket – direct pressure and shear force. Shear forces are forces the run (rub!) parallel to the skin and the main cause of skin blisters or ulcers. Just like when a running shoe rubs a foot, the fit of the socket can help to reduce blisters or rubbing.

If your socket fit depends on stump socks, then make sure you use your “best” socks for running and keep an extra sock in your pocket so you could put it on if your stump shrinks during your exercise period. A loose socket will cause blisters (just like a loose running shoe causes blisters on your heel). Use a stump compression sock (like Juzo stump shrinkers) when you are not wearing your leg because this will prevent swelling and let you put your leg back on again.

If you would like to improve your socket fit, then talk to your prosthetist. Also ask your prosthetist about suspension – you may need additional socket suspension for when you are running.

Other challenges for your stump comfort include the edge of the socket or liner – the transition from pressure to no pressure from a socket or liner can cause skin tension and pulling. This can lead to possible infections (hair follicles and other).

Pistoning of the socket may occur – this may not involve movement of the socket over the skin, but movement of the deeper stump tissues over the underlying bone.

## YOUR ENVIRONMENT

Confidence is a big part of enabling you to run. Think about where you would start to practice running and possibly the best person to talk to for advice is your rehabilitation consultant, your prosthetic physiotherapist and/or your prosthetist. It may be possible for you to visit the physiotherapy gym or a local sports centre where you could have your first running steps supervised indoors with specialists on hand to advise you.

## CO-ORDINATION, CONTROL AND BALANCE

Running is essentially controlled falling over! Your lean forward, fall forward and quickly put a foot ahead of you to stop you falling on your nose. Knowing where your prosthetic foot is in space without looking at your feet is called “proprioception” and despite you having no foot of your own, your brain can unconsciously work out where your prosthetic foot is to accurately place your foot under you so it is “there” when you need it to be. The more you repeat a movement pattern, the better your brain gets at that movement.



Image NCPO,  
University of Strathclyde

**Trans-tibial amputation:** If you have had an amputation below the knee, all the movement sensors in your knee still exist and so it is easier to learn to run.

**Trans-femoral amputation:** If you have had an amputation above the knee it is harder to control where the foot is in space because you can't always tell if your knee is straight when your foot hits the ground. The settings of your knee might slow the rate of swing through of your prosthetic knee down and so the foot won't be there for you when you need it. We recommend that you talk to your prosthetist about running so your knee settings are right and that you enlist the help of your physio to learn a running technique (or attend a running master class).

To help you with your chances of running, work on other non-running exercises that improve your fitness, your core muscle strength and your balance.

## COACHING

Working with a coach helps to progress your movement and running skills from one level to another. Drills and skills training help you to take better control of your body. We are working on a learning resource that will demonstrate such training techniques.

This resource has been provided by the charity PORT-ER. It is a work in progress and we will build upon this and share it on our website [www.port-er.com](http://www.port-er.com). Please feel free to contribute content to help us build up the resource.

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