



# INTRODUCTION

“Losing a limb is a traumatic and life-changing experience. Your body is permanently altered, almost all aspects of your life are affected, and you may feel that no one could possibly understand what you’re going through. This guide aims to provide you with a brief, practical introduction to a new life after limb loss, and will show that you are not alone. With the help of modern technology, the pioneering performances of Paralympic athletes and the example of thousands of ordinary, determined people, those of us who have lost limbs are starting to realise that they can lead rich, fulfilling lives and achieve things that were almost unimaginable to previous generations.” – **Ernst van Dyk**



Ernst van Dyk was born with congenital absence of both legs. Despite his disability, he demonstrated an affinity for sports codes of all kinds from an early age and was encouraged by his parents to participate in a wide range of activities, including gymnastics, swimming and even table tennis. His determination drove him to win the wheelchair race at the Boston Marathon a record-setting ten times, and in 2006 he received the prestigious Laureus World Sports Award for best sportsperson with a disability.

He has competed in seven Paralympic Games, winning multiple medals including a gold medal in Rio 2016. In 2010 he was awarded the Order of Ikhamanga by the president of South Africa. Not content with his achievements in sports, Ernst insists that one of his biggest personal accomplishments was being the first person with a disability to graduate with a degree in Sports Science from Stellenbosch University.

He has served on various bodies, including the International Paralympic Committee (IPC) Sport Science Committee. In 2015 he joined Össur, where he is currently the National Sales Manager for South Africa.



“We encourage you to inform yourself, since being informed will help you take responsibility for your own well-being and ensure that you make the right choices and decisions on your path to healing. The good news is that artificial limbs have come a long way in recent years.”  
– **Prof. Wayne Derman**

Prof Wayne Derman is the Director of the Institute for Sport and Exercise Medicine (SEM) in the Faculty of Medicine and Health Sciences at Stellenbosch University. Prof Derman is a past president of the South African Sports Medicine Association and is co-director of the International Olympics Committee (IOC) Research Centre in South Africa. He has played an important role in the training of sports physicians, exercise scientists and biokineticists. His research has focused on secondary prevention of chronic disease of lifestyle, and injury and illness prevention in athletes, especially those with disabilities.



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# PREPARING FOR LIMB LOSS

## CARING FOR YOU

When you undergo amputation surgery, you are profoundly challenged at every level of your being – physically, emotionally, mentally and spiritually. The indisputable fact is that your limb is permanently gone. How you respond to this reality depends on whether or not you give in to despair, and will determine whether you grow as a human being and heighten your appreciation of living.

## CHALLENGES AND GOALS

The challenges you face are obvious, but the opportunities to grow in the face of adversity are just as dramatic. We hope that the information in this guide will answer some factual and practical questions about limb loss, but also inspire you to find positive meaning in your experience.

The real challenges that accompany the loss of your limb cannot be made to disappear, but, through rehabilitation, their negative effects can be minimised. The word ‘rehabilitate’ means ‘restore’. After surgery, your rehabilitation goal should be to restore your body, mind and spirit.

### Challenges

- Physical
- Emotional
- Mental
- Spiritual

### Goals

- Positivity
- Appreciation of Living
- Personal Growth
- Rehabilitation – to restore your body, mind and spirit

## YOUR HEALTHCARE TEAM

### The Benefits of a Team Approach

Working with a team of well-coordinated experts increases the quality of your care and can significantly shorten the length of your rehabilitation. Your doctor will refer you to the right medical professionals who may be involved in the various aspects of your rehabilitation, based on your physical, psychological and vocational needs.

Consulting with a prosthetist is a good place to start on the road to recovery, but you will most likely need help from other medical professionals, such as:

- a physiotherapist
- a biokineticist
- an occupational therapist
- a dietitian
- and a psychologist

If you do not have the opportunity to get treatment at a specialised rehabilitation centre, ask your doctor or prosthetist to help you develop a rehabilitation plan that utilises the skills of those medical professionals that are available in your area. – Prof Wayne Derman

These types of teams are available in specialised rehabilitation centres, but if you live in a small town or a rural area, there may not be enough patients to support such a facility.

**GOOD IDEA** If you can, invest in your health by commuting to a rehabilitation centre until your independence is restored.



## MEDICAL TERMS

- **Prosthetist:** a medical professional trained in the design, manufacture and repair of artificial limbs (protheses).
- **Surgeon:** a doctor specialising in surgery and who will be part of the team who performs the amputation.
- **Surgery:** the medical treatment in which a surgeon repairs or removes damaged or diseased parts by incision or manipulation.
- **Orthopaedic surgeon:** a surgeon specialising in the musculoskeletal system.
- **Musculoskeletal system:** the system connecting bones with other bones and muscle fibres via connective tissue such as tendons and ligaments.
- **Prosthesis:** a prosthesis (plural: prostheses) is an artificial device that replaces a limb lost through trauma, disease or a congenital condition. The components of a prosthesis depend on the limb it replaces. If the prosthesis replaces a leg, for example, it is called a prosthetic leg.
- **Physiotherapist:** a medical professional trained in all aspects of human movement and who will help the new amputee to achieve the highest possible level of independence.
- **Biokineticist:** a clinical exercise specialist trained to prescribe exercise for rehabilitation or to enhance performance (sport and work), who will be a key team member in getting a new amputee back to a full, active lifestyle.
- **Vascular surgeon:** a surgeon specialising in diseases of the arteries and veins.
- **Occupational therapist:** a medical professional who helps patients improve their functioning, typically helping them to return to work and regain independence.
- **Dietician:** a medical professional who advises people what to eat in order to lead a healthy life or achieve a specific health-related goal.
- **Psychologist:** a medical professional who works with patients in various ways, often giving counselling or psychotherapy, who will play a key role during the adjustment phase after surgery.

# AMPUTATION SURGERY

## WHY ARE LOWER LIMB AMPUTATIONS DONE?

Amputations are done to remove a part of the body, a limb, or part of a limb to treat recurrent infection or gangrene in peripheral vascular disease, to remove cancerous tumours, and to treat severe trauma. The remaining portion of the limb (if applicable) is called the stump, or residual limb.

### Amputations are performed to:

- Relieve symptoms of disease
- Improve function
- Improve quality of life
- Save a life!

Each year, the majority of new amputations occur due to complications of the vascular system (pertaining to the blood vessels). The single largest cause is thus vascular disease, including diabetes and peripheral arterial disease (PAD), followed by victims of trauma and accidents and cancer.

Below-the-knee (BK or trans-tibial) amputations are the most common, representing 71% of dysvascular amputations. Among those living with limb loss in the USA, the main causes are:

### Vascular Disease



### Trauma



### Cancer



## Diabetes Is A Major Risk Factor

Diabetes affects 8.3% of the U.S. population and the number of amputations caused by diabetes increased by 24% from 1988 to 2009. The International Diabetes Federation predicts that the current global prevalence of diabetes will burgeon from 285 million people to reach 435 million people by the year 2030. It is also projected that the amputee population will more than double by the year 2050. Amputation is four times more likely in diabetics than non-diabetics.

### Other risk factors of peripheral arterial disease include:

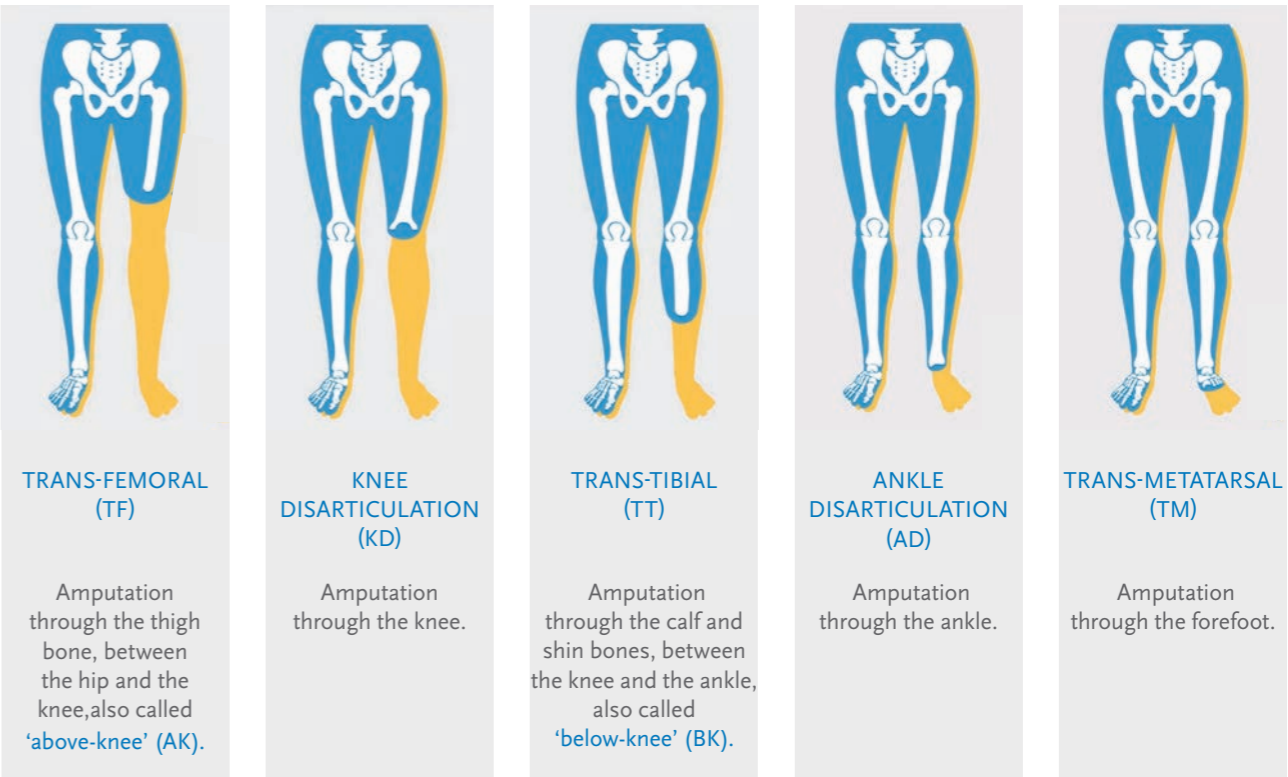
- Smoking
- An unhealthy diet
- Being overweight
- Stress
- Lack of exercise
- High cholesterol levels
- High blood pressure
- Genetic factors

Regardless of the causes, it is a traumatic and life-changing experience to lose a limb. Your body is permanently altered, almost all aspects of your life are affected, and you may feel that no one could possibly understand what you are experiencing. – Ernst van Dyk

## WHAT LEVEL OF AMPUTATION WILL I NEED?

Depending on the cause, amputations are carried out at different levels on the limb. The “level” or “site” of amputation refers to the location of the amputation of the affected limb. The amputation level is important as it partly determines the residual limb’s functional ability, strength and mobility – requirements to use a prosthesis. **Your doctor will consider every aspect of your unique case and select the best level based on what is best for your health.**

### Common Levels of Lower-Limb Amputation:




If your leg was amputated between the knee and the hip, you may be referred to as a person with an above-knee (AK) amputation, or alternatively a trans-femoral (TF) amputation. When two limbs are amputated, a person is said to be a bilateral amputee.

# > AMPUTATION SURGERY

## PREPARING FOR SURGERY

Unless you lose a limb through an accident or emergency procedure, you will be able to discuss the operation beforehand with your doctor. You'll probably be overwhelmed by the news that you face amputation surgery, and may have many questions and concerns.




**GOOD IDEA**

Bring along a written list of questions, so that you don't forget to ask them when you see your doctor.

A well-prepared person understands the need for amputation and realises that even though an artificial limb can't ever be the same as a natural limb, it could be better than a non-functional or diseased limb. Knowledge puts you at an emotional and even medical advantage: it reassures you, comforts you, aids your recovery and ultimately helps you fight your fears. **The better you understand why you need an amputation, what happens during surgery, and what the recovery and rehabilitation are expected to entail, the better you'll be able to deal with the consequences of losing a limb.**

Your active participation will be a major factor in your physical and emotional recovery. By being active in your rehabilitation, you will be exercising control over your life and helping yourself regain independence.



**MEDICAL TERMS**

- **Residual limb:** The portion of a limb remaining after an amputation, sometimes called the 'stump'.


## AFTER SURGERY

The recovery rate after amputation is different for each person. There are no two surgeries or people that experience the same healing times and rates.

- Following surgery you might:
- Feel discomfort (swelling) and pain
  - Receive medication to control pain
  - Have stitches on the residual limb (stump)
  - Have a drainage tube on the residual limb
  - Have a bandage (surgical dressing) covering your leg
  - Have a catheter
  - Experience phantom sensation and/or phantom pain

### Phantom Sensation and Pain

It is not unusual to feel that your limb (leg) is still there after the amputation or to feel pain in the limb that has been removed. This is called phantom sensation and pain and are quite common following an amputation. The cause is not known. If you are experiencing phantom sensation, you might forget that you have had an amputation and you are at very high risk of falling.



It is important that you take your time and think carefully before you move, especially when moving on and off a bed or chair. Being careful can help to prevent falls.

Once you've recovered from surgery and are adapting successfully to the physical changes resulting from your amputation, you may discover that focusing solely on the physical aspects of your recovery is simply not enough – there are psychological aspects too.

# PSYCHOLOGICAL ASPECTS OF LIMB LOSS


## GRIEVING IS NORMAL

Every individual is complex and unique, and your emotional response to amputation is part of that. In many ways, losing a limb is like the death of a loved one: you must work through a series of stages of grieving in order to recover.

Grieving gives opportunities for healing, renewal, growth and spiritual development. There will be times when your emotional recovery progresses smoothly, yet there may also be times when you're overwhelmed by painful feelings and limiting beliefs. It's important to know that these feelings are normal and that they can be overcome through the continuous support of a psychologist until you're fully adjusted to your new physical image and have adapted to your environment. – **Ernst van Dyk**

### Feeling a Wide Range of Emotions is Part of the Healing Process

During these rough times, you can turn to family and friends, your spiritual beliefs, and support groups. It would be helpful if you and your loved ones could recognise this intense range of emotions as part of the healing process. Some people find comfort and support in talking to others who have been through the same experience. Your prosthetist may be able to help by putting you in touch with someone else who has lost a limb or an amputee support group near you.



**GOOD IDEA**

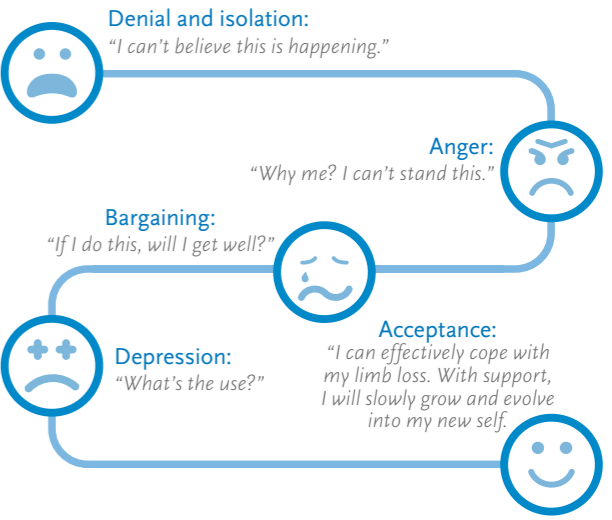
Set realistic goals and work towards independent functioning.

## COUNSELLING CAN BE KEY

At times, however, the process may become too much for you, and then we strongly recommend that you consider seeking professional counselling. Counselling can be a wonderful aid in your recovery process and in enhancing the quality of your life. You may even find yourself growing in ways that would never have occurred if you hadn't undergone amputation. It is important to emphasise that the psychological effects of an amputation are far-reaching and unique to the individual and can have a profound effect on almost all aspects of your life.

This means you must address this part of your recovery proactively. **The "Five Stages of Loss" will help you understand your emotions through this journey.**

### THE FIVE STAGES OF LOSS



# ADAPTING TO LIMB LOSS

Recovering from an amputation takes time. A “typical” lower-limb amputation can broadly be divided into three phases:

- Wound healing
- Mobilisation
- Reintegration

It is important to realise that every person is unique, and treatment methods differ. This means that the steps we describe may not coincide exactly with your own treatment pathway.

The healing time after surgery varies from person to person and the length of your recovery period depends on all kinds of factors, such as:

- The reason for your amputation
- Your age and general health
- Your active participation and determination
- The personalised rehabilitation protocol followed by your medical team

## WHAT TO EXPECT

While there are no set guidelines or timelines that will fit every amputee’s unique situation, there are some ‘general’ time frames and guidelines that may be helpful for your first year as a lower-limb amputee:

THE FIRST YEAR AS A LOWER LIMB AMPUTEE

Wound Healing	Mobilisation	Reintegration		
<div>MONTH 1: Recovering from surgery</div> <div><i>Start of your physical and psychological healing processes.</i></div> <div>Depending on how fast your limb heals, you can expect to:</div> <ul style="list-style-type: none"><li>• Have your stitches/staples removed within 3 to 4 weeks of your surgery</li><li>• Start pre-prosthetic physical therapy – working on your upper body strength and your lower limbs to maintain good range of motion in your hips and knees and strength in your leg muscles</li><li>• Start desensitising your residual limb</li><li>• Start with compression therapy</li><li>• Meet with your prosthetist for a thorough evaluation</li></ul>	<div>MONTH 1-3: Mobilisation</div> <div><i>Your first prosthesis</i></div> <div>Once your wound has sufficiently healed, you will meet with your prosthetist. Depending on your prosthetist, you can expect the following steps:</div> <ol style="list-style-type: none"><li>1. A diagnostic or “test” socket will be created. A test fitting might be completed in one visit or it could take multiple visits to make sure your test socket fits comfortably.</li><li>2. You and your prosthetist will discuss the prosthetic components that fits your physical requirements.</li><li>3. Your test socket will be manufactured, assembled and aligned to your other prosthetic components, resulting in your first prosthesis.</li><li>4. Adjustments to this prosthesis may be required during the first month or two that you wear it.</li></ol> <div>After you are fitted with your first prosthesis, you will usually see a physical therapist regularly. This is to ensure that you develop good habits while you relearn how to walk, using a prosthesis.</div>	<div>MONTH 3-6: Reintegration</div> <div><i>Adapting and adjusting</i></div> <div>Your residual limb will continue to go through physiological changes as you use your prosthesis more, typically resulting in volume loss. If your rehabilitation process has proceeded well to this point, you might:</div> <ul style="list-style-type: none"><li>• See your prosthetist now on a monthly or bimonthly basis.</li><li>• Be fitted with a socket replacement due to significant volume loss in your residual limb, which can cause your original test socket to become too large and adversely affect its fit.</li><li>• Be test fit again before you are fitted with another downsized laminated socket. This process can take a few visits to your prosthetist to complete. Be aware that every socket you are fit with will feel different, which may require some getting used to and possible adjustments following fitting.</li></ul>	<div>MONTH 6-9: Reintegration</div> <div><i>Final prosthesis</i></div> <div>By now, your residual limb may have stopped shrinking. At this point, your doctor and/or prosthetist might prescribe that you be fitted with your long-term prosthesis.</div> <ul style="list-style-type: none"><li>• This may require test fitting again and additional visits to your prosthetist before a new laminated socket is fabricated.</li><li>• Your prosthetist will also incorporate components into your final prosthesis that matches your current and/ or potential level of activity, assuming your activity level has changed since originally being fit with your preparatory prosthesis.</li><li>• You may have progressed through the use of a variety of assistive devices to the point where you can ambulate without an assistive device.</li></ul> <div>Not all lower-limb amputees are able to function safely without the use of an assistive device, depending on their overall health, determination and confidence. For some amputees, prolonged use of an assistive device can enhance safety and reduce the potential for falls.</div>	<div>MONTH 9-12: Living with limb loss</div> <div>As you approach the end of the first year since your amputation, you will hopefully have become fairly comfortable with life as an amputee:</div> <ul style="list-style-type: none"><li>• You will have mastered using a prosthesis – putting it on (donning), taking it off (doffing), making adjustments to the number of socks being worn, etc.</li><li>• Your phantom pain will have subsided and your phantom sensations will have lessened or become more tolerable.</li><li>• You will have found that you are able to do many of the activities of daily living that you did prior to your amputation, but possibly in different ways.</li><li>• You will have established a good relationship with your prosthetist, who you’ve seen many times during the past year and will continue to see on a regular basis in the future.</li></ul> <div>Source: Article originally published in ‘inMotion Magazine’ Volume 21, Issue 1, 2011 and amputee-coalition.org.</div>



Figure 1

Silicone sleeve

# WOUND HEALING

Following the amputation, treatment will focus on:

1. Healing the wound,
2. Preparing the residual limb for a prosthesis

## WOUND CARE

The first objective after surgery is to make sure that the wound heals. Your surgeon is actively involved during this stage and will be assisted by the hospital nursing staff.

A special removable rigid dressing may be applied after surgery (as shown in Figure 1), as it has been clinically proven that applying such a dressing has been proved to:

- reduce pain
- shorten wound healing time, and
- reduce the risk of injury resulting from falls.

## PREPARING THE RESIDUAL LIMB FOR PROSTHESIS

### Shaping of the Residual Limb

When the surgeon is satisfied with how the wound is healing, you will be discharged and referred to a prosthetist so that compression therapy can begin. The aim is to shape your residual limb, because this has a direct bearing on the successful fitting of a prosthetic leg: a residual limb with an even, uniform shape will present fewer complications when you're eventually fitted with a prosthetic leg.


Compression therapy traditionally involves the application of an elastic compression bandage over the residual limb in a specific way, but a far simpler and more accurate method is to wear a special silicone liner, called a post-operative silicone liner. If your prosthetist prefers this treatment, it will be introduced gradually until you are wearing the silicone liner twice daily for up to four hours at a time.

## Desensitisation of the Residual Limb

After amputation, the skin on your residual limb will be sensitive to the touch, and eventually, when the prosthesis is fitted and you are starting to walk, it will be subjected to forces it was never intended to cope with.

To develop a tolerance for these forces you will need to desensitise your residual limb. Desensitisation techniques may also decrease what is known as phantom pain (the sensation of pain in the absent part of a limb).

- Start with light and gentle touching and tapping, and then progress to light massaging. As your tolerance improves, slowly increase the pressure.
- Rub the skin with different materials: start with a cotton wool ball, rubbing it in a circular motion. As you develop more tolerance, progress to rougher materials such as paper towels and various kinds of brushes.
- Try to do this for 15 to 20 minutes, three times a day, until desensitisation is fully achieved.

 You have to be especially cautious when massaging or rubbing the sutured area.




These are general tips and every individual is different, so you should always follow the guidance of your health care practitioner, and must never hesitate to contact him or her if you experience any pain or discomfort, or simply have a question.

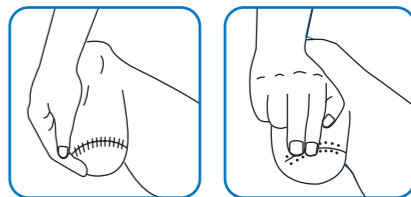
## Scar Mobilisation

Sometimes as your body heals, scar tissue adheres to the soft tissue and bone beneath it. This can cause skin problems and pain when you're wearing the prosthesis. The following technique is recommended to help keep the skin and scar tissue supple and free of adhesions.

You may experience some pain when you do this, but you should persist, as it can help prevent future pain and skin problems when you're starting to walk with your prosthesis.

- Place two fingers over the area where you can feel the bone beneath the skin of your residual limb, press firmly and move your fingers in a circular motion, but without moving them in relation to the skin. This helps move the skin away from the underlying tissue.
- Continue this procedure around all the bony areas of your residual limb.
- Try to do this for 15 to 20 minutes, three times a day, until fully mobilised.

 Only use this procedure once your scar has healed. Do not massage the sutured area and unhealed scar tissue.



## > WOUND HEALING

### Positioning Your Residual Limb

After a leg amputation, it is very important to keep your residual limb positioned correctly to prevent complications such as muscle contracture, to maintain a full range of motion in your remaining joints, and to promote good blood circulation.

#### In a straight position

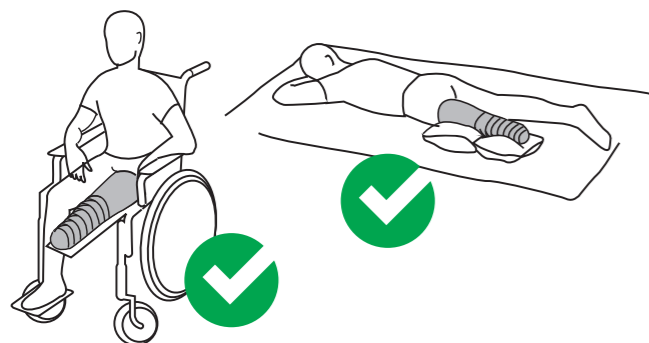
Resist the habit of putting your residual limb in a flexed (bent) position. If the knee or hip joint remains flexed for long periods, blood circulation is disturbed which leads to muscle contracture.

##### For below-knee amputations:

- When seated, always keep your residual limb supported and the knee straight.
- In a wheelchair you can use an “amputee board”.
- On a regular chair use a second chair of the same height to support your residual limb.

##### For both below-knee and above-knee amputations:

- Lying flat on your stomach stretches the muscles at the front of your hips, which can help combat the contractures that develop when seated for too long. Try to spend 15 to 20 minutes in this position several times per day.



#### In an elevated position

Resting your residual limb in an elevated position can also help reduce pain and swelling. Just remember to keep it straight, especially when resting it on something like a cushion, where it may inadvertently bend.

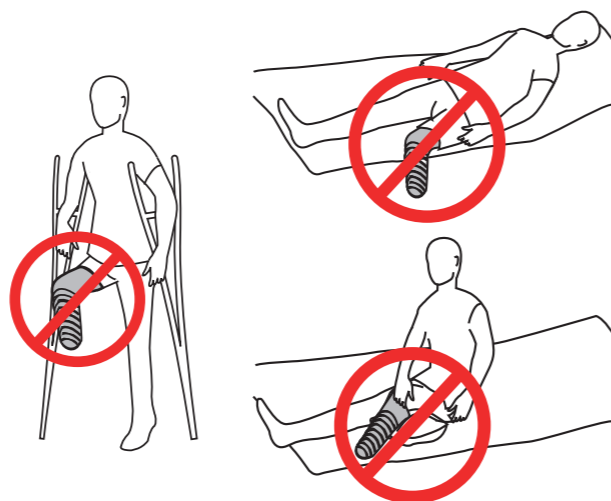


##### GOOD IDEA

A piece of foam cut to size and in the right shape works very well to elevate the residual limb, while keeping it straight.

##### Do not bend your residual limb by:

- Supporting it on the handle of a crutch
- Hanging it over the side of a bed
- Keeping the knee joint flexed when sitting on a bed



## MOBILISATION

As soon as your surgeon feels you're ready, a physiotherapist will help you mobilise your body with special exercises and you should continue the mobilisation exercises until you're ready for the first fitting of a prosthetic leg.



Early mobilisation is very important: it has been proved that in general the earlier one is mobilised, the faster recovery happens.

At this stage, your residual limb is probably still being shaped by a prosthetist applying post-operative silicone liners or compression bandages, and you'll be carefully monitored to see when you're ready for the **reintegration phase**.

Once the wound has healed and you're ready to be fitted with your new prosthesis, the prosthetist becomes a central figure in your further recovery and reintegration. In fact, a prosthetist will play an important role in helping keep you mobile for the rest of your life.

### CHOOSING A PROSTHETIST

Choosing a prosthetist is one of the most important decisions you need to make. You may want to continue with the prosthetist who has been treating you up to now, but you might also like to consider another prosthetist.



You have a choice in which prosthetist to appoint. You are not obliged to work with any particular medical practitioner.

### First Evaluation

The first step in the process of choosing a prosthetist is to make an appointment for an evaluation. You can make many appointments to be evaluated by different prosthetists in order for you to choose one that is best suited to your needs.

During your consultation the prosthetist will do a thorough evaluation in which he or she reviews your physical condition, specifically the condition of your residual limb and whether it has healed sufficiently to accommodate the pressures of the prosthesis on your skin.

The evaluation will include your lifestyle requirements, with questions like:

- Do you have an office job, or is your work more physically demanding?
- Do you walk mainly indoors?
- Are the areas around your house and work flat, or are there many slopes?
- Do you often climb stairs?

Your answers during the consultation will help the prosthetist decide what type of components to include in the design of your prosthesis. Some components are designed to support less active people struggling to maintain the balance of safety, comfort and mobility, and others for people who are keen to become increasingly mobile. The prosthetist takes all of this and more into account in his recommendation of the design for your best prosthetic leg.

## > MOBILISATION

Consider the following when choosing a prosthetist:

### Referrals

Your best starting point is always referrals and recommendations from other medical professionals, but ideally also from other people who have lost a limb.

 **GOOD IDEA** — Websites and social media platforms can be an excellent source of information.

### Experience

As in any profession, some practitioners are more experienced than others, and some may have special clinical interests. Enquire about the experience the prosthetist has in making prostheses for others with similar needs to yours. If it turns out to be difficult to have such a basic conversation, that may be a warning of potential communication problems down the line. **Experience isn't necessarily connected with physical age, as people's career paths vary.**

**Q: Are you experienced in making prostheses for people with similar needs as myself?**

### Communication Skills

The prosthetist's communication skills are very important: can he or she interpret and understand your needs and feelings, address your fears and concerns, and clearly explain to you how the process will work and what to expect? **During a long-term relationship, communication and trust from both parties are essential for constructive cooperation.**

### Familiarity with the Latest Trends and Research

Is the prosthetist up to date with the latest technology? This is easy to establish, as leading manufacturers of prosthetics require prosthetists to do extra courses and demonstrate a high level of competence before certifying them to work with the latest technology. Look for a prosthetist who is certified by the manufacturer of your prosthesis as competent to prescribe and work with their latest technology.


### Treatment Facility

Top prosthetists invest in their treatment facilities and equipment so that they can offer high-quality care: although you probably won't know what most of their equipment is for, your overall impression of the facilities is still important. **Also consider the proximity and convenience of the location of your prosthetist's facility.** A prosthesis needs to be adjusted and maintained from time to time and it will be practical for you to visit your prosthetist when in need.

### Rehabilitation Team and Other Helpful Contacts


Coordinating all the medical professionals working on your rehabilitation is a critical requirement for successful reintegration. Can the prosthetist introduce or refer you to additional services that might improve your life – for example, support groups, emotional recovery counsellors and sports groups for people with limb loss?

**Q: Do you work alone or in a team with other medical specialists such as physiotherapists and biokineticists?**

 **GOOD IDEA** — You can find more information about registered prosthetists on The South African Orthotic and Prosthetic Association's website ([www.saopa.co.za](http://www.saopa.co.za)).


### Financial Considerations

Most of us don't feel comfortable talking about money when our health is at stake; we all want access to medical care with compassion and dignity, and without compromise. **Don't appoint a prosthetist until you have a clear understanding of the costs and financial arrangements.** You don't need to rush into a decision.

 **GOOD IDEA** — The best time to discuss future financial arrangements is during the first evaluation. Read the section on financial considerations (page 38) for more information.

Take your time and investigate all your options. Be well informed, before you take the next step and appoint a prosthetist to design your prosthetic leg. It is important to ask why a prosthetist has made a specific recommendation, so that you know exactly why he or she is recommending certain components for you, and what you will be paying for.

Once you understand this clearly, you will also be able to understand the differences between quotes from different prosthetists, and ultimately compare apples with apples. As with everything in life, neither the cheapest nor the most expensive is necessarily the best.

 It is important to select a prosthetist whom you trust and feel you can work with as a long-term partner in your health.



# REINTEGRATION: MAKING YOUR PROSTHETIC LEG



Generally, the sooner your prosthesis is fitted, the shorter your rehabilitation is likely to be. Once you have appointed a prosthetist, the general progression of events for making your prosthetic leg will be as follows:



## DESIGNING THE PROSTHETIC LEG

A well-designed prosthesis should provide its user with the most natural movement and function possible. Every prosthetist will have his or her own fitting style, fabrication techniques and opinions of what might be the best for you. A good prosthetist will stay up to date with the latest developments, but it is also important for you to know what is currently available.

Many different factors have to be considered when fitting a prosthesis. You and your prosthetist should explore and discuss the right selection of components for you, giving full weight to your own perceptions and judgement, but also keeping an open mind throughout the process and delaying your final decision until you feel confident that you have taken all relevant factors into account.

The goal of the reintegration phase is to regain your mobility and restore your independence to a level as close as possible to what it was before amputation. – Prof Wayne Derman

## BUILDING THE PROSTHETIC LEG


The fitment and manufacture of the prosthesis is both a science and an art, but the two most important aspects of a good prosthesis are:

- The design of a well-fitting socket with optimal suspension.
- The correct assembling and alignment of the prosthetic components with the residual limb.

### Designing and Manufacturing of the Socket

#### Capturing the shape of the residual limb

The next step for the prosthetist is to capture the shape of your residual limb and take measurements for the prosthesis.

 A good prosthetist always takes special care to make a socket that fits your residual limb perfectly and ensures that the components are aligned correctly.

Capturing the shape can almost be described as developing a ‘blueprint’ for your residual limb so that a well-fitting, comfortable socket can be designed, taking into account the unique shape of your residual limb. As this is the basis of the suspension for the prosthesis (where the prosthetic leg is


attached to your residual limb), it is vitally important to capture the shape accurately. Soft tissue changes shape when pressure is applied, which makes this is one of the hardest parts of the prosthetist’s job – and explains why choosing an experienced prosthetist can make a big difference to your life.

It helps if the residual limb is shaped in a way that makes designing a socket simpler, which is why we emphasise the correct post-operative treatment during the wound healing phase.

There are various ways of capturing the shape of the residual limb such as casting directly on the residual limb with an air pressure system, or by using digital scanners, but the most common method is to apply plaster of Paris to get a cast of the limb. Your prosthetist will take measurements and guide you through the process. The most constructive thing you can do is to relax. If your muscles are tense, the cast will be distorted. Plaster of Paris is applied to get an impression of the shape of the limb and removed minutes later. Any plaster left behind can easily be removed with water.

#### Fitting the diagnostic socket

Using the shape taken from the cast, your prosthetist will manufacture a diagnostic or ‘test’ socket to evaluate whether the shape will fit comfortably onto your residual limb. The diagnostic socket is typically fitted at the following appointment, as it takes time for the socket to be manufactured, modified and perfected before the final socket is made. The test socket is made from a transparent plastic material and is adjustable.

 **GOOD IDEA** Dress appropriately for this procedure, and discuss with your prosthetist how his or her technique works and how you can help the process.

## Assembling and Aligning of the Components

Once you and the prosthetist are satisfied with the design and the comfort of the fit, prosthetic components will be assembled and aligned with you in a standing position, a process called ‘static alignment’. If the result is a stable, comfortable prosthesis, you should soon be able to take your first steps!



## > REINTEGRATION: MAKING YOUR PROSTHETIC LEG

### LEARNING TO WALK

Think of your first steps as a learning experience: some people walk well right from the beginning, but most take time. It's all part of the journey to reach your own potential. There's no need to rush: use this phase of the rehabilitation process to get to know how your prosthetic leg works and how your body interacts with it, and ask all the questions you need.

You'll need gait training in order to learn how to walk as normally as possible while expending as little energy as possible. Logically, the higher the amputation, the more complicated it becomes to use the prosthesis, since more components are used to restore function to each joint that's been replaced. Accept that you'll have to work hard to regain your independence, because disciplined exercise is a vital part of regaining mobility. It's also normal to experience some pain and discomfort during the first month after surgery.



As your limb heals, walking will become more and more comfortable.

Early gait training under the close supervision of a physiotherapist, biokineticist and/or prosthetist is essential so that you learn to walk in the best possible way. Learning to walk with a prosthesis requires you to adopt new techniques; and it's far better to develop a good walking technique from the outset than to try to correct an inefficient technique later. Your physiotherapist or biokineticist, assisted by your prosthetist, will recommend special exercises aimed at training the specific muscles needed to walk with your prosthetic leg.

Typical exercises, as illustrated on pages 34 to 37, are just suggestions and may not be the best exercises for your specific circumstances. Always follow the advice given by the medical professionals in your team, because they have made an expert physical assessment of your individual situation.

### FITTING OF THE FINAL PROSTHESIS

The residual limb will go through a process of healing and changing shape as it stabilises over time. This is due to a combination of factors, the main one being fluid changes in your body. The muscles in the limb will shrink (atrophy) since they aren't functioning the way they used to, you may gain or lose weight, and you may lose muscle tone. Once you start walking again, you'll build back some of that muscle tone and might return to your normal weight.

Because your residual limb will continue to change shape, the socket attaching your prosthetic leg to it will, at some point, no longer fit perfectly.

A socket that doesn't fit well may move around, which could jeopardizes your safety, energy consumption and comfort. There are ways to manage this temporarily, for instance by putting extra socks over your residual limb, but eventually a new, correctly fitting socket has to be made.

Depending on how much your residual limb changes shape, this might have to be done several times, until the limb stabilises – at this point a long-term socket can be manufactured for your prosthesis.



A physiotherapist or biokineticist who specialises in treating people with limb loss and is well informed about prosthetic components can make a major contribution to your rehabilitation. Prosthetic knee mechanisms don't all work the same way, and a competent physiotherapist or biokineticist will be able to teach you different techniques for walking down stairs, for instance, depending on the type of prosthetic mechanism you're using. Insist on being referred to a gait training specialist, as this is a vital part of reintegration.

### FOLLOW-UP CONSULTATIONS

Although this long-term socket should fit properly for much longer than the initial, temporary socket(s), you'll have to get updated sockets made at regular intervals in future. Some adjustments may also be needed now and then as your ability and activity increase and your body adjusts. This process has no clear, predefined conclusion, and there is never a “final leg”, simply because your body is a dynamic system that changes over time, and also because prosthetic components have a limited life. How long the interval between each new socket will be is difficult to predict and varies from patient to patient, but typically it could be three years, with minor adjustments possibly having to be made in between.

A correctly fitting, comfortable socket is critically important, and you should always give this top priority.



#### GOOD IDEA

Establish a maintenance schedule for your prosthetic components. Clearly define what your prosthetist will be responsible for and what you can look after yourself. Taking care of the components that you rely on for your mobility will increase your quality of life and save you money in the long run.



# ABOUT PROSTHETIC LEGS

Artificial limbs have come a long way in recent years. With the help of modern technology, the pioneering performances of Paralympic athletes and the example of thousands of ordinary, determined people, people who have lost limbs are starting to realise that they can lead rich, fulfilling lives, and achieve things that were almost unimaginable in previous generations.

The variety of components available to build a prosthetic leg has increased vastly in the past decade. It now ranges from simple mechanical-passive instruments to intelligent, powered bionic devices that adapt to each user and the specific terrain.

Groundbreaking scientific progress has been made in prosthetic components in recent years. Wonderful innovations have been introduced in the pursuit of a life without limitations, and it's a fact that the latest components are pushing the boundaries of what was previously believed impossible. We're at the beginning of a medical revolution, and people are now presented with more information, more choice than ever before. Naturally this leads to questions such as, 'What's the best prosthetic leg?' – **Ernst van Dyk**

A prosthetic prescription is a detailed description of all the features of the completed prosthesis:

- socket design
- skin-socket interface
- suspension strategy
- additional modular components

## WHAT IS THE IDEAL PROSTHETIC LEG?

Every amputee is unique, with different body shapes, amputation levels, health status and lifestyles. It is only with

careful consideration of the person's complete profile that the care team can recommend the components and design that will lead to the most optimal prosthetic outcomes – comfort, safety and efficient functioning of the prosthesis.

The most appropriate prosthesis is the prosthesis that suits the person's individual requirements. One size does not fit all: the ideal prosthesis for one person may be completely useless to another. The same component will not necessarily give the same benefit to everyone. Selecting the appropriate component based on your specific needs often makes the difference between being able to continue certain lifestyle activities and having to adjust your lifestyle.

The two most important aspects of a good prosthetic leg are:

- The **design** of a well-fitting socket with optimal suspension.
- The **correct alignment** of all the mechanical components together.

The best prosthetic leg is the one where ALL the selected components – from the foot to the socket – work together as a total solution to ensure an optimal functioning prosthetic leg. Focusing on one component in isolation, such as a knee joint, and hoping that this component will make all the difference may very well lead to unrealistic expectations and disappointment.

Your best prosthetic leg is the one which will be able to restore your mobility to a level as close as possible to what it was before, one where the appropriate components are:

- Based on a well-fitting, comfortable socket with optimal suspension.
- Selected for your specific needs.
- Selected to work together as a total solution.
- Aligned accurately.
- Functioning as intended and as expected.

## BIONIC TECHNOLOGY

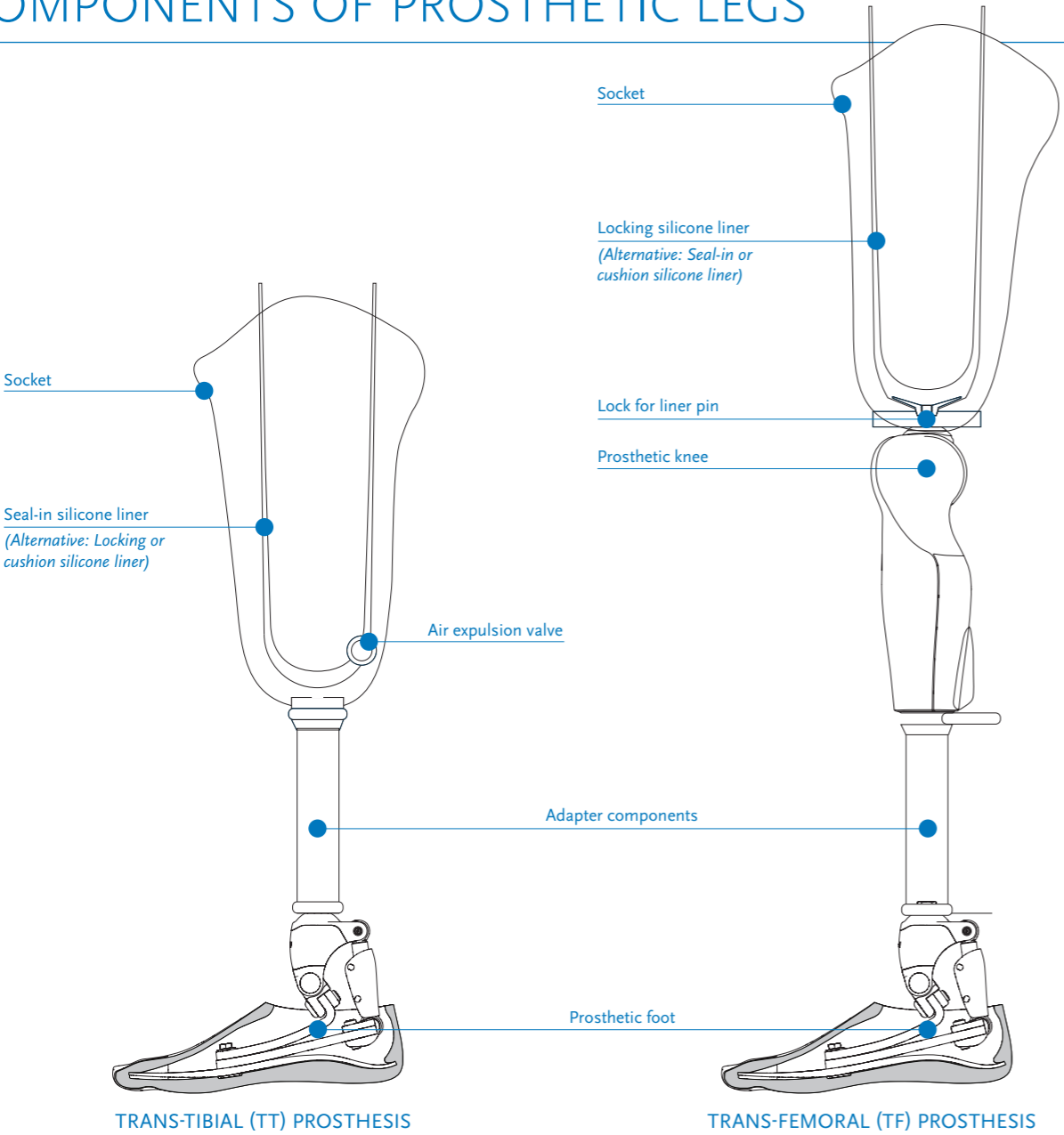
Bionics incorporate artificial intelligence, an established yet constantly evolving branch of computer science that deals with intelligent behaviour, learning and adaptation in machines. Many of the latest developments in prosthetic devices come from advances in bionics in the form of microprocessors, battery technology and neurotechnology.

Össur's **RHEO KNEE** 'learns' constantly, analysing how the user walks and adapting its response accordingly. This means the device's safety and functionality are enhanced, which helps reduce mental and physical effort, as well as the strain on other parts of the body that follows an amputation.

Össur's **POWER KNEE** augments the intelligent behaviour of the prosthesis with battery-powered actuators that control its movement, playing a similar role to that of muscles in human movement.



# COMPONENTS OF PROSTHETIC LEGS



# > COMPONENTS OF PROSTHETIC LEGS

## THE ALL-IMPORTANT SOCKET

Despite all the technological advances in prosthetic knee units, prosthetic feet, and materials, the single most important influence on a good functional outcome with a prosthetic leg is the socket fit. The socket is the crucial interface that is the foundation for connecting the prosthesis directly with your residual limb. This rigid “shell” encases your residual limb and attaches it to the prosthesis. After an amputation your residual limb needs to function in a way it was not designed for, i.e. to support your weight during walking, and is crucial to control the prosthetic leg that is attached to the distal (far) end of the socket.

The socket interface is custom-made to form-fit the unique shape of the residual limb. An comfortable fitting socket is essential to move with comfort and allow effective use of your prosthetic leg. In fact, it is hard to think of anything else you might wear that has to fit as well as the socket.

Designing and manufacturing a well-fitting socket is the most difficult part of a prosthetist’s job, and top prosthetists constantly work on improving their knowledge, methods and technical know-how so that they can consistently meet the challenge of producing precise-fitting sockets.

Every prosthetic leg starts with the design of a socket best suited to the anatomy of the individual: if the socket does not provide a good, comfortable fit, if the suspension that links the socket to the body doesn’t perform well, and if all the components are not correctly aligned, even the most expensive prosthetic components will underperform and probably be inadequate.

– Prof Wayne Derman


The socket design, interface, and suspension method need to be considered together as their functions are often interrelated and interdependent upon one another. A soft liner, for example, can function both as an interface and as the suspension for the prosthesis. In the same way, a socket that is designed with a different interface may contraindicate certain suspension options.

Forethought regarding how those three design elements intermingle will increase the probability of producing a comfortable and functional prosthesis for the individual.

### The Importance of Good Communication

It will take a while for your residual limb to stabilise as your muscles adapt to be used in new ways. This means that your prosthetist will manufacture and adjust or modify several sockets as your limb changes shape. During this process, honest and clear communication is essential, because the socket is custom-made for you and the prosthetist needs to interpret both your physical and verbal feedback to assist you with the best outcome. In the beginning you might struggle to describe the ways in which the socket feels uncomfortable.

If you are experiencing poking, pinching, irritation, pressure, or skin breakdown, your prosthetist needs to know. Open and clear communication with your prosthetist can lead to suggestions and adjustments that help minimise both the duration and intensity of discomfort. Persevere until the fit, function and comfort of your socket is good and you are able to control your prosthetic leg effectively.

 You should NOT have to experience pain while wearing your prosthesis.

## WHAT MAKES A GOOD SOCKET?

- **A Snug and Comfortable Fit:** The possibility of walking with a normal gait (the way you walk) depends firstly on the quality of the socket fit. Much care and time should be spent on socket design and fitting, as a less than ideal fit can quickly lead to pain, injury, skin breakdown and lack of function. The socket has to provide an intimate, comfortable fit, maintaining total contact with the residual limb thus distributing the pressure and forces across the total skin surface of the residual limb (rather than just one small spot at the bottom). Some sockets have a soft, flexible inner lining that provides extra padding and comfort to the residual limb. The outer surface of the socket should also be smooth, with a low profile allowing it to fit easily under clothes and preventing chaffing of your other leg.
- **Prosthesis Control and Function:** To effectively control the prosthesis, it is essential that the socket fits securely and snugly. This prevents the prosthesis from loosening or detaching from the residual limb, as well as prevents the limb from moving up and down (pistoning), side-to-side or twisting (rotating) within the socket. These movements will significantly hamper your ability to control the prosthesis, making it more difficult to place your foot exactly where you want to (proprioception) and possibly causing injury. Great care should be taken to minimise motion within the socket. Secure fitting will make your prosthetic leg feel lighter, help you to move with less effort and without pain, improve your balance and overall help you to move with more confidence.



## > COMPONENTS OF PROSTHETIC LEGS >

### THE SILICONE LINER

Most amputees wear a soft liner that rolls up over the residual limb between their socket and their skin.

The liner is a close companion to the socket and selecting the best-suited liner for the specific person is often the first step when the prosthetist designs the socket.

Together the liner and socket are described as the interface (between the prosthetic leg and the body) and the liner has two main functions:

1. To help attach the socket to the user's body, providing an effective suspension with maximum stability and control.
2. To protect the skin of your residual limb inside the hard shell of the socket from forces (friction and rubbing) it wasn't created to withstand.

Suspension using a silicone liner is obtained by the following techniques:

1. A locking liner: The traditional method uses a liner that is rolled onto the limb, with a locking pin at the bottom end of the liner that inserts into a special, built-in lock in the bottom of the socket.
2. A cushion liner: An extra sleeve is applied over the liner and socket, and an air expulsion valve is used.
3. A seal-in suction liner: An airtight fit (vacuum) is created between the liner and the socket with specially designed seals or rings positioned on the liner, between the liner and the socket wall.



### WHAT MAKES A GOOD SILICONE LINER?

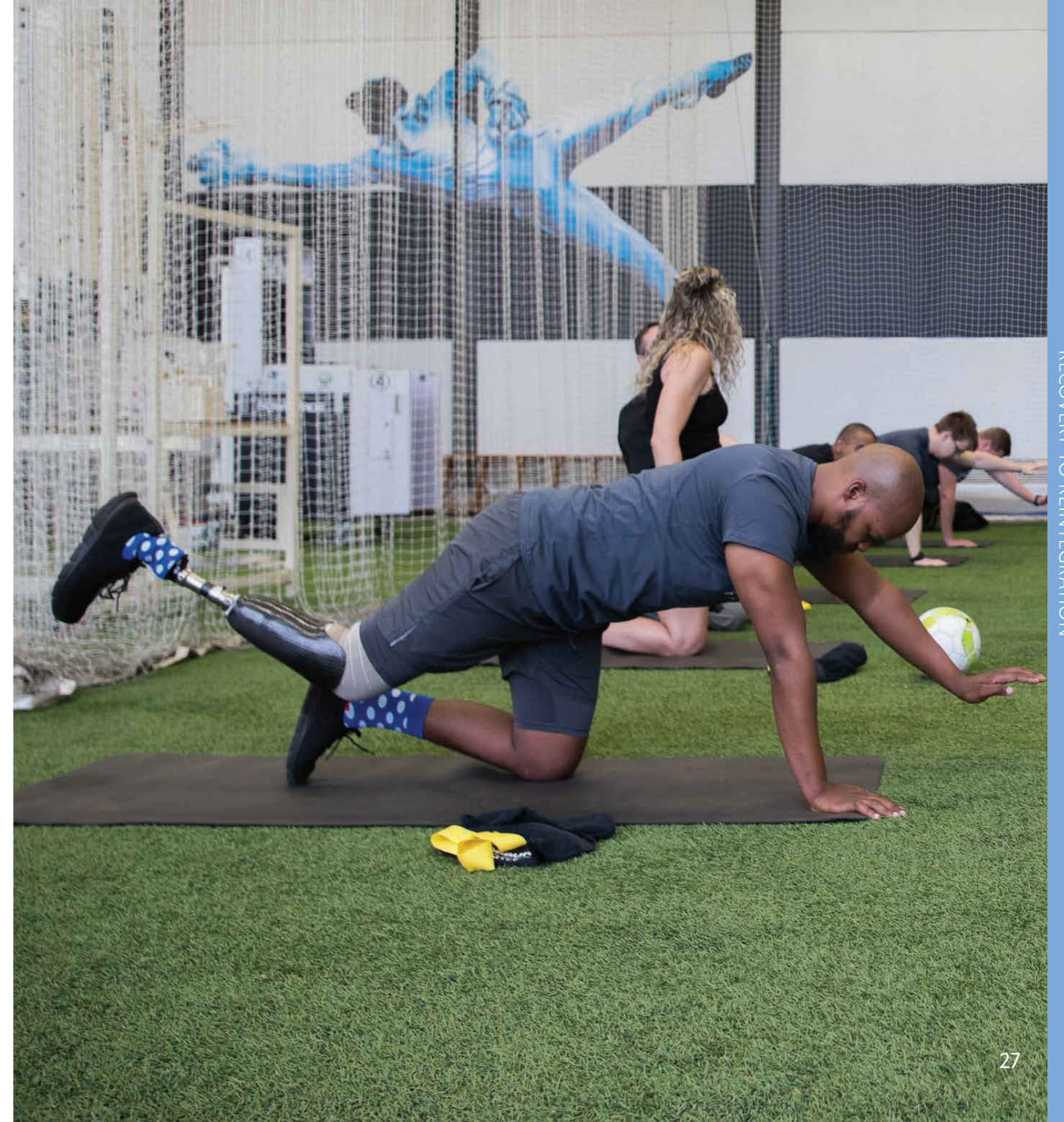
- **Security and Reliability:** A secure, dependable and personalised-fitted connection between the socket and the liner minimises movement in the socket for greater control of the prosthesis. Excellent adhesion ensures that rotational or up-and-down movement of the residual limb is minimised and proprioception (knowing where a limb is without having to look at it) is enhanced, thereby increasing safety and confidence. Using less energy to walk allows you to walk further and for longer without tiring.

- **Comfort and Control:** To ensure comfort, the liner needs to have exactly the right softness to protect and cushion the residual limb's skin, reducing rubbing, movement and pressure points in the socket while at the same time being firm enough to stabilise soft tissues. The muscles that are left can control the limb much more directly. A mild compression across the entire surface area of the residual limb, improves blood circulation, reduces swelling and ensures good control of a prosthetic leg.

*Getting the balance right between skin protection and tissue control, while also being durable enough at the same time, is the reason why Iceross liners from Össur is the world's leading range of liners.*



The silicone liner works closely with the socket. The best possible result in this aspect is paramount. Once the socket and liner work optimally, other components such as the knee and foot can function optimally.



# > COMPONENTS OF PROSTHETIC LEGS >

## THE PROSTHETIC KNEE


The knee is one of the most complicated joints in the human body and it is a formidable challenge to design and manufacture a prosthetic knee joint that functions like a real knee.

A prosthetic knee's primary aim is to replicate the function of a real knee by:

- Providing stability, safety and natural motion, when walking.
- Give stability when standing and when going down steps or stairs.
- Allow a range of motions that makes sitting and kneeling possible.



The effects of an unsuitable knee joint can be as sudden and dramatic as falling, or more gradual but just as damaging over the long term if the user is forced to walk in an unnatural way.

 No component works in isolation. A well-functioning prosthetic leg is a system of components that work together and is most effective when paired with other components.

## WHAT MAKES A GOOD PROSTHETIC KNEE?

• **Stability, Safety and Support:** Moving with confidence is only possible if you feel safe on your prosthetic leg, so the knee component needs to act in a predictable way, providing stability or swinging freely as needed. As your heel hits the ground during walking, weight is transferred from one leg to the other, and the prosthetic knee needs to provide resistance so that supports your body while you swing through the sound leg for the next step and doesn't collapse under your weight. The prosthetic knee must remain stable as body weight rolls forward over the prosthetic foot during the stance phase of gait. It should respond quickly and naturally should an unexpected movement occur and also needs to support your body during actions such as standing.

• **Smooth and Symmetric Movement:** To simulate normal gait, the prosthetic knee must smoothly flex and extend through the swing phase of gait. Effortless movement, as naturally and symmetrically as possible, helps to take the strain off other body parts, such as the hip, back or sound leg that may occur if the prosthetic leg is not functioning properly. The prosthetic knee needs to adapt to your walking style, speed and environment. Achieving this will play a major role in supporting a person's health over the long term.



# > COMPONENTS OF PROSTHETIC LEGS

## THE PROSTHETIC FOOT

A human foot is a complicated structure with 26 bones, 33 joints and over 100 ligaments, muscles and tendons.

A correctly designed prosthetic foot will ensure that the user will be able to walk in a natural, symmetrical way.

Feet are recommended based on a multitude of factors that are specific to the amputee, such as the person's health, daily activities, recreational activities, home environment and general lifestyle requirements.



The aim is to replicate the function of a real foot as closely as possible by:

- Providing a safe, stable platform for standing, walking and other activities.
- Supporting a natural walking action using the full length of the foot effectively.
- Providing effective, predictable energy return to compensate for lost muscle power.
- Protecting the body from shock and rotational forces that would have been absorbed by the amputated joints.

## WHAT MAKES A GOOD PROSTHETIC FOOT?


- **Safe & Stable Platform:** The foot interacts between the ground and the prosthetic leg and needs to be able to adapt to the surface, whether it is a regular, even surface inside a building, an inclined surface, or an irregular surface typically encountered outside buildings.
- **Natural Walking Action:** The ultimate aim for any prosthetic leg is to enable the user to walk naturally and symmetrically like an able-bodied person so that no extra strain is placed on the remaining joints and muscles. The reason is simple – extra strain on other body parts may lead to injury, pain and issues such as osteoarthritis.
- **Effective, Predictable Energy Return:** To compensate for the loss of muscle power around the foot and ankle structure. A foot that provides as much energy return as possible, in an even, predictable way, will allow the person to walk further, have more confidence and be less fatigued.
- **Protecting from Shock and Rotational Forces:** As the heel strikes the ground and the foot rolls over from heel to toe when moving, impact and rotational forces are generated that are absorbed by the foot and the knee. If these forces are not absorbed by the prosthetic foot, the impact will increase the load to other parts of the body such as the residual limb and joints, leading to pain, discomfort and potential long-term health complications.

## ADAPTERS

An adapter is any prosthetic component that links the main components such as the liner, knee and foot together, and can vary from a simple straight tube to special adapters that can modify alignment.

## COSMESIS

A cosmesis is a lifelike limb covering made from a material such as silicone or PVC. Its purpose is to mimic the appearance of a real limb, complete with freckles, veins, hair or even tattoos. Some types of cosmesis are ready-made, but for a truly realistic appearance a cosmesis must be custom designed and manufactured by a prosthetist specialising in this aspect of prosthetics. The importance of appearance of a prosthesis is different for everyone. During the final analysis, appearance must be weighed up against the extra cost, extra maintenance and the possible effects on function.

**GOOD IDEA**

Openly discuss your ambitions and lifestyle requirements with your prosthetist – while, as always, taking personal responsibility to be informed.

## SPECIALISED PROSTHESIS

Thanks to the amazing versatility of the human body, even the best current prosthetic technology is not suitable for the full spectrum of human activities. The technology has come a long way, though, and today a person can often use the same prosthesis for quite a wide range of activities – something that simply wasn't possible even a decade ago.

But there are activities – such as sprinting, long-distance running and swimming – in which a specialised prosthesis is much more functional and will give the user more enjoyment.

Although some general-purpose prostheses can be used for running, if you plan to go sprinting regularly it's better to use components made specifically for this, such as the Cheetah blade. A recent innovation by Össur is a unique crossover foot prosthesis inspired by the original Cheetah design. Although primarily designed for everyday use, the Cheetah Xplore allows the user the option to engage in a variety of sports as well.

Current prosthetic technology plays no active role in any swimming motion and is merely an extra weight on the body. Swimming, or snorkelling are typical activities where the person can benefit from a sports-specific device.



# CARING FOR YOURSELF

Even though several medical professionals may be involved in your path to recovery, it is vital for you to take responsibility for your own health. Here are some useful tips on taking care of your residual limb once you have been fitted with a prosthesis. **These are general tips and every individual is different. You should always follow the guidance of your health care practitioner, and you must never hesitate to contact him or her if you experience any pain or discomfort, or simply have a question.**

## INSPECTION OF YOUR RESIDUAL LIMB

Skin problems can make using the prosthesis uncomfortable or even impossible. **Regular inspection of your residual limb will help identify any skin problems early, before they become too severe:**

- Use a mirror to check your residual limb from every angle.
- In the beginning, check your residual limb whenever you change your dressing or take off your prosthesis.
- Later on, one daily inspection after washing your residual limb should be sufficient.



**!** If you lost a limb due to vascular disease such as diabetes, proper care of your residual limb, including regular inspections, is even more important, as skin breakdown could lead to another amputation.

**“** If you find a skin irritation, contact your prosthetist or doctor as soon as possible – even the smallest skin lesion might be important. Be on the lookout for increased sensitivity of the soft tissue below the skin that feels like bruised tissue. – **Prof Wayne Derman**

## INSPECTION OF THE SOCKET-LINER INTERFACE

**“** The socket-liner interface is the most important part of the prosthesis – it attaches the prosthetic leg to your residual limb – so it’s very important to take proper care of it. – **Ernst van Dyk**

### Daily Cleaning of the Socket

- Daily cleaning is best done before bedtime, so that the prosthesis can fully dry overnight.
- Clean your socket daily with the cleaning solution recommended by your prosthetist.
- Wipe the inside of the socket with a damp cloth. The cloth should only be mildly damp with the cleaning solution, so that excess water does not permeate the prosthetic components.
- Once dry, apply rubbing alcohol to a paper towel and wipe the inside of the socket thoroughly.
- Make sure that the alcohol has fully evaporated before you wear your prosthesis.

**!** Your residual limb must fit snugly but comfortably in the socket. If the socket becomes loose, or if there are pressure areas, your skin might get damaged and your walking dynamics will be affected. Discuss this with your prosthetist before it becomes a problem.

## WEIGHT CONTROL

During rehabilitation and beyond, it is important to eat as healthily as possible and keep your weight stable. **Maintaining a consistent, healthy weight is important for everybody, but for those who have lost a limb it is even more important, for the following reasons:**

- To maintain the proper fit of the prosthetic socket attached to your residual limb.
- To reduce the energy required to use your prosthesis.
- To prevent or reduce secondary conditions, such as back pain.
- To control diseases such as diabetes and high blood pressure.

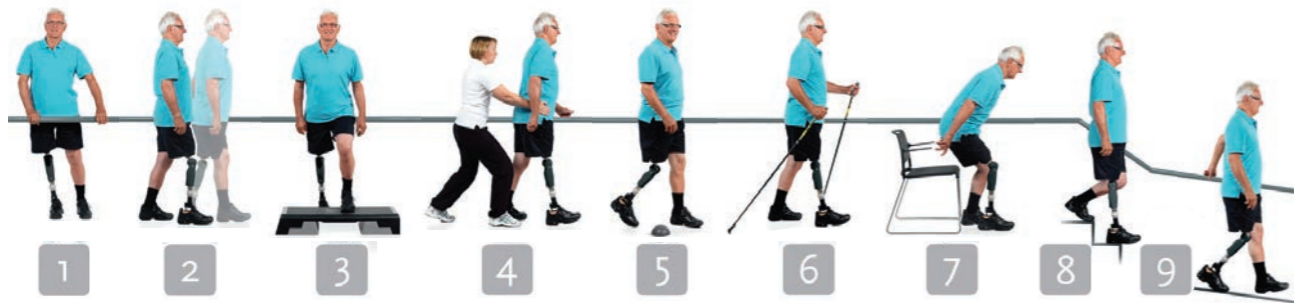
**“** By maintaining a healthy, stable body weight you will have less need for adjustments to your socket, and apart from walking more comfortably and improving your quality of life, you also won’t have to spend as much on regular socket adjustments. – **Prof Wayne Derman**



# EXERCISES FOR AMPUTEES

The following training exercises will help you recondition your muscles and adapt to walking with a prosthesis. They should initially be supervised by your physiotherapist or biokineticist to ensure that you perform them correctly, and later you can start exercising at home in your own time. This type of training will enable you to master the correct walking technique from the start and also help you through your reintegration phase.

## EXERCISES FOR ABOVE-KNEE AMPUTEES



### 1. Side-to-side Pelvis Shift

Place your feet approximately 10 cm apart and shift your pelvis slowly from left to right and back again. You will feel how your weight is shifting from one foot to the other.

### 2. Stepping Forward

Step forward with your sound-side foot, actively loading your weight onto the prosthetic side. Focus on your balance over the prosthesis as you move forward and backward.

### 3. Stepping Up

With both feet on the ground, shift your weight slowly onto your prosthetic leg, push your residual limb into the socket

Do not underestimate the importance of exercise and training: they are a vital part of getting you walking again.



These exercises are just suggestions and may not be the best exercises for your particular situation. Always follow the advice given by the medical professionals in your team, who have physically assessed you.

and place the sound-side foot on the step. Feel your full weight loaded on your prosthetic knee. Try to control your balance on the prosthetic side using the muscles around your hip.

### 4. Walking

Practise walking while your prosthetist or physiotherapist gently restrains your pelvis on the prosthetic side. This increased resistance during the exercise will help give you more forward momentum. When walking, this will produce a longer and more natural stride.

### 5. Figure-8-walking / Turns

Place rubber cups on the floor and walk in a figure of eight or make gentle turns. Concentrate on the roll-over movement of the prosthetic foot and feel how smoothly the prosthetic knee is flexing.

### 6. Walking with Sticks

Using sticks can help improve your trunk rotation and balance as you get used to the prosthetic knee. Actively loading the prosthesis (putting your weight on to it) and generating a smooth rollover of the prosthetic foot will enhance your forward momentum.

### 7. Sitting Down

Place the prosthetic foot slightly forward, then put your weight on your prosthetic knee and keep it there until you can gently bend it. The resistance – or braking power – you can feel helps you to sit down slowly. (The amount of resistance will depend on what kind of prosthetic knee you are fitted with. Whether you are on a microprocessor knee or a mechanical knee, be sure to first consult with your prosthetist before attempting this exercise.)

### 8. Walking down Stairs

Hold the handrail(s) and place the rear half of the prosthetic foot on the step. Practise putting weight on the prosthetic side and gradually move the pelvis forward. By loading the prosthetic knee like this, you will produce the resistance needed to get you down to the next step smoothly.

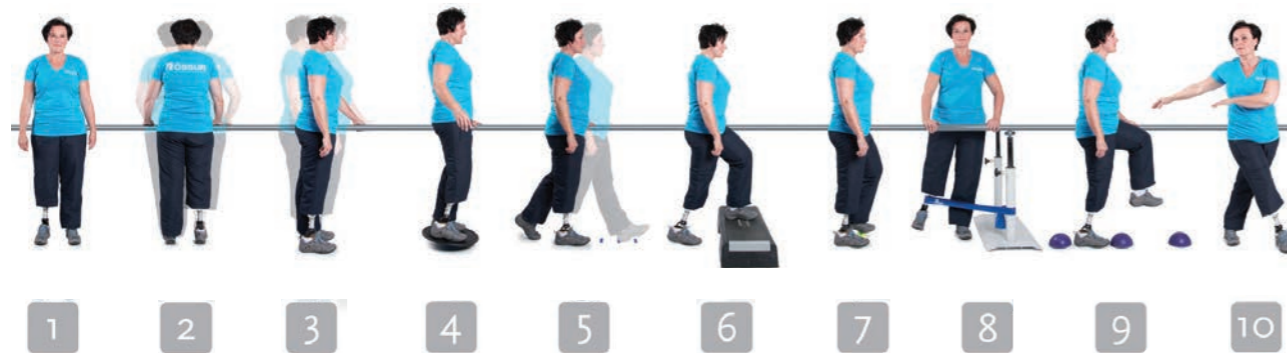
### 9. Walking down a Ramp or Slope

Hold the handrail(s) and take short, evenly paced steps. Loading the prosthetic knee will produce the resistance needed to walk down the ramp in a controlled way.



## > EXERCISES FOR AMPUTEES

### EXERCISES FOR BELOW-KNEE AMPUTEES



#### 1. Standing

Stand upright, dividing your weight evenly between the prosthetic side and the sound side. Use a mirror for visual control.

#### 2. Side to side

Shift your weight slowly onto your prosthetic side; it will help if you contract your gluteal muscles (muscles around your hip) and your residual limb. Next, shift your weight slowly back onto your sound side. Repeat.

#### 3. Forwards – Backwards

Stand upright, dividing your weight evenly between the prosthetic side and the sound side. Shift your weight slowly forward and backward, controlling your balance and feeling your prosthetic forefoot when shifting forward.

#### 4. Balancing

To make balancing more difficult, try to stand on a balance board with both feet. Be very careful when you step onto and off the balance board.

#### 5. Spot-stepping

Mark three different spots on the floor, for a small step, a medium step and a large step. Actively load your weight onto the prosthetic side and take a step forward with your sound side. Focus on your balance over the prosthesis as you move forward and backward with your foot. Make sure you take a full step forward and backward.

#### 6. Stepping Up

Shift your weight slowly onto your prosthetic side, then push your residual limb into the socket and place the sound-side

foot on the step. Try to control your balance on the prosthetic side using the muscles around your knee and hip. Pay attention to the forward movement of your pelvis to keep it in line without twisting or rotating.

#### 7. Tennis Ball Movements

Shift your body weight slowly onto your prosthetic side and contract your residual limb in the socket. Place a tennis ball underneath your sound-side foot. Make small circles with your sound-side foot and alternate with fast cross-movements.

#### 8. Thera-Band Movements

Shift your weight onto the sound side, place the Thera-Band around your prosthetic foot and tie the other end to a fixed object. Move your prosthetic foot in a slow and controlled way to the side, making sure it travels in a straight line.

#### 9. Obstacle Stepping

Place obstacles (plastic cups or toys) on the floor at equal distances and step over them. Raise your knee until it is in line with your hip and repeat with every step.

#### 10. Extra Exercises

Walk sideways, crossing the prosthetic foot over the sound-side foot. Other options you can try: crossing the sound-side foot over the prosthetic foot, side steps, imaginary tightrope walking, backwards walking and big steps.




# FINANCIAL CONSIDERATIONS



It is crucial to understand that for the rest of your life you will need to budget and plan for expenses related to your prosthetic leg. **The important thing is not to give up when confronted by red tape and other obstacles, and to persist in seeking the treatment you need.**


## THE COST OF A PROSTHETIC LEG

Do not rush into a decision, but take your time and investigate all your options – in other words, be well informed – before you appoint a prosthetist to design your prosthetic leg. **It is important to ask why the prosthetist makes a specific recommendation so that you can understand exactly why he or she recommends certain components for you, and what you will be paying for.** Once you understand this clearly, you will also be able to understand the differences between quotes from different prosthetists, and ultimately compare "apples with apples".

 Be clear about the financial arrangements and what you are paying for before you start working with a prosthetist.


**Typically, the cost of a prosthetic leg can be divided into the following three categories:**

1. The **manufacturing** or labour part consists of designing and manufacturing the socket, and aligning and assembling the components correctly to ensure the complete system works as intended. The more complicated the shape of your residual limb and the more health complications you may have, such as scar tissue, the more time and expertise will be required to manufacture your prosthesis.

 It is not possible to estimate a “standard price” for this part of the process, because there is no “standard residual limb”.

2. The cost of all the **mechanical components**, such as the prosthetic foot, which the prosthetist purchases from prosthetic device manufacturers such as Össur. The key factor driving costs here is the prices of the specific components that the prosthetist recommends for you. It is only possible to estimate the price of your complete prosthetic leg once the prosthetist has listed the components that are recommended for you.

3. **Recurring costs:** Once you have received your prosthesis and regained your mobility, your prosthesis will have to be adjusted periodically as your residual limb may change shape and volume over time. The mechanical components will also wear out over time, depending on various factors such as how well you look after your prosthesis. You can expect to replace the mechanical components approximately every five years.

 **GOOD IDEA**  
By maintaining a healthy, stable body weight you will have less need for adjustments to your socket, and apart from walking more comfortably and improving your quality of life, you also won't have to spend as much on regular socket adjustments.

## REIMBURSEMENT OPTIONS

**Depending on the cause of the amputation, your prosthesis and prosthetic rehabilitation is likely to be financed through the following avenues:**

- |  |                           |
|--|---------------------------|
| 1. Medical Aid   | 3. Personal Injury Claims |
| 2. Compensation for Occupational Injuries and Diseases Act (COIDA) Funding | 4. Road Accident Fund     |
|  | 5. Private Funds          |
|  | 6. Disability Insurance   |
|  | 7. Public Sector          |

**1. MEDICAL AID:** If you are a member of a medical aid, you should enquire about the benefits available as soon as possible, so that you can insist on getting the right treatment early on in your rehabilitation. There are so many different medical aid plans and options that navigating your way through the process can be quite intimidating. Our advice is to get help – and an experienced prosthetist can be just the person you need to guide you through the administrative process required to get a medical aid to authorise payment for your treatment.

WHO?	Medical aid members via Prosthetic Benefits, Prescribed Minimum Benefits (PMB) and Ex gratia.		
	1. Prosthetic Benefits: Most medical aid schemes have a prosthetic (external medical device) benefit. The benefit amount depends on the medical aid and the specific plan within the medical aid. If your medical aid prosthetic benefit is insufficient, you can enquire about PMB.	2. PMB: This is a set of defined benefits to ensure that all medical scheme members have access to certain minimum health services, regardless of the benefit option they have selected. This includes: <ul style="list-style-type: none"><li>• Any emergency medical condition.</li><li>• A limited set of ±270 medical conditions (which includes amputation).</li><li>• 25 chronic conditions.</li></ul>	3. Exgratia: In special circumstances, medical aids would consider a (exgratia) contribution outside of their official benefit level. With a detailed motivation and supporting arguments the exgratia committee of the medical aid can decide to increase the benefit contribution on compassionate terms. This is often a 'once off' contribution.
HOW?	Depending on the medical aid, your prosthetist can enquire on your behalf with the medical aid what your available prosthetic benefit is. Be persistent when dealing with your medical aid, and don't automatically accept it if the fund refuses your first request for a specific prosthesis. Don't assume that your medical aid simply doesn't want to help you, but realise that the people making the decisions about payment have a responsibility to pay only for treatments with proven health benefits. If the medical aid benefit is low and insufficient to cover all the costs for the prosthetic rehabilitation, the patient would need to contribute the balance of the costs.		
WHAT?	Medical treatment, rehabilitation and the prosthesis		
NECESSARY DOCUMENTS	Letters from your prosthetist and doctor clearly explaining the health benefits to you of getting a certain prosthetic component often succeed when a case is reviewed by the medical aid:		
	1. Benefit: Quotation from prosthetist sent to your medical aid on your behalf. Wait for pre-authorisation.	2. PMB: Your medical aid will provide the documents that needs to be completed by you and your prosthetist. Feedback usually within 60 days.	3. Exgratia: Detailed motivation and supporting arguments

2. COMPENSATION FOR OCCUPATIONAL INJURIES AND DISEASES ACT (COIDA) FUNDING: Every employer in South Africa is required by law to make a monthly contribution to the Department of Labour Compensation Fund, whose purpose is to compensate people who have been injured at work.			
WHO?	COIDA applies to all employers (casual and full-time workers) who, as a result of a workplace accident or work-related disease are injured, disabled or killed. Under this act, there are different bodies:		
	1. Workman's Compensation Fund (WCA) – General workers	2. The Federal Employer's Mutual Assurance Company (FEM)– Construction industry	3. Rand Mutual Assurance (RMA) – Mining sector and iron, steel and metal industry
HOW?	<div>Occupational Injuries from WCA and FEM:<ol style="list-style-type: none"><li>Report any injury to your employer immediately.</li><li>Take a WCA form with you for completion by the doctor and hospital staff. This, together with any other forms given to you by the doctor, must be submitted to the WCA.</li><li>The WCA will give you a case number, which you will use for all future claims and enquiries.</li><li>Follow up with your employer on the progress of the matter.</li><li>Once you are awarded a claim number, you can visit your prosthetist, who will then send an application and motivation for pre-authorisation for your prosthesis to WCA.</li></ol></div> <div>Occupational Injuries from RMA:<ol style="list-style-type: none"><li>Inform your employer immediately. Your employer must report the incident to RMA within 7 days from the date of the accident for all injuries, or within 14 days of diagnosis of disease.</li><li>Submit the necessary documents to your employer who will in turn need to submit these to RMA together with your claim:<ul style="list-style-type: none"><li>Completed Section 51 document if you are under the age of 26 years or if you are a learner or trainee.</li><li>Medical reports – your first medical report must be submitted with your original claim, however, additional medical reports are required during the course of your treatment so that your progress can be tracked, particularly in the case of Temporary Total Disablement (TTDs).</li><li>Final assessment document.</li></ul></li><li>Once you are given a claim number, you can visit your prosthetist, who will then send an application and motivation for pre-authorisation for your prosthesis to RMA. Please be aware that it can take several months for the WCA to respond to this request.</li></ol></div>		
WHAT?	The COIDA tariff list used by Workman's Compensation only allows for basic prosthetic components. For higher-end components you may need to combine this with some other reimbursement options.		
NECESSARY DOCUMENTS	Your employer must send the necessary documents and your prosthetist must send an application and motivation for pre-authorisation for your prosthesis to the WCA, FEM or RMA. For more information on the topic and to view all the relevant forms please visit the Department of Labour's website: <a href="http://www.labour.gov.za">www.labour.gov.za</a> . Keep in mind that if you've lost a limb due to an injury at work and the funds available from the Compensation Fund aren't enough to cover the costs of a prosthetic leg with adequate functionality to allow you to return to work and become a productive employee again, your employer may very well be willing to contribute towards the shortfall.		

3. PERSONAL INJURY CLAIMS			
WHO?	<div>Medical negligence</div> <div>It is an unfortunate reality that negligence by medical personnel in the treatment of many diseases, conditions and injuries can result in the amputation of a limb that may have been otherwise avoidable. The following conditions may result in amputation:<ul style="list-style-type: none"><li>Onset of infection in hospital (non-sterile IV equipment, infection after artificial joint replacement).</li><li>Mismanagement of infection once present.</li><li>Misdiagnosis of vascular disease or vascular damage (in case of trauma).</li><li>Compartment syndrome (swelling occurring within a plaster of Paris cast or brace that was applied).</li></ul></div>	<div>General personal injury</div> <div>Gunshots, dog bites or assault such as stabbing, causing severe injury that can result in eventual amputation, very often as a result of vascular damage or later onset of serious infection.</div>	<div>Metrorail/Transnet injuries</div> <div>If you have been injured while using the South African rail network, you may have a claim against Metrorail or Transnet.</div>
HOW?	<div>If a case of negligence is suspected against a medical facility or its personnel, it is advised that the services of a medical negligence attorney is obtained. The attorney, with assistance of the relevant medical experts that will be appointed, will investigate the specific case and give a professional view on whether negligence was potentially the cause for the amputation. It should be noted that a relatively small percentage of medical negligence cases are successful as it is often difficult to prove that the alleged negligence itself caused the relevant aggravation (which in this case would be amputation) and that it would not have occurred in any case as a result of the condition, disease or injury itself.</div>	<div>A personal injury claim would be instigated against the insurance of the individual(s)/ group or organisation that are represented.</div> <div>In case of a dog bite, a claim would be against the owner of the dog (or the owner's personal liability insurance). It is recommended that an experienced personal injury attorney/firm is consulted to determine if such a claim would indeed be viable and likely successful.</div>	<div>Consult with an experienced personal injury attorney to assess viability of such a claim.</div>
WHAT?	<div>Claim for medical treatment, rehabilitation, prosthesis, loss of income, etc..</div>	<div>Claim for medical treatment, rehabilitation, prosthesis, loss of income, etc..</div>	<div>Claim for medical treatment, rehabilitation, prosthesis, loss of income, etc..</div>

> FINANCIAL CONSIDERATIONS

<b>4. ROAD ACCIDENT FUND:</b> The Road Accident Fund provides compulsory cover to all users of South African Roads. The RAF reimburses road accident victims who were seriously injured and as a result incurred medical costs, loss of employment or income and often require long-term medical treatment, which also has financial implications.	
WHO?	A road accident victim. If you were injured in an accident, you may have a claim for compensation against the Road Accident Fund (RAF). This includes both motor vehicle (car, motorcycle, taxi, bus, truck) and pedestrian accidents.
HOW?	The RAF encourages people who have been injured in a car accident to contact them directly ( <a href="http://www.rafc.co.za">www.rafc.co.za</a> ), but it is generally beneficial to get a competent and experienced attorney to facilitate your claim against the RAF. In most cases, experience has shown that individuals who are represented by an attorney get better compensation as compared to direct claims handling and settlement by the Road Accident Fund itself.
WHAT?	In terms of an amputation as a result of a road accident, the individual would be compensated in two parts: 1. A financial reimbursement for general damages. 2. An undertaking for future medical expenses. If you succeed with your claim, you may be compensated with a lump-sum payment – but remember that the costs associated with a prosthetic leg can be substantial, so plan and budget carefully for your prosthetics needs as you go forward.
NECESSARY DOCUMENTS	Your attorney and prosthetist can help you to get all the necessary forms, documentation and medical expert reports that would be needed to process your claim. In most cases, the prosthetist would apply for pre-authorisation on your behalf at the RAF. Once authorisation is received your prosthesis fitting and rehabilitation can start.



<b>5. PRIVATE FUNDS:</b> Individuals who do not have a medical aid and did not lose their limb as a result of a road accident or occupational injury; thus, there is no claim against the Road Accident Fund or Workman's Compensation Fund for example.	
WHO?	This often includes individuals who lose a limb as a result of disease, or as a result of general injury/trauma (that results in serious infection), or in cases of congenital (birth) deformity where they do not have medical aid.
HOW?	Amputees and/or their families would need to pay for the prosthesis. They can also get financial support through: <ul style="list-style-type: none"><li>• Personal funds (such as savings, bank credit or loans, selling assets).</li><li>• Contributions and donations from family members and friends.</li><li>• Sponsorship (by individuals or companies).</li><li>• Fundraising events can be very successful. Your message must be clear, so that people can see why getting the prescribed device will help you lead a productive life. You need to be able to explain exactly what the device will enable you to do and what difference it will make to your health and mobility. A letter from your prosthetist or doctor explaining the medical benefits of the specific device they are recommending will go a long way towards getting other people to understand your needs.</li></ul>
WHAT?	Medical treatment, rehabilitation and prosthesis.

**6. DISABILITY INSURANCE:** If you have disability insurance or insurance against the risk of not being able to do your job due to illness or injury, contact your insurance broker to ask about the coverage available. **In fact, it's important for everybody to have sufficient disability cover.** Most South Africans are vastly underinsured when it comes to losing a limb. A small adjustment to a person's insurance policy can mean the difference between being able to afford a suitable prosthesis and having to make do with something inferior.

**7. PUBLIC SECTOR:** A All South Africans are entitled to treatment at a government medical facility. Go to your local (closest) government clinic first. You will then be referred to a government orthotics and prosthetics centre. A prosthetist at the centre will evaluate you and suggest the appropriate treatment and components you will need for your prosthesis. Although the options available in the government sector are fewer than in the private sector, prosthetic technology is constantly improving, and components that were previously only available in the private sector are starting to filter through to public health care. The cost of your prosthesis will be determined by your income level and whether or not you receive a disability or pension grant from SASSA.

## MY NOTES AND QUESTIONS

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