Prosthetic
Best Practice Guidelines
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The organisation and editing of the guidelines has been carried out by Vicky Jarvis and Tim Ver-rall.

Vicky is the clinical and quality lead for Steeper Group, and a prosthettist with many years experience. She was a member of and later led the prosthetics Best Practice Group, whose focus have been the development of evidence-based prescription guidelines and clinical governance protocols. Vicky has completed a postgraduate diploma in Health Research at Leeds University, and maintains an active interest in research and development in the field.

Tim trained as a prosthettist with Steeper at Roehampton in 1974, and has worked at Manchester and Liverpool prosthetic centres. He headed up the Steeper Best Practice Group for five years, contributing his considerable experience in both upper and lower extremity prosthetics to the guidelines. With patience and dedication he drew together all the evidence and hard work of the group to form this comprehensive guide to prescribing every aspect of modern prosthesis.

Our thanks also go to former members of the Best Practice Group (BPG) who have contributed ideas, material and valuable time to make the guidelines what they are today:

Tony Miller – Prosthettist, Mags Miller – Orthotist, and Debbie Franklin – Prosthettist, Derby, who, along with several other prosthettists, formed the Best Practice Working Party (BPWP) and set the ball rolling.

Julie Kirby – Prosthettist, Liverpool, who headed up the BPWP for a time and to all the Best Practice co-ordinators from each of the Steeper centres at which they worked.

Karen Edwards – Physiotherapist, with a special interest in clinical governance who joined the BPWP for a while to broaden the expertise available.

Penny Broomhead – Physiotherapist, Nottingham, for advice on guideline writing and meeting NHS standards.


Colette Shaw – Prosthettist, Leeds, member of the BPG in 2007 plus publication support in 2010 as the Marketing Director at Steeper.


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1. Originally, all literature searched was carried out using the RECAL bibliographic search engine of the National Centre for Prosthetics and Orthotics based at the University of Strathclyde. The search terms used and exclusion criteria are explained in the introduction and also in the Central Reference File held by Steeper Best Practice Group. Since 2007 RECAL has not been updated and subsequent literature searches have been undertaken using a range of databases including Medline, CINNAHL and Embase.

2. The Delphi technique is an internationally recognised method for obtaining unbiased consensus of opinion. The method of obtaining this consensus is explained in the introduction and Central Reference File for these guidelines.
Introduction

Scope and Purpose

These guidelines aim to address the clinical question:

“What is best evidence-based practice for the prescription of socket type, the choice of casting method, and the generic hardware for patients with a lower extremity amputation?”

These guidelines aim to:

• Guide and support clinicians in the decision-making process when prescribing prostheses.
• Facilitate prescription of the most appropriate prosthesis for each patient, thereby aiding the patient to reach their maximum functional potential.
• Aid the implementation of current best evidence-based practice.
• Reduce large national variations in prescription.
• Produce recommendations which can be easily audited.
• Produce recommendations based upon the general consensus of professional opinion and best available current evidence.
• To gain consensus of professional opinion for each guideline statement using the Delphi technique.
• To produce recommendations through guideline statements in three key areas:
  • Prescription of socket type
  • Casting method
  • Prescription of generic hardware
• To produce a tool for audit purposes.

The objectives of these guidelines are:

• To identify and critically appraise all relevant published articles.
• To gain consensus of professional opinion for each guideline statement using the Delphi technique.
• To produce recommendations based upon the general consensus of professional opinion and best available current evidence.
• To produce recommendations through guideline statements in three key areas:
  • Prescription of socket type
  • Casting method
  • Prescription of generic hardware
• To produce a tool for audit purposes.

These guidelines do not aim to dictate which method or prescription must be used overall, but rather to offer guidance to the clinician by highlighting indications and contraindications for a variety of practices which are all considered to be good practice.

The guideline then highlights the most appropriate patients within that patient population, by defining indications and contraindications for that socket type, casting method or generic hardware. These guidelines do not address patients with congenital anomalies or upper extremity absences.

Stakeholder Involvement

These guidelines were originally compiled and used by clinicians within Steeper Group, a private company providing prosthetic and orthotic services to the NHS. The main compilers have been a group of clinicians with a special interest in the field of evidence-based practice, who then drew on the wider community of clinicians to gain consensus of opinion alongside the best available evidence. The guidelines have been widely used and expanded significantly over the years.

Development and Production of Prescription Guidelines

The process of developing a guideline is important to ensure an unbiased representation of the consensus of clinical opinion and current best available evidence. For these guidelines, an adapted form of the Delphi Technique³ was used to gain consensus of professional opinion together with literature reviews for each topic.

Literature Search/Review

RECAL was a specialist search engine for the National Centre for Prosthetics and Orthotics. It was based at the University of Strathclyde and contained references from many prosthetic and specialist rehabilitation journals worldwide. In 2007 this service was disbanded although the original database with abstracts is still available online in the form of Recal Legacy, though it is no longer updated.

The preferred search engine is now PUBMED (or MEDLINE where available) with Athens, NHS Evidence, CINNAHL and Embase also searched. Abstracts are screened and papers thought to be of use are sourced through the NHS or university libraries. Search terms are recorded in the central reference copy of that guideline. References were also obtained from the clinical consensus process described on page 9.

References where a hard copy was not available or which were not in English were automatically excluded. Furthermore any references which were deemed to be irrelevant to the guideline after appraisal by members of the Steeper Best Practice Group (BPG) were also excluded.

All of the remaining references were critically appraised by two members of the BPG and their conclusions recorded on a review form. They were classified using the CASP⁴ system to give the type of study undertaken within the types listed on the following page. Methodological quality was assessed to ensure only papers which attempted to reduce confounders or bias were considered relevant. Any indications or contraindications arising from the results of the papers were recorded. For a new guideline these results are compiled into preliminary prescription criteria to form the first phase of the consensus procedure described on page 9. In the case of updates to existing guidelines the references were added to the guideline, using italics to denote that they are only from the literature review and not consensus.
Definitions of Study Types

Qualitative research

The collecting of people’s experiences which are then collated and analysed in largely non-statistical ways. Examples include diaries, structured and non-structured interviews.

Quantitative research

The gathering of observations measured and analysed in a numerical, scientific way, carried out to provide statistical evidence to support an existing hypothesis. Examples of quantitative research include:

- Case studies or series - A descriptive study of the characteristics/clinical findings seen in one (study) or several (series) patients who have the same condition or disease. It is a study method that can lead to increased understanding of one context and the processes at work. It is scientifically weak, but can be a good starting point for further research. Routine surveillance programs can use accumulating case reports or series to suggest the emergence of new disease or epidemics.

- Cross-sectional study - A descriptive study that looks at exposure and disease status simultaneously at one point or period of time, e.g. frequency of disease, risk factors or other characteristics at that time. Strength of evidence is low as it can only show an association between factors. The scale and scope may vary; it can be used to assess prevalence – the overall proportion of the population who have the disease or incidence – or the number of new cases over a defined time. It can also be analytical when comparing more than one sample or exposure variables that do not change over time. For example: a study of silicone suspension liner wearers over a defined time. It can also be analytical when comparing more than one sample or exposure variables that do not change over time. For example: a study of silicone suspension liner wearers over a defined time.

- Case control study - An analytical study in which subjects are selected on the basis of presence of disease or condition and compared to a control group who do not have the disease of interest. The groups are compared retrospectively for evidence of an exposure or characteristic of interest. For example: a study of the prevalence of blisters in people with a silicone suspension liner compared to patients not using a silicone suspension liner of that type.

- Cohort – An observational analytical investigation where subjects are classified on the basis of presence or absence of exposure to a suspected risk factor for a disease. They are followed up over time to determine the development of disease. This is compared to the unexposed control group. The design can be prospective – subjects have been exposed but the disease has not yet occurred, or retrospective – the investigation starts after both exposure and disease has already occurred. For example: a study of a group of dysvascular patients over five years, recording the level of second amputation in those patients who smoke compared to those who don’t smoke.

- Randomised Control Trial (RCT) – An intervention or experimental study where subjects are randomly allocated to one of two (or sometimes more) groups. For example, patients experiencing phantom pain are randomly provided either a Relax Night Care sock or a placebo sock then followed up to record frequency and intensity of phantom pain at night. One group receives the experimental treatment or intervention, the other group is the control and receives a placebo or standard treatment. Effectiveness is measured by comparing outcomes in the groups. Intervention studies are considered to be the most scientifically robust as the process of randomising achieves, on average, control of all the other factors that may affect outcomes.

This type of study is often quoted as the gold standard for research; however a poorly designed RCT has little or no value and would be less scientifically robust than a well designed cohort or case control study.

Professional Consensus

The nature and history of prosthetics mean that research can be scarce and often of poor methodological quality, therefore a necessary source of evidence has to be consensus of clinical professional opinion. This is obtained using an adaptation of the Delphi Technique. This process is illustrated in Fig. 1 on page 10.

Phase One: Literature review

The results of a literature review completed as described above are compiled into a list of preliminary prescription criteria. See below for more details on critical appraisal.

Phase Two: Establishing prescription criteria

The preliminary prescription criteria are sent to all Steeper prosthetists and the multidisciplinary teams in each branch with a request to comment on the given criteria, and to suggest any other factors that would affect their prescription practise or any research they are aware of. All responses are anonymous and are collated and edited to a standard wording to form initial guideline statements.

Phase Three: Obtaining professional consensus

These guideline statements are compiled into a questionnaire and returned to all Steeper prosthetists and the multidisciplinary teams in each branches with a request to indicate their level of agreement with each statement. The available responses are ‘Strongly Agree’, ‘Agree’, ‘Disagree’, ‘Strongly Disagree’ or ‘No Experience’ with each statement. Any responses outside these categories are disregarded. Again all returns are anonymous and the branch of origin or profession is not recorded. There is also opportunity to add any further criteria that may affect the prescription. This phase can be repeated to include these criteria if necessary.

Phase Four: Production of guideline

The final guideline is produced using the consensus of agreement to indicate the importance of each criterion. Each indication/contraindication statement has four levels of agreement: Strongly Agree (SA), Agree (A), Disagree (DA) and Strongly Disagree (SDA).

On return of the phase 2 questionnaires, the agreement (SA + A) for each indication and contraindication is to be calculated as a percentage of the total number of responses (SA + A + SDA + DA), thus excluding the ‘No Experience’ responses.

Consensus is defined as a “general agreement of a substantial majority”, this is reached when >75% of responses agree or strongly agree.

A figure of <60% is defined as no consensus and the indication/contraindication is rejected. For figures between 60% and 75%, the BPG review the particular indication or contraindication to decide if there is either sufficient evidence to suggest it should be included, a need to reword it for clarification and resubmit it, or a need to exclude it.

The strength of agreement or disagreement is accounted for when each indication or contraindication that has consensus is scored using the following method to weight the amount of agreement: (SA*2) + (A*1) – (DA*1) – (SDA*2). This score is used to determine the order in which the criteria appear in the guideline.

At regular intervals, the Steeper BPG will review each guideline to search for new literature and audit prescription criteria. If a revision of the guideline is indicated the process will be restarted at phase two.
The Format and Presentation of the Guidelines

These guidelines have been developed with the aim of making them as user friendly as possible. The format of the guidelines should help clinicians determine the available options for each amputation level and easily decide which casting method, socket type or generic hardware is most appropriate.

The published guidelines will consist of:

1. The Prosthetic Best Practice Guidelines containing; a brief introduction, contents page, all guidelines and overview pages. This has been published as a book and is available as a PDF on the Steeper Group website.

2. The Introduction; a quick reference guide to how the guidelines have been put together and how best to use them.

3. The contents page listing all the available guidelines for the socket types, casting methods and generic hardware for each amputation level. After identifying each option relevant to their patient it is then up to the clinician to decide which method is most appropriate.

4. The guidelines contain a Guideline Statement, with Definitions to ensure clarity, followed by a table of Indications and Contraindications, with definitions, notes and explanations of any terms or expressions used.

Where professional consensus and/or references are contradictory or unclear, explanations are provided. The recommendations made by the indications and contraindications are intended to be clear and concise to enable comparisons between the guidelines to be made easily.

Each chapter ends with a table of references, in which the APA style of referencing is used. The reference details will include the author(s) name, publishing year, article/study title, journal name, volume, issue (if applicable), and page number(s).

References that support a specific indication/contraindication are linked to that indication / contraindication in the guideline, by a superscript number.

Overview pages are included to provide additional information which, though it may not be exhaustive, can help in the application of the guidelines.

There is also a Central Reference File containing all details of literature searches including hard copies of references used; details of professional consensus surveys and all material relating to development of the guidelines. This will be held centrally and be available for examination on request.

The Application of the Guidelines

These guidelines have been produced for the benefit of those who are responsible for determining the most appropriate socket type, casting method and generic hardware for a particular patient with a lower extremity amputation. This is most often the responsibility of the prosthetist and rehabilitation consultant, but may also include the physiotherapist, occupational therapist and other members of the multidisciplinary team, and should always include the patient themselves.

The guidelines can be a useful tool by which the clinician can reason through the various options available. Indications and contraindications can be compared to find the most appropriate way of making progress with the patient’s prosthetic rehabilitation according to current best practice guidelines.

Fig. 1 Method for Producing a Prescription Guideline
It should also be a useful tool for the multidisciplinary team, providing the team with greater assurance that the proposed course of action is best practice according to the evidence and professional consensus, and not just a preference of the clinician involved. The contraindications observed may also provide the team with a clearer idea of what issues need to be considered prior to prosthetic provision or the application of a particular technique.

They can also be used to work through the various options with the patient as part of the process of gaining their consent for a particular course of action, or to explain why an alternative approach is inappropriate. The guidelines are not intended to restrict clinicians from attempting to make progress with the rehabilitation of the patient, or to remove their freedom to make decisions regarding their patient’s care. Rather it is to provide a framework of evidence to support and advise them as to what others in the profession believe to be the most appropriate application of the many different prosthetic approaches available, and to warn of any potential pitfalls.

The Best Practice Guidelines are the property of Steeper. They are clinically independent with no affiliation or bias towards any manufacturer or supplier of prosthetic products.

### References - Introduction

Partial foot prostheses

Amputation Type

- Toe disarticulations
- Transmetatarsal amputations
- Midtarsal amputations. Generally referred to as Chopart disarticulations

Prosthetic Treatment

These amputations are most often treated by the provision of bespoke insoles, used in either standard or bespoke footwear. In the case of multiple or significant toe amputations, a carbon graphite sole may also be used to provide better function at toe off. Removal of the first or fifth ray rarely requires more than an insole in an appropriate shoe. Removal of the central, or more than one ray is not recommended.

Casting Method

- Compression box
- Hand casting
- Alginate casting

Materials

The materials used are dependant on the type of prosthesis that is chosen.

The guidelines shown in italics have yet to be produced.

Partial foot overview

Toe amputation

Toe amputation involves removal of one or more toes through phalanges, interphalangeal joints or metatarsophalangeal joints. Metatarsal head pressure can become more prominent, and fixation of the long extensor tendon to the dorsal joint capsule aids in elevation of the metatarsal head. The standard technique is to prepare a plantar soft tissue flap, consisting of the thick plantar skin, which enables weight-bearing.

Disarticulation of the second toe may result in hallux valgus deformity because the great toe tends to migrate towards the third toe to fill in the gap. Amputation of the great toe or even of all five toes usually does not impair walking ability. Prosthetic toes can be fitted for cosmetic restoration, although it may be difficult for these to remain in place. If function is impaired or hallux valgus develops, this can be treated by similar methods to non-amputated feet.

Ray amputation

Ray amputation involves the excision of the toe and a variable portion of its metatarsal. The bone should be bevelled on the plantar aspect to avoid an area of high pressure during latter stance phase. In regard to the first (medial) ray, the metatarsal shaft should be left as long as possible to aid in effective elevation of the medial arch by a custom-molded insole. Single amputations of rays two, three, or four will only moderately affect the width of the forefoot. Resection is best carried out through the proximal metaphysis just distal to the intersection of the base of the involved ray with those of the adjacent metatarsals, leaving the tarsometatarsal joints intact. For a fifth metatarsal amputation, the shaft should be transected obliquely with an inferolateral-facing facet, leaving the uninvolved half to three-quarters of the shaft to preserve forefoot width and retain the insertion of the peroneus brevis.

Prosthetic solutions for this amputation level can include cosmetic restoration using a silicone toe – this may need to be secured to the foot around the forefoot and does not usually affect function. If function is compromised, orthotic insoles with a simple toe filler and medial and/or transverse arch support can be used. Shoe adaptations are sometimes required to improve function.
Transmetatarsal amputation

Transmetatarsal amputation involves the excision through the epiphysis of the metatarsals. The tendons of the flexor and extensor muscles are sutured to each other or if possible, fixed to the bone. It is important to avoid an equinus position. Patients with these amputations can usually walk without a prosthesis however base of support is decreased which results in balance that is less than normal and reduced push off power. A tightly fitting silicone prosthesis can provide cosmetic restoration, protect the distal end and provide transmetatarsal support. A rigid sole plate may be necessary to improve roll over and push off.

Transmetatarsal (Lisfranc) disarticulation

First described by Lisfranc in 1815, Lisfranc disarticulation involves the incision of the foot at the tarsometatarsal joint, with the sole being preserved to make the flap. Approximately 50% of the original supporting area is remaining but a major loss of the forefoot length. Equinovarus is a common postoperative problem. This has been overcome quite adequately with the reinsertion of the extensor tendons and the peroneal tendons at a more proximal site.

Some surgeons perform an Achilles tendon lengthening when they think that an equinovarus is probable. The lost surface area must be restored to improve balance, push off and avoiding an equinus position. It is important to improve roll over and push off.

Midtarsal (Chopart) disarticulation

This disarticulation is through the talonavicular and calcaneocuboid joints. Chopart disarticulation removes the forefoot and midfoot, saving talus and calcaneus. At the time of disarticulation, all ankle dorsiflexors are divided. Without restoration of dorsiflexor function and weakening of the plantar flexors, severe equinus deformity from myostatic contracture of the unopposed triceps surae is inevitable. Active dorsiflexion can be restored to this extremely short residual foot by attachment of the anterior tibial tendon to the talus, either through a drill hole in the talar head or with sutures or staples to a groove in the distal aspect of the head.

A subcutaneous Achilles tenotomy can be carried out to prevent equinus deformity. The ankle and subtalar movement between residual limb and socket create the biggest challenge for Chopart. The movement results in friction and the possibility of skin breakdown and sores. This can be neutralised with a good grip of the socket around the heel. A surgical alternative to avoiding movement inside the socket is an arthrodesis of the foot joint and between talus and calcaneus. This results in a stable residual limb that can tolerate end-bearing and a slight shortening which will simplify prosthetic fitting.

The advantages with Chopart disarticulation are a longer lever arm for balancing forces (compared to a higher level amputation) and an area for weight distribution. With preservation of full leg length and a stable heel pad, the Chopart patient can walk with direct end bearing for short distances without a prosthesis, although this short residuum has no inherent rollover function.

A tightly fitting silicone prosthesis can provide cosmetic restoration, protect the distal end and provide trans-metatarsal and medial arch support. A rigid sole plate may be necessary to improve roll over and push off. Depending on the shortening of the limb and condition of the residuum this level is sometimes treated prosthetically as a Symes amputation – see chapter three.

References - Partial foot overview


Silicone partial foot for Chopart

Prescription Guideline - PF P SSS 01

Guideline Statement

A silicone partial foot prosthesis should be prescribed for any patient with a Chopart (midtarsal) amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

• Silicone partial foot prosthesis is a slip on, self-suspending prosthesis made almost entirely of silicone, providing a restoration of the forefoot shape.

Guideline Statement

Prescription Guideline - PF P SSS 02

Guideline Statement

A silicone partial foot prosthesis should be prescribed for any patient with a Lisfranc amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

• Silicone partial foot prosthesis is a slip on, self-suspending prosthesis made almost entirely of silicone, providing a restoration of the forefoot shape.

Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
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<tbody>
<tr>
<td>Patient prefers cosmetic appearance124</td>
<td>Primary patient with oedematous residual limb1</td>
</tr>
<tr>
<td>Psychological benefits with improved body image</td>
<td>Activity level above moderate walking, requiring good foot action1</td>
</tr>
<tr>
<td>Stable ankle joint1</td>
<td>Ankle joint requires functional support1</td>
</tr>
<tr>
<td>Healed residual limb3</td>
<td>Unhealed residual limb12</td>
</tr>
<tr>
<td>Good personal hygiene</td>
<td>Poor personal hygiene</td>
</tr>
<tr>
<td></td>
<td>Excessive perspiration</td>
</tr>
<tr>
<td></td>
<td>Bulbous residual limb</td>
</tr>
<tr>
<td></td>
<td>Large residual limb</td>
</tr>
<tr>
<td></td>
<td>Inappropriate footwear*4</td>
</tr>
<tr>
<td></td>
<td>Allergic reaction to material used</td>
</tr>
</tbody>
</table>

*Inappropriate footwear - may best be defined as that which has too high a heel, such that the plantar-flexed position of the residuum creates loads on it that cannot be comfortably maintained, or has heels that are so narrow that medial/lateral stability is compromised, or which has so little containment that it cannot safely be kept in place on the prosthesis. At this level of amputation it is preferable if the shoe provides some support or retention above the level of the prosthesis to help retain it on the residuum.

Silicone can be an excellent material with which to provide protection for delicate areas of tissue, especially if a softer patch is included in the lay-up of the prosthesis. But it can also cause perspiration and this may lead to a softening of the tissue, increasing the problem. Care needs to be taken therefore to determine the cause and nature of such a problem before proceeding.

Exceptions

• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.

• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The multidisciplinary team (MDT) must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.

• Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Prescription Guideline - PF P SSS 03

Guideline Statement

A silicone partial foot prosthesis should be prescribed for any patient with a Chopart (midtarsal) amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Silicone partial foot prosthesis is a slip on, self-suspending prosthesis made almost entirely of silicone, providing a restoration of the forefoot shape.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
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<td>Patient prefers cosmetic appearance¹²³⁴</td>
<td>Primary patient with oedematous residual limb¹</td>
</tr>
<tr>
<td>Psychological benefits with improved body image</td>
<td>Activity level above moderate walking, requiring good forefoot action¹</td>
</tr>
<tr>
<td>Healed residual limb²</td>
<td>Unhealed residual limb¹²</td>
</tr>
<tr>
<td>Good manual dexterity⁴</td>
<td>Impaired hand function⁴</td>
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<td>Stable ankle joint¹</td>
<td>Unstable ankle joint that requires support¹</td>
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<td>Good personal hygiene</td>
<td>Poor personal hygiene</td>
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<td>Bulbous residual limb</td>
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<td>Large residual limb</td>
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<td>Inappropriate footwear*¹⁴</td>
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<tr>
<td></td>
<td>Allergic reaction to material used</td>
</tr>
</tbody>
</table>

*Inappropriate footwear – may best be defined as that which has too high a heel, such that the plantar-flexed position of the residuum creates loads on it that cannot be comfortably maintained, or has heels that are so narrow that medial/lateral stability is compromised, or which has so little containment that it cannot safely be kept in place on the prosthesis. At this level of amputation it is preferable if the shoe provides some support or retention above the level of the prosthesis to help retain it on the residuum.

Silicone can be an excellent material with which to provide protection for delicate areas of tissue, especially if a softer patch is included in the lay-up of the prosthesis. But it can also cause perspiration and this may lead to a softening of the tissue, increasing the problem. Care needs to be taken therefore to determine the cause and nature of such a problem before proceeding.

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The multidisciplinary team (MDT) must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

References - Partial foot prescription guidelines

Symes amputation

For many years now the standard ankle disarticulation has been that described by Syme in 1843 as a "disarticulation through the ankle joint with preservation of the heel flap to permit weight-bearing at the end of the residual limb".

The amputation involves an incision as shown in fig. 1 - the disarticulation of the talus from the ankle joint and the shelling out of the calcaneus from the heel pad.

At this stage the calcaneus and the forefoot are removed. Syme recommended the removal of the articular surface of the tibia, but unless there is some other reason for doing so, most surgeons think this unnecessary.

The heel pad, once centered under the leg, is held by suturing the plantar fascia to the anterior tibial cortex through drill holes. Since the main reason for failure of this type of amputation is the migration of the heel pad, it must always be supported until the patient is able to wear a prosthesis. The end result should be a functional endbearing residual limb, with sufficient ground clearance to allow the use of a dynamic prosthetic foot. It should also enable ambulation without a prosthesis, though if this becomes too frequent it can cause the heel pad to move.

This method is also frequently used where a congenital deformity of the foot has occurred, possibly with some other associated absence. This allows the opportunity for the provision of a functional prosthesis, but bearing no resemblance to those covered by these guidelines.

Pirogoff and Boyds amputations

These amputation methods both rely on the successful fusion of a calcaneotibial arthrodesis. In both cases the talus is removed and the end of the tibia is cut to expose the cancellous bone.

Pirogoff makes a vertical section of the calcaneus and, disposing of the anterior portion, securely fixes the remainder with the heel pad to the end of the tibia. Boyd makes a transverse section of the calcaneus, just distal to the peroneal tubercle and similarly fixes the remainder to the end of the tibia.

Both should result in an end-bearing residual limb more suited to ambulation without a prosthesis, but the minimal ground clearance makes the provision of a functional prosthesis very difficult.
### Prescription Guideline - AD P SYM 01

**Guideline Statement**

Sockets with a differential liner should be prescribed for any patient with a Symes amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Differential liner – a foam liner built up and split medially to allow donning over residual limb and easy donning of the outer socket over that.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>All children</td>
<td>Volume of residuum fluctuates</td>
</tr>
<tr>
<td>Stable volume of the residual limb</td>
<td>Compromised hand function</td>
</tr>
<tr>
<td>Well defined shape to the residual limb</td>
<td>Patients requiring good cosmetic shape, but with a bulbous distal end of the residual limb</td>
</tr>
<tr>
<td>Patient is heavy, or uses the prosthesis for high impact activities, or carries heavy loads, such that a trap would compromise the socket strength</td>
<td>Sensitive distal end of the residual limb, such that pushing into the liner would cause pain or discomfort</td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

### Prescription Guideline - AD P SYM 02

**Guideline Statement**

Sockets with a medial trap should be prescribed for any patient with a Symes amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Medial trap – the socket has a medial aperture to allow donning, with a cover fastened over it to provide suspension and contain the residuum.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulbous distal end of residual limb</td>
<td>Poor manual dexterity</td>
</tr>
<tr>
<td>Positive suspension – provided a suitably bulbous distal to the residual limb</td>
<td>Little or no bulbous shape to the distal end of the residuum – parallel or conical in shape</td>
</tr>
<tr>
<td>Ease of donning – medial aperture best position to accommodate residual limb</td>
<td>Straps to hold medial trap cosmetically unacceptable</td>
</tr>
<tr>
<td>Where an aperture is required at an area of the socket where least forces act</td>
<td>Size of the medial aperture compromises the structural integrity of the socket</td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Guideline Statement

Sockets with a posterior trap should be prescribed for any patient with a Symes amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Posterior trap – the socket has a posterior aperture to allow donning, with a cover fastened over it to provide suspension and contain the residuum.

Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly defined calcaneus</td>
<td>Extreme medial condyle shape</td>
</tr>
<tr>
<td>Where differential &quot;push fit&quot; liner too bulky</td>
<td>Scarring over posterior aspect</td>
</tr>
<tr>
<td>cosmetically</td>
<td></td>
</tr>
<tr>
<td>Scarring over medial aspect</td>
<td>Prominent Achilles tendon – irritation at</td>
</tr>
<tr>
<td></td>
<td>calcaneal trim line</td>
</tr>
<tr>
<td></td>
<td>Upper limb weakness/absence</td>
</tr>
</tbody>
</table>

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

References - Ankle disarticulation prescription guidelines

### Transtibial sockets

<table>
<thead>
<tr>
<th>Amputation Type</th>
<th>Socket Type</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTB</td>
<td>Silicone self-suspension socket</td>
<td>Polypropylene</td>
</tr>
<tr>
<td>Suprapatella</td>
<td>Silicone self-suspending sockets for the purpose of these guidelines the gel socket can be defined as any thicker, softer silicone, urethane or polymer liner, worn inside a total contact socket.</td>
<td>Acrylic laminate</td>
</tr>
<tr>
<td>Elastic sleeve suspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supracondylar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cuff strap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corset &amp; side steels</td>
<td>ICEX</td>
<td></td>
</tr>
<tr>
<td>Anterior slab technique</td>
<td>Icecast®</td>
<td></td>
</tr>
<tr>
<td>Wrap technique</td>
<td>Hand casting (plaster)</td>
<td></td>
</tr>
<tr>
<td>CAD/CAM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The guidelines shown in italics have yet to be produced.

### The patella tendon-bearing socket overview

As with numerous things in prosthetics, the principle behind the patella tendon-bearing (PTB) socket, when it was first introduced around 1959, has been revised and the subsequent socket shape changed many times, that trying to produce a definition that all clinicians will agree with is almost impossible. This attempt has been based on what little literature there is, coupled with input from a number of experienced prosthetists.

Most of the available literature starts by stating that the PTB is a total contact socket. It then goes on to define the specific weight-bearing areas and the areas that are unsuitable for weight-bearing, namely the fibula head, the anterior border and tuberosity of the tibia, and the cut ends of both the tibia and fibula. These need to be given a certain amount of relief when rectifying the positive cast, dependant on the quality of the tissue cover and their prominence.

Excessive allowances will obviously compromise the original intention of total surface contact and failure to provide contact distally can lead to distal congestion in the residuum. As the name suggests, it is intended that the main weight-bearing area is the patella tendon and to this end a patella bar is produced in the socket. The effectiveness of this has often been questioned, but in order to achieve it the cast needs to be taken in about 50 degrees of flexion and the bar shaped to produce an upward force on the tendon, with the anterior wall of the socket extending to encapsulate about a third of the patella.

To maintain the patella tendon on the patella bar the posterior wall must apply a force anteriorly in the popliteal region with the proximal edge, approximately 15mm higher than the centre of the patella bar, flared to provide comfortable knee flexion and trimmed to avoid pressure on the hamstrings. Some weight-bearing can be incorporated in the medial wall by means of the tibial flare and paratibial pressure can be applied to help prevent rotation.

The proximal edges of the medial and lateral walls normally extend to about the level of the adductor tubercle of the femur. This also helps prevent rotation as well as containing the soft tissues, and may help some mediolateral stability. They may, however, be trimmed lower if the suspension system chosen requires or allows it.

PTB sockets are most often produced with a polyethylene foam liner (Pelite), but it is possible to use hard sockets without liners, provided the shape of the residuum allows it to be donned. Some patients prefer this style of socket, but the foam liners do allow some opportunities to adjust the fit and accommodate changes in residual limb volume.
**Patella tendon-bearing (PTB) sockets**

**Prescription Guideline - TT P PTB 01**

**Guideline Statement**

Patella tendon-bearing sockets should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- PTB – please see the information on the patella tendon-bearing overview.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>A residual limb able to tolerate localised pressures on the patella tendon, paratibial and popliteal fossa areas</td>
<td>Excessively grafted or scarred residual limbs, or limbs which are vulnerable to frequent breakdown</td>
</tr>
<tr>
<td>A residual limb able to tolerate full weight-bearing¹</td>
<td>Intolerance to full weight-bearing through the residual limb²</td>
</tr>
<tr>
<td>A requirement for rotational stability</td>
<td>Adherent scar tissue</td>
</tr>
<tr>
<td>Dysvascular amputee</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

---

**Patella tendon-bearing (PTB) sockets with supracondylar suspension**

**Prescription Guideline - TT P PTB 02**

**Guideline Statement**

Patella tendon-bearing sockets with supracondylar suspension should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Supracondylar – the suspension is integral to the socket. The medial and lateral walls of the socket extend proximally to include the area above the condyles of the femur. The socket grips in this area to provide the suspension by means of a bony lock.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease donning and doffing (quick)²</td>
<td>Poor bone definition i.e. obese thigh</td>
</tr>
<tr>
<td>Medio-lateral stability required¹</td>
<td>May be difficult to don and doff i.e. if large discrepancy between supracondylar and epicondylar areas¹</td>
</tr>
<tr>
<td>Prevention of knee hyperextension</td>
<td>Hyperextension of knee</td>
</tr>
<tr>
<td>Preference based on patient experience</td>
<td>Medially sited femoral bypass graft</td>
</tr>
<tr>
<td>Eliminates need for auxiliary attachments</td>
<td>Excessive scar tissue</td>
</tr>
<tr>
<td>Short or medium residual limb**¹</td>
<td>Low pressure tolerance</td>
</tr>
<tr>
<td>Less restrictive to circulation than certain other suspension systems</td>
<td>Painful knee joint or low pressure tolerance (contributing factors: arthritis, osteoporosis)</td>
</tr>
<tr>
<td>Improved suspension***³</td>
<td>Volume fluctuation</td>
</tr>
<tr>
<td>Ease of adjustment</td>
<td>Poor cosmesis³</td>
</tr>
<tr>
<td>Improved cosmesis¹</td>
<td>Limits knee range of motion (in flexion)¹</td>
</tr>
</tbody>
</table>

*These are comparative issues, both may apply, dependant on the alternatives.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**Prescription Guideline - TT P PTB 03**

**Guideline Statement**
Patella tendon-bearing sockets with suprapatella-supracondylar suspension should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**
- Suprapatella-supracondylar - the suspension is integral to the socket. The medial, lateral and anterior walls of the socket extend proximally to include the area above the condyles of the femur and the patella, the socket grips in this area to provide the suspension by means of a bony lock.

**Indications** | **Contradications**
--- | ---
Short residual limb<sup>1,4</sup> | Poorly defined skeletal anatomy
Medio-lateral stability required<sup>1,3,4</sup> | Volume fluctuation
Prevention of knee hyperextension | Reduced tolerance to pressure
Well-defined skeletal anatomy | Knee joint pain
Improve suspension<sup>4</sup> | Work or leisure activities
Athletic or other sporting activities | Patient concern about cosmetic appearance<sup>1,4</sup>
Good rotational stability<sup>4</sup> |  

<sup>*</sup>Short residual limb – distal end of tibia barely longer than distal border of the fibula head.

**Exceptions**
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

---

**Prescription Guideline - TT P PTB 04**

**Guideline Statement**
Patella tendon-bearing sockets with elastic suspension sleeves should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**
- PTB – please see the information on the patella tendon-bearing overview.
- Elastic suspension sleeve - a tubular sleeve that is fitted on the top part of the socket and then rolled or pulled over the knee to mid-thigh level. Many sleeves are available, from simple cotton/Lycra, neoprene, silicone, and gel, with varied thicknesses and properties, all with the aim of aiding suspension of the prosthesis.

**Indications** | **Contradications**
--- | ---
Improved control of prosthesis | Patients who require positive suspension (sleeve may elongate)
Poor muscle tone | Excessive perspiration<sup>4,7</sup>
Better cosmetic effect – hides trimlines<sup>16</sup> | Allergic reactions<sup>1</sup>
Increased security | May constrict circulation<sup>4</sup>
Comfort when sitting | Poor hygiene
Secondary suspension | Patients with tapered thigh (may roll down)
Large thigh | Patients who kneel (poor wear rate)<sup>4</sup>
Can aid in waterproofing prosthesis if a silicone suspension sleeve is used | Impaired hand function creates problems donning the sleeve
Long residual limb<sup>1</sup> | Patients who require unrestricted knee movement<sup>4</sup>

**Exceptions**
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**PTB with cuff strap**

**Prescription Guideline - TT P PTB 05**

**Guideline Statement**

Patella tendon-bearing sockets with cuff strap suspension should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Cuff strap** – a simple circumferential strap, generally in leather, that fastens above the femoral condyles and is attached to the socket with two side straps.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure flexible suspension required²</td>
<td>Cuff strap cosmetically unacceptable³</td>
</tr>
<tr>
<td>Preference based on patient experience</td>
<td>Scarring/grafting at site of cuff strap</td>
</tr>
<tr>
<td>Adjustable - accommodates residual limb</td>
<td>Patient requires medio-lateral support</td>
</tr>
<tr>
<td>knee¹</td>
<td></td>
</tr>
<tr>
<td>Primary patient: oedematous or changing</td>
<td>Patients who have ill defined contours</td>
</tr>
<tr>
<td>limb volume</td>
<td>in residual supracondylar area</td>
</tr>
<tr>
<td>Other suspensions not suitable</td>
<td>Short residual limb</td>
</tr>
<tr>
<td>Positive suspension when sitting³</td>
<td>Poor eyesight</td>
</tr>
<tr>
<td></td>
<td>May constrict circulation¹</td>
</tr>
<tr>
<td></td>
<td>Needs a degree of strength/dexterity²</td>
</tr>
<tr>
<td></td>
<td>Some inherent pistoning³</td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

**Prescription Guideline - TT P PTB 06**

**Guideline Statement**

Patella tendon-bearing sockets with corset and side steels should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- A standard PTB limb and modular components with the addition of side steels, knee joints and a thigh corset. The knee joint is usually single axis and set posterior and higher than the anatomical knee joint. When fitting to a PTB socket with intimate contact the corset must be loose enough to allow movement when sitting. The corset may be soft or hard depending on the function needed, e.g. weight-bearing or suspension only. Additional suspension in the form of a shoulder strap or belt may be necessary depending on the patient’s anatomy.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater knee stability required i.e. for</td>
<td>Good thigh musculature</td>
</tr>
<tr>
<td>medio-lateral instability of the knee²,³,⁴,⁸,⁹</td>
<td></td>
</tr>
<tr>
<td>Poor thigh musculature</td>
<td>Good weight-bearing residual limb</td>
</tr>
<tr>
<td>Unable to fully bear weight on residual</td>
<td>Stable knee</td>
</tr>
<tr>
<td>limb⁹</td>
<td></td>
</tr>
<tr>
<td>Short residual limb¹,²</td>
<td>Cosmetic appearance unacceptable³</td>
</tr>
<tr>
<td>Wounds or skin abnormality on the residual</td>
<td>Compromised hand function making donning</td>
</tr>
<tr>
<td>limb¹,²,³,⁸</td>
<td>difficult</td>
</tr>
<tr>
<td>Heavy user of prosthesis</td>
<td>Prosthesis can be heavy¹,²</td>
</tr>
<tr>
<td>Patients with recurvatum</td>
<td>Unable to load bear through the thigh or</td>
</tr>
<tr>
<td></td>
<td>ischium</td>
</tr>
<tr>
<td>Instability of contra lateral limb²</td>
<td>Less comfort in wear³</td>
</tr>
<tr>
<td>Patients who require an interim prosthesis⁴</td>
<td>Reduced proprioceptive input³</td>
</tr>
<tr>
<td>Flexion contracture in the knee³</td>
<td>Paresis of proximal leg muscles i.e. hip</td>
</tr>
<tr>
<td></td>
<td>musculae (for which prosthesis is too heavy to use)⁴⁹</td>
</tr>
<tr>
<td>Patients who require very positive</td>
<td>Abnormal residual limb shape³</td>
</tr>
<tr>
<td>suspension⁹</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Hand Casting Guideline - TT C PTB 01

Guideline Statement

Patella tendon-bearing sockets should be hand cast using the wrap technique for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- The wrap technique for casting for patella tendon-bearing sockets can be taken to include any style of casting where the residual limb is wrapped with plaster bandage and palpated to define the bony or soft areas previously marked.

Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue can be manipulated as required</td>
<td>Uncovered open wounds</td>
</tr>
<tr>
<td>Weight-bearing areas on the residual limb can be preloaded</td>
<td>Allergy to plaster bandage</td>
</tr>
<tr>
<td>A good representation of the patients residual limb can be achieved</td>
<td></td>
</tr>
<tr>
<td>Problem areas on the residual limb can be identified and palpated</td>
<td></td>
</tr>
<tr>
<td>Patient preference</td>
<td></td>
</tr>
<tr>
<td>Control of the orientation of line of progression</td>
<td></td>
</tr>
</tbody>
</table>

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Hand Casting Guideline - TT C PTB 02

Guideline Statement

Patella tendon-bearing sockets should be hand cast using the anterior slab technique for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- The anterior slab technique for casting for patella tendon-bearing sockets, involves the application of an anterior plaster slab to define the patella tendon, tibial crest and the cut end of the tibia. When set, this is then wrap cast to capture the residual limb volume.

Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable for patients who need increased definition of the patella tendon and tibial crest</td>
<td></td>
</tr>
<tr>
<td>Residual limbs with excessive soft tissue in the posterior half (as this technique minimises M-L distortion)</td>
<td></td>
</tr>
</tbody>
</table>

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Prescription Guideline - TT P SSS 01

Guideline Statement
Silicone self-suspending sockets should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
• Silicone self-suspending sockets for the purpose of this guideline, are considered to be any 2mm thick, silicone liners or roll on silicone sockets, using shuttlelock and pin, lanyard or suction valve suspension systems.

Indications | Contradications
--- | ---
Positive suspension | Allergic reaction to liner
Reduced socket forces | Poor personal hygiene
Minimal socket pistoning | Distal end of residual limb is hypersensitive
Grafted or scarred skin | Invaginated scarring (unless steps are taken to care for the condition of the scar tissue)
Short residual limb | Ulceration/unhealed scars
Patient has an active lifestyle | Excessive distal redundancy (though can be accommodated in Pelite liner over the silicone liner)
Soft tissue stabilisation required | Adherent distal scarring
Good cosmesis (no auxiliary suspension) | Lack of space for prescribed hardware
Problems encountered with other forms of suspension | Residual limb shapes that cannot be accommodated within a liner
Poor sensation – sock causing skin breakdown | Patient suffers persistent sweating problems
Patient preference | Difficulty in donning/doffing
Comfort | Volume control
Hygienic interface (easy to clean)

*Some work has been done by Össur that would indicate that Iceross® liners can be used to enhance the healing process.

Exceptions
• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
• Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Icecast® Guideline - TT C SSS 02

Guideline Statement
Silicone self-suspending sockets should be cast using Icecast® for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
• Icecast is a pressure casting method using the patented Össur equipment to obtain a positive plaster cast.

Indications | Contradications
--- | ---
Excessive flaccid tissue | Transtibial residual limbs greater or equal to size 32 liner
Measurable distal elongation and pressure applied | Previous intolerance of pressure casting technique
Residual limb tolerant to even distribution of pressure | Children/patients whose residual limb is too small for casting equipment
Patient wears silicone liners which have no matrix, allowing elongation under pressure | If specific modification of the plaster cast is required during casting
Particular residual limbs which give no definition | Silicone socket manufacturer expressly advises against the use of Icecast

Exceptions
• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
• Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**Hand Casting Guideline - TT P SSS 03**

**Guideline Statement**

Silicone self-suspending sockets should be hand cast for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Hand casting is defined as the wrapping of the residuum with plaster bandage, palpating so as to displace any surplus material posteriorly. See casting instructions provided by liner manufacturers.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater control* of loading areas***</td>
<td>Excessive flaccid tissue</td>
</tr>
<tr>
<td>Accommodate flexion contractures</td>
<td>Consistency of modification*** of the positive cast is required</td>
</tr>
<tr>
<td>Patient preference based on previous experience</td>
<td>Where exact measurement of distal elongation and pressure applied is required</td>
</tr>
</tbody>
</table>

*Control – able to define contours of residual limb.
**Loading areas – option to provide varying degrees of surface pressure.
***Modification – the alteration to volume and shape of the positive cast.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

**Prescription Guideline - TT P GEL 01**

**Guideline Statement**

Gel sockets should be prescribed for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- For the purposes of this guideline the gel socket can be defined as any thicker, softer silicone, urethane or polymer liner, worn inside a total contact socket. Suspension may be by means of a lanyard, shuttlelock and pin, elastic suspension sleeve or a sleeve with a suction socket valve. These different suspension methods require consideration before prescriptions as they each have different indications and contraindications.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bony residual limb</td>
<td>Allergic reaction to liner</td>
</tr>
<tr>
<td>Sensitive residual limb requiring reduced friction and shear</td>
<td>Excessive distal redundancy (when using lock and pin)</td>
</tr>
<tr>
<td>Grafted or scarred tissue that requires protection**</td>
<td>Lack of space for prescribed hardware, especially when using a shuttlelock and pin</td>
</tr>
<tr>
<td>Positive suspension, especially with suction valve and sleeve**</td>
<td>Invaginated scarring (unless steps are taken to care for the condition of the scar tissue)</td>
</tr>
<tr>
<td>Problems with other forms of suspension</td>
<td>Unhealed scars or ulceration</td>
</tr>
<tr>
<td>Patient prefers the cosmesis</td>
<td>Poor personal hygiene</td>
</tr>
<tr>
<td>Patient preference based on experience</td>
<td>Hypersensitive distal end of residual limb**</td>
</tr>
<tr>
<td>Comfort†</td>
<td>Persistent perspiration†</td>
</tr>
<tr>
<td>Adherent scars*</td>
<td>Adherent scars*</td>
</tr>
</tbody>
</table>

*This appears as an indication and a contraindication, gel sockets may cause problems with adherent scars, but evidence suggests that these are less than with other socket types.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**Socket Hand Casting Guideline - TT C GEL 01**

**Guideline Statement**

Gel self-suspending sockets should be hand cast for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Hand casting is defined as the wrapping of the residuum with plaster bandage, palpatating so as to displace any surplus material posteriorly (as when hand casting transtibial Iceross type sockets using the Össur technique).

*Please refer to the liner manufacturer's instructions for details of their recommended method, especially with regard to the rectification of the positive.

**Recommended practice is to produce a diagnostic socket from the cast and then to proceed to the production of the definitive socket.

**Indications**

<table>
<thead>
<tr>
<th>Problem areas on the residual limb that need to be identified and palpated when casting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft tissue can be manipulated as required</td>
</tr>
<tr>
<td>Patient preference based on experience</td>
</tr>
</tbody>
</table>

**Contradications**

<table>
<thead>
<tr>
<th>Where a diagnostic socket fitting is recommended and patient may find the additional visit problematic**</th>
</tr>
</thead>
</table>

*Recommended practice is to produce a diagnostic socket from the cast and then to proceed to the production of the definitive socket.

**Note:** Attempts have been made to use Icecast or suction when casting for gel sockets, but the results have been inconsistent.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

---

**Resin Bandage Casting Guideline - TT C GEL 02**

**Guideline Statement**

Gel self-suspending sockets should be cast using resin bandage for any patient with a transtibial amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Casting with a resin bandage is defined as the tight wrapping of the residual limb with a resin bandage, or casting tape (such as Dynacast P), without palpatating. It was originally offered as a casting method specific to the Silipos Explorer liner.

**Indications**

<table>
<thead>
<tr>
<th>Where a diagnostic socket fitting is recommended and patient may find the additional visit problematic*</th>
</tr>
</thead>
</table>

*Recommended practice is to trim the finished cast and use it as a diagnostic socket, drilling a number of holes to allow the degree of contact to be observed. Any allowances required could either be made on the subsequent positive plaster cast, or by means of silicone pads applied prior to casting. This is a clean casting method, producing a rigid negative that obviates the need for an additional diagnostic socket and associated fitting.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
## References- Transtibial prescription and casting guidelines


## Knee Disarticulation Guidelines

<table>
<thead>
<tr>
<th>Prescription Guideline Title</th>
<th>Ref Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee disarticulation end-bearing socket</td>
<td>KD P EB 01</td>
</tr>
<tr>
<td>Knee disarticulation ischial-bearing socket</td>
<td>KD P IB 01</td>
</tr>
<tr>
<td>Knee disarticulation self-suspending socket with liner</td>
<td>KD P SS 01</td>
</tr>
<tr>
<td>Knee disarticulation self-suspending socket with medial trap</td>
<td>KD P SS 02</td>
</tr>
<tr>
<td>Knee disarticulation self-suspending socket with lacing</td>
<td>KD P SS 03</td>
</tr>
<tr>
<td>Knee disarticulation self-suspending socket with bladders</td>
<td>KD P SS 04</td>
</tr>
<tr>
<td>Knee disarticulation total surface-bearing socket with silicone liner</td>
<td>KD P TSB 01</td>
</tr>
<tr>
<td>Knee disarticulation total surface-bearing socket with gel liner</td>
<td>KD P TSB 02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Casting Guideline Title</th>
<th>Ref Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee disarticulation weight-bearing hand casting</td>
<td>KD C WB 01</td>
</tr>
<tr>
<td>Knee disarticulation non-weight-bearing hand casting</td>
<td>KD C NWB 02</td>
</tr>
</tbody>
</table>
Knee disarticulation sockets

<table>
<thead>
<tr>
<th>Amputation Type</th>
<th>End-bearing socket</th>
<th>Ischial-bearing socket</th>
<th>TSB socket with Silicone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspension</td>
<td>Supracondylar self-suspension</td>
<td>Auxiliary suspension</td>
<td>Gel</td>
</tr>
<tr>
<td>Differential liner</td>
<td>The brim shape of this socket is the same as that described in the transfermoral guidelines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lacing socket</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bladders</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Disarticulation of the knee is a comparatively rare and rather controversial choice of amputation in Britain, although it is more widely used elsewhere. It has definite surgical and rehabilitation benefits, but these are often contradicted by the prosthetic disadvantages. The choice of prosthetic knees is limited and the prosthesis may have a poor cosmetic appearance due to the bulky distal end of the socket and distal displacement of the prosthetic knee centre.

This means this amputation level is most frequently used when the amputee is considered to be inappropriate for prosthetic rehabilitation or for children, where it is preferable to preserve the growth plate. This allows the residual limb to grow naturally without the need for revision surgery at regular intervals in the child’s life. Normally the residual limb does not grow to its full length thus overcoming the prosthetic disadvantages once adulthood has been reached.

Benefits of a knee disarticulation

- A quick and simple procedure with reduced trauma and risk of infection. It has a reduced recovery time and is the preferred level for an emergency lifesaving operation.
- Increased length of lever arm and intact muscle groups allow greater strength and control of the limb and a reduced risk of hip contractures. In rehabilitation, non-limb wearers benefit from the longer lever arm for sitting balance and transfers. It has also been shown that amputees with a knee disarticulation walk further and use their prosthesis more often than their transfemoral counterparts.
- The ability to weight-bear through the residual limb increases the comfort of the limb compared with an ischial-bearing socket.
- The retention of the condyles allows for the socket to be self-suspending thus removing the need for auxiliary suspension. The retention of the condyles also aids rotational stability of the socket.

Types of knee disarticulation

There are three commonly used variations of the knee disarticulation amputation:
1. Standard knee disarticulation
2. Adapted knee disarticulation
3. Gritti-Stokes amputation

Standard knee disarticulation

This is the only true disarticulation as no bone is cut.

The surgeon removes the joint capsule and sews the quadriceps muscles to the hamstrings at the attachment of the tendon. The most frequent cause of failure of this amputation is poor wound healing as a result of ischaemia, in which case a transfemoral revision is required.

The guidelines shown in italics have yet to be produced.
Adapted knee disarticulation

This was developed to counter some of the criticisms of the knee disarticulation. The femoral condyles are removed and the distal surface of the femur cut flat. The muscle groups are then attached as above. This improves the cosmetic appearance by reducing the bulk of the distal residuum whilst maintaining a long lever arm and minimising muscle imbalance. However, the advantages of distal weight-bearing and self-suspension may be lost as result of the condyles being removed.

The Gritti-Stokes amputation

This is named after the surgeons who described this amputation technique and is the most controversial of the methods. In this case the femur is cut just above the level of the condyles. The patella is then reshaped and attached to the cut femur to reproduce the distal weight-bearing surface. This shortens the residual limb and reduces the distal bulk with the intention of overcoming the prosthetic objections to this level. However the removal of the condyles loses the benefits of suspension and rotational stability. Also experience suggests the uneven muscle pull between the flexors and extensors may cause the patella to become detached anteriorly. The patella is then reshaped and attached to the cut femur to reproduce the distal weight-bearing surface. This shortens the residual limb and reduces the distal bulk with the intention of overcoming the prosthetic objections to this level. However the removal of the condyles loses the benefits of suspension and rotational stability. Also experience suggests the uneven muscle pull between the flexors and extensors may cause the patella to become detached anteriorly resulting in a very sensitive and non-weight-bearing distal end of the residual limb. Despite more recent surgical techniques that angle the cut end of the femur to try and overcome this, it remains a strongly disliked amputation method among many prosthetists.

Reading list - Knee disarticulation


Knee disarticulation casting & rectification techniques

Casting theory

When taking the impression of all forms of knee disarticulation amputation usually the two goals are self-suspension and end-bearing. There are two primary approaches to taking the plaster of paris cast impression for knee disarticulation sockets as outlined in the guidelines:

- Weight-bearing cast – Originally described by Lyquist.¹ Uses a foam pad distally to allow weight-bearing whilst casting.
- Non-weight-bearing – Described by Botta and Baumgartner.² Suitable for patients unable to stand for a weight-bearing cast. Stresses meticulous moulding of femoral condyles.

Casting procedure for weight-bearing cast¹,³,⁴

Before casting, circumferential measurements of the residual limb should be taken – beginning 5cm proximal to the distal surface and continuing proximally at 5cm intervals to a level approximately 5cm below the ischial tuberosity. These measurements may serve as a guide during rectification.

- A cast sock is worn suspended over the shoulder. Mark the positions of the patella (if present), the adductor tubercle (on the lateral posterior femoral condyle) especially if prominent or painful and the intercondylar notch. To capture the bony contours of the distal femoral condyles, an adjustable stand with a soft end pad is used to support approximately half the patient’s body weight. Adjust the height of the platform until the pelvis is horizontal and instruct the patient on weight-bearing to ensure equal loading between the platform and the sound side (Fig. 1).

- An anterior cutting strip may be needed as the contouring over the medial condyle could make cast removal difficult.

- Remove the platform and wrap plaster bandage around the residual limb. Slabs may be used to cover the distal end. Extend proximally to a level a little below the ischial tuberosity. With larger patients it may be necessary to do the cast in two parts. Reposition the residual limb on the platform, ensuring that flexion/extension and adduction/abduction are as desired.

- The area above the medial condyle should be contoured to provide suspension, with a counter pressure over the lateral area (Fig. 2). The posterior section at this level can also be flattened slightly to form a triangular shape in the supracondylar area that will help prevent rotational movement of the socket on the residual limb.

- Proximally the cast should be flattened slightly posteriorly and in the Scarpa’s triangle area to provide sitting comfort and allow proper function of the adductor longus and rectus femoris.

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Fig. 1 Use of a weight-bearing platform with plastazote pad

Fig. 2 Contour the medial supracondyle area, with a flat counter pressure laterally
Cast procedure for non-weight-bearing casts²

Using this casting method it is important to pay particular attention to the anatomy of the distal end of the residual limb to enable the femoral condyles to transmit full weight onto to the prosthesis.

- The cast is taken with the patient lying supine on his/her back and holding the residual limb in a position of about 70 degrees of flexion.
- A tubigrip sock sewn to the correct shape is donned. Ideally the negative mould should be produced using elastic plaster bandages to allow even pre-compression of the soft tissues, although ordinary bandages may be used.
- Pre-cut strips of plaster bandage - the first is applied in a sagittal direction to cover the intracondylar notch, with other strips applied to cover the patella (if present) and condyles, continuing proximally as necessary, finishing with circular plaster bandage to cover the entire residual limb.
- The negative is now moulded with two hands, one gently modelling the intracondylar notch while the other provides a snug fit of the plaster cast just proximally to the femoral condyles and the proximal end of the patella.
- The proximal trim of the socket should extend to just below the ischial tuberosity. This provides control of lateral and torque forces. Rectification should not be needed.

References - Knee disarticulation casting & rectification techniques

**Knee disarticulation ischial-bearing socket**

**Prescription Guideline - KD P IB 01**

**Guideline Statement**

Ischial-bearing sockets should be prescribed for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Form of knee disarticulation – see overview.
- Ischial-bearing socket – this is a socket designed to take the majority of a patient’s weight through the ischial tuberosity with support and some weight through the thigh, but little or no contact distally.

**Indications**

- A residual limb unable to tolerate weight-bearing on the distal end e.g. painful scarring, mobile/painful patella
- A residual limb able to tolerate ischial weight-bearing

**Contradictions**

- Intolerance to full ischial bearing e.g. excessive scarring or grafting over the ischial tuberosity
- Where the patient is unable to tolerate high and/or rigid socket trims e.g. when sitting or for cosmetic reasons

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

**Knee disarticulation self-suspending socket with liner**

**Prescription Guideline - KD P SS 01**

**Guideline Statement**

Self-suspending sockets with a differential liner should be prescribed for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Form of knee disarticulation – see overview.
- Self-suspending socket with differential liner – a flexible liner manufactured in foam or flexible plastic that conforms to the anatomical shape of the femoral condyles on the residual limb to provide suspension. The outside of the liner is built up to allow insertion into the rigid support of the main socket. The inner socket can be split to aid donning.

**Indications**

- A residual limb with well defined condyles
- Patients who would have difficulty separating the inner liner from socket
- Patients who do not require or prefer not to use auxiliary suspension
- Where the condyles are poorly defined or have been surgically removed
- Where adjustment to fit may be required
- A residual limb with excessive soft tissue
- Where the patient cannot tolerate excess heat from an enclosed socket

**Contradictions**

- Patients who would have difficulty separating the inner liner from socket
- Inability to tolerate supracondylar pressure
- Where cosmesis is an important factor and minimum overall socket thickness is required
- Where extra protection over bony anatomy is required
- Where the patient is unable to tolerate high and/or rigid socket trims e.g. when sitting or for cosmetic reasons

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Knee disarticulation self-suspending socket with medial trap

Prescription Guideline - KD P SS 02

Guideline Statement

Self-suspending sockets with medial traps should be prescribed for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Form of knee disarticulation – see overview.
- Self-suspending socket with a medial* trap - (this may be referred to as a window socket). The rigid outer of the socket has a window cut out on the medial* side at supracondylar level, that aids donning and doffing. A trap is then secured in place using straps. The trap provides suspension. It may or may not have a Pelite or other liner incorporated into the whole, or just the distal end of the socket.

*Whilst a trap positioned medially is common, the trap may be located elsewhere for structural or build requirements e.g. use of side steels.

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>A residual limb with well defined condyles</td>
<td>A patient who has large thighs where the straps and fastenings may rub on the conterlateral limb</td>
</tr>
<tr>
<td>Where easy donning and doffing are required</td>
<td>Where adjustments to overall fit are likely</td>
</tr>
<tr>
<td>Where a slim cosmesis is required (especially where no liner is used)</td>
<td>Where the patient is concerned about the cosmetic effects of the straps</td>
</tr>
<tr>
<td>Where small volume changes may need to be accommodated at supracondylar level in order to retain suspension</td>
<td>Where a structurally strong socket is required</td>
</tr>
</tbody>
</table>

*Lacing could be replaced with velcro cross straps or lanyard systems such as the RevoFit™ in cases of poor hand function.

Knee disarticulation self-suspending socket with lacing

Prescription Guideline - KD P SS 03

Guideline Statement

Self-suspending sockets with lacing should be prescribed for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Form of knee disarticulation – see overview.
- Self-suspending sockets with lacing - sockets made from either leather or composite materials split the length of the socket anteriorly then secured in place by lacing. Modern techniques allow it to be used with modular components, but it is more commonly used with conventional limbs.

Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients requiring a socket with a good range of adjustment* e.g. volume or weight fluctuation</td>
<td>Where the patient dislikes the appearance of the lacing*</td>
</tr>
<tr>
<td>Where a socket material with breathable properties is required</td>
<td>Poor manual dexterity/strength*†</td>
</tr>
<tr>
<td>Where the patient is concerned about the cosmetic effects of the straps</td>
<td>Poor patient hygiene</td>
</tr>
<tr>
<td>Where a quick manufacture time is required</td>
<td>Where the patient cannot apply/determine the appropriate pressure when tightening the lacing</td>
</tr>
<tr>
<td>Where the condyles are poorly defined or have been surgically removed</td>
<td>Where the condyles are poorly defined or have been surgically removed</td>
</tr>
</tbody>
</table>

*Lacing could be replaced with velcro cross straps or lanyard systems such as the RevoFit™ in cases of poor hand function.

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Knee disarticulation self-suspending socket with bladders

Prescription Guideline - KD P SS 04

Guideline Statement
Self-suspending sockets with bladders should be prescribed for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
- Form of knee disarticulation – see overview.
- Self-suspending sockets with bladders – pneumatic pads or silicone bladders are incorporated between layers of laminate in the socket. The patient inflates these to the required pressure after donning to provide suspension.

Indications & Contradications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who require good localised suspension over the condyles</td>
<td>Where the patient cannot apply/determine/administer the appropriate supracondylar pressure</td>
</tr>
<tr>
<td>Patients who require good control of supracondylar pressure</td>
<td>Volume fluctuation that cannot be accommodated by inflating the pads</td>
</tr>
<tr>
<td>Residual limbs with minor volume changes</td>
<td>Poor hand function</td>
</tr>
<tr>
<td>Patients who require self-suspension with easy donning</td>
<td>Where a quick manufacture time is required</td>
</tr>
</tbody>
</table>

Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Knee disarticulation TSB socket with silicone liner

Prescription Guideline - KD P TSB 01

Guideline Statement
Total surface-bearing (TSB) sockets with silicone liner should be prescribed for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
- Form of knee disarticulation – see overview.
- TSB socket with silicone liner - a total contact socket that incorporates a silicone interface. Suspension can be provided by a pin, lanyard or suction with a hypobaric seal. A pin is not recommended because of space considerations. Where the choice of suspension affects the guideline, this will be noted.
- Silicone liners – generally have a stabilising matrix and are available in various durometers. They protect the skin from shear forces and can provide suspension.

Indications & Contradications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where abundant scar tissue is present</td>
<td>Where the patient cannot tolerate silicone e.g. an allergy, invaginated scarring etc</td>
</tr>
<tr>
<td>Where the patient would benefit from a protective liner between the residual limb and outer socket, whilst keeping socket thickness to a minimum</td>
<td>Where poor hand function prevents donning e.g. especially for liners with a hypobaric sealing membrane</td>
</tr>
<tr>
<td>Fleshy or muscular residual limb with little bony definition</td>
<td>Where minimum build height is required (when using pin and lock suspension)</td>
</tr>
<tr>
<td>Where a positive lock (suspension) is required that is independent of volume changes e.g. with a pin or lanyard</td>
<td>A residual limb with prominent condyles</td>
</tr>
<tr>
<td>Where minimum build height is required (hypobaric sealing membrane only)</td>
<td>Patients who suffer from persistent sweating</td>
</tr>
<tr>
<td>Where specific weight-bearing cannot be tolerated</td>
<td>Where the patient would benefit from full end-bearing through the femur, e.g. in children to encourage normal bony growth</td>
</tr>
<tr>
<td>An insensate residual limb</td>
<td>Poor personal hygiene</td>
</tr>
</tbody>
</table>

Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
### Knee disarticulation TSB socket with gel liner

**Prescription Guideline - KD P TSB 02**

**Guideline Statement**

Total surface-bearing sockets with gel liners should be prescribed for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Form of knee disarticulation – see overview.
- TSB socket with gel liner – a total contact socket that incorporates a gel interface. Suspension can be provided by the self-suspending shape of the knee disarticulation residual limb.
- Flexible gel liners - generally urethane or polymer gels that are thick and soft with flow properties, providing cushioning for the residual limb. They do not normally contain a matrix and therefore are not recommended for use with a pin or lanyard as this can distend the liner and distal tissues, as well as adding to the build height.
- An air expulsion valve can be used distally.1

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive scarring/grafting of skin</td>
<td>Where poor hand function prevents donning</td>
</tr>
<tr>
<td>An insensitive residual limb</td>
<td>Poor personal hygiene</td>
</tr>
<tr>
<td>Where specific weight-bearing cannot be tolerated</td>
<td>Where patients cannot tolerate a gel liner e.g. allergies or heat problems</td>
</tr>
<tr>
<td>Where minimum build height is required</td>
<td>Where the patient would benefit from full end-bearing through the femur e.g. in children to encourage normal bony growth</td>
</tr>
<tr>
<td>Fleshy or muscular residual limb with little bony definition</td>
<td>Patient suffers from persistent sweating</td>
</tr>
</tbody>
</table>

### Knee disarticulation weight-bearing

**Hand Casting Guideline - KD C WB 01**

**Guideline Statement**

All forms of knee disarticulation amputation should be hand cast using the weight-bearing technique for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Form of knee disarticulation – see overview.
- Weight-bearing hand casting – see knee disarticulation casting page.

**Indications**

- Patients who would benefit from distal contouring that weight-bearing produces
- Patients who are able to tolerate distal weight-bearing

**Contradications**

- Patients who cannot tolerate distal end-bearing e.g. painful bursa distally
- Patients who may find it difficult to stand for casting e.g. comorbidities, bilateral amputations

To provide correct weight-bearing alignment of the residual limb on the end-bearing pad during casting
- Patients who are able to stand in an upright position during casting1
- To allow the patient to control the amount of weight taken distally*

*Some patients may need or prefer to partial end-bear and partially ischial-bear, although this loses some of the benefits of end-bearing - see main guidelines for socket shapes.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**Hand Casting Guideline - KD C NWB 01**

**Guideline Statement**

All forms of knee disarticulation amputation should be hand cast using the non-weight-bearing technique for any patient with a form of knee disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Form of knee disarticulation** – see overview.
- **Weight-bearing hand casting** – see knee disarticulation casting page.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who may find it difficult to stand for casting e.g. comorbidities, bilateral amputations&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Patients who would benefit from weight-bearing during casting&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>Patients who would benefit from the definition achieved by hand moulding of the distal end of the residuum&lt;sup&gt;4&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Patients who require comfort and safety during casting&lt;sup&gt;5&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

**References - Knee disarticulation prescription and casting guidelines**

## Transfemoral Guidelines

<table>
<thead>
<tr>
<th>Prescription Guideline Title</th>
<th>Ref Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadrilateral sockets</td>
<td>TF P QUS 01</td>
</tr>
<tr>
<td>Ischial containment sockets</td>
<td>TF P ICS 01</td>
</tr>
<tr>
<td>Transfemoral suction sockets</td>
<td>TF P SUC 01</td>
</tr>
<tr>
<td>Transfemoral soft elastic suspension belts</td>
<td>TF P SUS 01</td>
</tr>
<tr>
<td>Transfemoral silicone self-suspending sockets</td>
<td>TF P SSS 01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Casting Guideline Title</th>
<th>Ref Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadrilateral socket hand casting</td>
<td>TF C QUS 01</td>
</tr>
<tr>
<td>Quadrilateral socket brim casting</td>
<td>TF C QUS 01</td>
</tr>
<tr>
<td>Ischial containment socket hand casting</td>
<td>TF C ICS 01</td>
</tr>
<tr>
<td>Ischial containment socket jig casting</td>
<td>TF C ICS 02</td>
</tr>
</tbody>
</table>

### Transfemoral sockets

- **Amputation Type**: There are no specific amputation types for this level that would significantly affect the choice of socket type.

- **Socket Type**: Quadrilateral, Ischial containment

- **Suspension**: Suction, Auxiliary suspension

- **Casting Method**: Quadrilateral hand casting, ICE hand casting, Quadrilateral brim casting, Casting jigs

- **Materials**: Polypropylene, Laminates

*The guidelines shown in italics have yet to be produced.*
The traditional quadrilateral socket has a narrow anterior to posterior dimension (A) compared to the medial to lateral dimension (B) - see Fig 1. The anterior wall of the socket is ideally 5-7cm higher than the posterior wall to retain the residuum, and combined with the narrow anterior to posterior dimension, helps keep the ischial tuberosity on the ischial seating area of the posterior brim, but may need to be reduced to provide comfort when sitting. The ischial seating should normally be parallel to the ground.

The corner between the anterior and medial walls of the socket is shaped to provide relief for the adductor tendon when it comes into action in the stance phase; the proximal edge of the medial wall is kept low enough to prevent painful contact with the ischial ramus.

The lateral wall of the socket, whilst it should be kept as high as possible in order to spread the lateral forces over as large an area as possible, is generally lower than with other types of socket. This combined with the wider medial to lateral dimension can allow a lack of mediolateral stabilising force, but since this lower lateral wall makes it very suitable for use with a rigid pelvic band suspension, this problem is then negated.

The diagram below gives some idea of the socket shape at brim level, but soft tissue or highly toned muscular tissue would change the shape of the residuum and subsequently the shape of the socket would need to change to accommodate the differences.

The above are the principles that underpin the design of the preformed brims developed by Hosmer and others, for assisting prosthetists in casting and measuring patients for this type of socket.

**Prescription Guideline - TF P QUS 01**

**Guideline Statement**

Quadrilateral sockets should be prescribed for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Quadrilateral socket – as defined by the overview.

**Indications** | **Contraindications**
---|---
Patients who have long residual limbs and therefore more intact adductor musculature | Patients who have prominent hamstrings which the standard quadrilateral shape may impinge upon
Patient preference, based on previous experience | Intolerance to pressure on the ischial tuberosity
Patients whose residual limb has good muscle tone | The need to avoid excess pressure on the neuro-vascular bundle (Scarpa’s triangle)
Those patients who require a rigid pelvic band for suspension | Patients who have a short residual limb
Less active/geriatric patients | Patients who have soft residual limb muscle tone

*Studies have shown that quad sockets can cause pain in these areas due to M/L socket width and shear forces at the gluteus medius.*

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
### Hand Casting Guideline - TF C QUS 01

**Guideline Statement**

Quadrilateral sockets should be hand cast for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Quadrilateral socket – as defined by the overview.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scars or grafted tissue which must be accommodated by modifying the quadrilateral shape.</td>
<td>Patients who are unable to stand without the assistance of a casting jig for the required time period needed for casting.</td>
</tr>
<tr>
<td>The patient does not fit comfortably into any jig or brim.</td>
<td></td>
</tr>
<tr>
<td>Patient preference based upon previous experience.</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

### Brim Casting Guideline - TF C QUS 02

**Guideline Statement**

Quadrilateral sockets should be cast using a brim for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Quadrilateral socket – as defined by the overview.
- A “brim” takes the form of the proximal section of a quadrilateral socket. Made of plastic or metal and available in a range of sizes, these can be applied to the patient, checked for fit and, with some types, adjusted whilst on the patient. They are then either held on to the patient by means of a shoulder strap, or they may have some form of jig which will allow the patient to weight-bear on the brim. The distal section is then wrapped with plaster.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less time consuming casting procedure therefore possibly less stressful for weak patients.</td>
<td>Residual limb is too short for the brim.</td>
</tr>
<tr>
<td>Patients who would benefit from support of a casting jig during casting.</td>
<td>The patient’s residual limb does not fit comfortably into any available brim.</td>
</tr>
<tr>
<td>Patient preference based upon previous experience.</td>
<td>Patients with residual limbs &lt;4 ¾” (12cm) medio-laterally.</td>
</tr>
<tr>
<td>Minimal patient contact required when casting i.e. for religious reasons.</td>
<td>Patients with residual limbs &gt;8” (20.3cm) medio-laterally.</td>
</tr>
<tr>
<td>Where the quad shape is indicated but difficulties arise defining the quad shape by hand.</td>
<td>Residual limbs where significant oedema is present.</td>
</tr>
<tr>
<td>To aid casting for a quadrilateral socket for patients with a transfemoral amputation who require to be cast lying on a bed.</td>
<td></td>
</tr>
<tr>
<td>To aid in the production of the quadrilateral shape when applying an immediate postoperative rigid dressing.</td>
<td></td>
</tr>
<tr>
<td>Where consistency in socket shape is required when casting.</td>
<td></td>
</tr>
</tbody>
</table>
Prescription Guideline - TF P ICS 01

Guideline Statement

Ischial containment sockets should be prescribed for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Ischial containment sockets may be defined as any transfemoral socket which contains the ischium within the socket supporting the ischium and ramus medially, whilst holding the femur in a position of natural adduction by way of lateral support along the length of the femur.

Exceptions - see exceptions on page 69.

Indications | Contraindications
---|---
Intolerance to ischial weight-bearing
Short residual limb
Patient preference based on previous experience
Previous problems with rotational control of the socket on the residual limb
Desired improvement of proximal socket edge cosmesis
High activity patient
A history of discomfort over cut end of femur
Patients who require positive M/L stabilisation of the femur
Patients who require reduced pressure at the Scarpa’s triangle area
Patients who have fleshy residual limbs
Patients who are wearing a quadrilateral socket who require improved comfort when sitting
Patients who are wearing a quadrilateral socket who show significant lumbar lordosis at heel off
Patients who are wearing a quadrilateral socket who require improved M/L stability at mid-stance
Patients who are wearing a quadrilateral socket who require reduced energy expenditure
Patients wearing suction sockets
Patients who have groin and low back pain (a study has shown IC sockets to reduce pain in these areas)
Patients who require socket pressure to be distributed over as large an area as possible (e.g. for those with an insensate residual limb)

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Hand Casting Guideline - TF C ICS 01

Guideline Statement

Ischial containment sockets should be hand cast for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Ischial containment sockets may be defined as any transfemoral socket which contains the ischium within the socket supporting the ischium and ramus medially, whilst holding the femur in a position of natural adduction by way of lateral support along the length of the femur.

Exceptions - see exceptions on page 69.

Indications | Contraindications
---|---
Patients who do not fit comfortably into any available jig or brim
Patients who are not able to stand unaided without the assistance of a jig for the duration of casting

Note: Hand casting for ischial containment sockets may require more than one prosthetist and a longer appointment slot. Additionally, the ischial containment casting technique is of a more intimate nature, therefore it is very important that informed consent is gained from the patient before proceeding.

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**Jig Casting Guideline - TF C ICS 02**

**Guideline Statement**

Ischial containment sockets should be cast using a casting jig for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Ischial containment sockets may be defined as any transfemoral socket which contains the ischium within the socket supporting the ischium and ramus medially, whilst holding the femur in a position of natural adduction by way of lateral support along the length of the femur.

- An ischial containment casting jig is a piece of equipment, the intention of which is to define the critical aspects of the socket shape on the patient during casting (as shown in images on the following page).

**Indications**

<table>
<thead>
<tr>
<th>Patient preference based upon previous experience</th>
<th>Patient does not fit comfortably into the jig or brim</th>
</tr>
</thead>
<tbody>
<tr>
<td>The patient is unable to stand unassisted for the duration of casting</td>
<td>Patients who have short residual limbs</td>
</tr>
<tr>
<td>Patients who have medium to long residual limbs</td>
<td>Patients who have fleshy residual limbs</td>
</tr>
<tr>
<td>Patient’s residual limb has good muscle tone</td>
<td>Hip flexion contracture present</td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.

- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.

- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Transfemoral suction socket

Prescription Guideline - TF P SUC 01

Guideline Statement

Suction sockets should be prescribed for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Transfemoral suction sockets suspended by slight negative 'residual limb-socket' pressure, combined with muscle contraction. No auxiliary attachments are usually required and the residual limb is in direct contact with the socket, and may otherwise be in any style appropriate to the patient’s needs.

Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved cosmesis is required</td>
<td>Residual limb volume fluctuation</td>
</tr>
<tr>
<td>Stable residual limb volume</td>
<td>Impaired hand strength for donning</td>
</tr>
<tr>
<td>Good residual limb muscle tone</td>
<td>Poor residual limb/hip muscle control</td>
</tr>
<tr>
<td>Elimination of auxiliary attachments</td>
<td>Poor personal hygiene</td>
</tr>
<tr>
<td>Full range of hip motion</td>
<td>Very short, &lt;3&quot; (7.5cm) residual limb</td>
</tr>
<tr>
<td>Improved comfort</td>
<td>Conical shaped residual limb</td>
</tr>
<tr>
<td>Less interference with clothing</td>
<td>Bulbous residual limb</td>
</tr>
<tr>
<td>Very positive suspension is required</td>
<td>Very long residual limb</td>
</tr>
<tr>
<td>Patients who have contralateral limb</td>
<td>Patients with poor balance</td>
</tr>
<tr>
<td>Patients who participate in athletic</td>
<td>Invaginated/adherent scaring at the socket edge</td>
</tr>
<tr>
<td>Medium-length residual limb</td>
<td>Compromised vascularity/dysvascular</td>
</tr>
<tr>
<td>A residual limb free of complications</td>
<td>Insufficient flesh cover</td>
</tr>
<tr>
<td>Patients who prefer not to wear a</td>
<td>Previous distal congestion</td>
</tr>
<tr>
<td>residual limb sock</td>
<td>Patients who cannot tolerate a high anterior socket wall</td>
</tr>
<tr>
<td>Patients who require improved control</td>
<td>Patients who are unwilling or unable to devote the</td>
</tr>
<tr>
<td>and proprioception from the prosthesis</td>
<td>necessary time and effort for the required fitting stages</td>
</tr>
<tr>
<td>Primary patients (greater success is</td>
<td>Excessive scarring/graft sites</td>
</tr>
<tr>
<td>seen if this is the first transfemoral</td>
<td>Excessive redundant soft tissue</td>
</tr>
<tr>
<td>socket fitted)</td>
<td>Excessive hip flexion contracture</td>
</tr>
<tr>
<td>Hygienic residual limb-socket interface</td>
<td>Residual limbs which cannot tolerate more than 1½ psi of</td>
</tr>
<tr>
<td>is required</td>
<td>negative pressure for 1½ minutes</td>
</tr>
<tr>
<td></td>
<td>Sharp bone spurs</td>
</tr>
</tbody>
</table>

Contraindications

- Residual limbs with ulceration, cysts or abscesses present
- Residual limbs with drainage sinuses present
- Residual limbs where infection is present
- Dermatological residual limb complications
- Excessive perspiration causing skin problems
- Associated injuries to the pelvis or hip joint
- Capillary fragility
- Large neuromas
- Residual limbs which cannot tolerate up to 4 psi for a second at a time
- Muscles which are not strong enough to contract sufficiently to maintain suspension during the swing phase
- Excessive oedema
- Hypertrophic scarring or deep fissures
- Scar tissue which has poor elasticity
- Compromised heart conditions
- Residual limbs which cannot tolerate the tissue stress (i.e. shear forces) when donning

Note: Suction sockets generally require greater dexterity, effort and balance for donning and doffing than alternative methods of suspension. Literature has also been found which contradicts this statement.

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
## Prescription Guideline - TF H SUS 01

### Guideline Statement
Soft elastic suspension belts should be prescribed for any patient using a transfemoral prosthesis when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

### Definitions
- Soft elastic suspension belt – a fabric suspension belt which fits circumferentially onto the socket and around the users pelvis. Also known as Total Elastic Suspension (TES) belt.

### Indications vs. Contraindications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where an additional method of suspension is required with a self-suspending</td>
<td>Hip joint instability</td>
</tr>
<tr>
<td>socket*</td>
<td></td>
</tr>
<tr>
<td>Where a method of suspension is required that is not affected or compromised</td>
<td>Allergic reaction to material</td>
</tr>
<tr>
<td>by volume fluctuation of both the residual and trunk</td>
<td></td>
</tr>
<tr>
<td>Where a simple method of suspension is required</td>
<td>Where the belt is used as the sole method of suspension for patients who require positive rotational control of the socket</td>
</tr>
<tr>
<td>Patient preference</td>
<td>Poor upper body strength making donning difficult</td>
</tr>
<tr>
<td>Comfort required when sitting</td>
<td>Poor hip muscle power</td>
</tr>
<tr>
<td>Where the prosthesis is intended for cosmetic/transfer use only**</td>
<td>Patients who cannot tolerate the heat generated when wearing neoprene</td>
</tr>
<tr>
<td>Where cosmosis under clothes is an issue</td>
<td>Abdominal pathology for example colostomy</td>
</tr>
</tbody>
</table>

*Self-suspending – where suspension is inherent in the socket design i.e. suspension over the femoral condyles, suspension from tight fit of socket and pull through or suspension from a ratchet pin, hypobaric valve or lanyard.*

**It has been identified that there are wide variations with regard to how cosmetic prostheses are manufactured. Some may utilize a soft suspension belt to secure the cosmetic prosthesis in place whilst others may attach the prosthesis to the wheelchair. The above indication refers to the former.***

***Although the contraindication ‘patients with a short residual limb’ did not reach the consensus level of 75% agreement, it did gain 73% agreement and so the best practice group members felt that this high level of agreement should be recognised.

### Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

## Prescription Guideline - TF P SSS 01

### Guideline Statement
Silicone self-suspending sockets should be prescribed for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

### Definitions
- Silicone self-suspending sockets for the purpose of this guideline, are considered to be any 2mm thick, silicone liners or roll on silicone sockets, using shuttlelock and pin, lanyard or suction valve suspension systems.

### Indications vs. Contraindications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive suspension</td>
<td>Heavy scarring of residual limb</td>
</tr>
<tr>
<td>Patients who do not like secondary suspension aids like TES belts*</td>
<td>Allergic reaction to liner*</td>
</tr>
<tr>
<td>Patient would benefit from a total contact socket*</td>
<td>Patients who cannot adapt to a different socket shape</td>
</tr>
<tr>
<td>Mild volume fluctuation, able to add/remove socks if necessary*</td>
<td>Patient who cannot cope with extra weight to the prosthesis</td>
</tr>
<tr>
<td>Moderate to high activity patients**</td>
<td>Low activity patients**</td>
</tr>
<tr>
<td>Improved proprioception</td>
<td>Ulceration/unhealed scars***</td>
</tr>
<tr>
<td>Patient ability to don liner effectively and consistency for pin alignment</td>
<td>Poor hip muscular control</td>
</tr>
<tr>
<td>Strong musculature</td>
<td>Lack of space for prescribed hardware1</td>
</tr>
<tr>
<td>Reduced friction and shear forces on residual limb1, 3, 5</td>
<td>Poor hygiene1, 3, 5</td>
</tr>
<tr>
<td>Low activity patients</td>
<td>Excessive distal sensitivity1</td>
</tr>
<tr>
<td>Volume fluctuations of residual limb3, 5</td>
<td>Persistent perspiration</td>
</tr>
</tbody>
</table>

*Patient needs a good understanding of socks and volume management. **Journals say otherwise. ***Some work has been done by Össur that would indicate that Iceross liners can be used to enhance the healing process.

### Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Socket Hand Casting Guideline - TF H SUS 01

Guideline Statement

Silicone self-suspending sockets should be hand cast for any patient with a transfemoral amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Hand casting is defined as the wrapping of the residuum with plaster bandage, palpatating so as to identify underlying anatomy and shape to desired design. See casting instructions provided by liner manufacturers.

- Silicone self-suspending sockets for the purpose of this guideline, are considered to be any 2mm thick, silicone liners or roll on silicone sockets, using shunt/lock and pin, lanyard or suction valve suspension systems.

Indications

| Casting method recommended by the manufacturers | The patient is unable to stand long enough for the cast to be taken*16 |

Note: It has been presumed that the hand-casting technique being considered here is that taught by Össur.

‘It is possible, if the patient has difficulty standing for the length of time required by this technique, to cast using a quadrilateral brim with a supporting jig. The resultant socket will not have the characteristic shape achieved when using the Össur method, but has been found to be reasonably satisfactory.

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.

- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.

- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

References - Transfemoral prescription and casting guidelines

36. Össur transfemoral casting course literature.
## Hip Disarticulation and Hemipelvectomy Guidelines

### Prescription Guideline Title Ref Number
- Hip disarticulation ischial-bearing sockets HD P IBS 01
- Hip disarticulation ischial containment sockets HD P ICS 01
- Hemipelvectomy volume-bearing sockets HD P VBS 01
- Hip disarticulation and hemipelvectomy silicone sockets HD P SSS 01

### Casting Guideline Title Ref Number
- Hip disarticulation and hemipelvectomy hand casting HD C HDP 01
- Hip disarticulation and hemipelvectomy jig with wedges casting HD C HDP 02
- Hip disarticulation and hemipelvectomy suspension casting HD C HDP 03

### Hip disarticulation and hemipelvectomy sockets

<table>
<thead>
<tr>
<th>Amputation Type</th>
<th>Socket Type</th>
<th>Casting Method</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip disarticulation</td>
<td>Hemipelvectomy</td>
<td>Hand casting using a jig with wedges</td>
<td>Silicone &amp; laminate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hand casting without a jig</td>
<td>construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAD/CAM</td>
<td>Resin laminates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Leather &amp; laminate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>construction</td>
</tr>
</tbody>
</table>

The guidelines shown in italics have yet to be produced.

### Prescription Guideline - TF P IBS 01

**Guideline Statement**

An ischial-bearing socket should be prescribed for any patient with a hip disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Ischial-bearing** – where the ischial tuberosity and the volume of the residuum contained within the socket are the means of weight-bearing through the prosthesis.

- **Volume fluctuations and obesity**[^1]^[^2] were considered by some clinicians to be contraindications, but consensus was not achieved.

**Indications**

- Good tissue covering of the ischial tuberosity area
- No scarring or pain in the ischial tuberosity area
- Patient prefers cosmetic appearance (improved body symmetry)
- Volume fluctuations of the residual limb[^1]^[^2]
- Unable to tolerate ischial containment
- Unable to tolerate high socket walls
- Unhealed fractures or dislocation of pelvis

**Contraindications**

- Patient cannot tolerate ischial weight-bearing e.g. scarring or pain in ischial area[^2]
- Unable to tolerate pressure on the abdomen
- Patient requires greater stability e.g. ischial containment required

[^1]: Volume fluctuations
[^2]: Obesity

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
### Hip disarticulation ischial containment socket

**Prescription Guideline - HD P ICS 01**

**Guideline Statement**

An ischial containment socket should be prescribed for any patient with a hip disarticulation amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Ishial containment** – where the socket contains the ischium and supports the ischium and ramus medially.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient requires improved stability of socket - providing better control of the prosthesis</td>
<td>Unstable volume</td>
</tr>
<tr>
<td>Patient prefers cosmetic appearance as the socket can be reduced in size, whilst still retaining adequate stability and suspension</td>
<td>Invasive casting technique unacceptable to patient</td>
</tr>
<tr>
<td>Improved suspension</td>
<td></td>
</tr>
<tr>
<td>Improved comfort</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

### Hemipelvectomy volume-bearing socket

**Prescription Guideline - HD P VBS 01**

**Guideline Statement**

A volume-bearing socket should be prescribed for any patient with a hemipelvectomy amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Volume-bearing** - where the volume of the residuum is contained within the socket. This forms the means of weight-bearing through the protheses.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good tissue covering</td>
<td>Patient has a hernia that would not benefit from containment</td>
</tr>
<tr>
<td>Stable internal anatomy</td>
<td>Residual limb intolerant to pressure</td>
</tr>
<tr>
<td>Residual limb requires tissue support</td>
<td>Painful or adherent scarring</td>
</tr>
<tr>
<td>Inability to weight-bear on skeletal areas e.g. contralateral ischium or rib cage</td>
<td>Unhealed or damaged internal organs</td>
</tr>
<tr>
<td>Patient has a hernia that would benefit from support</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Prescription Guideline - HD P SSS 01

Guideline Statement
A silicone socket should be prescribed for any patient with a hip disarticulation or hemipelvectomy amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
- Silicone socket – A socket in which the containment and suspension are provided by a silicone material that encapsulates the structural element of the required limb system.

Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Indications Contradications
- Increased comfort
- Good suspension (worn next to skin)
- Hygiene
- Increased freedom of movement
- Less effort when walking
- Fluctuation in residual limb volume
- Excessive perspiration
- Patient likely to require alterations to socket

Hand Casting Guideline - HD C HDP 01

Guideline Statement
Hip disarticulation and hemipelvectomy sockets should be cast using a hand casting technique for any patient with a hip disarticulation or hemipelvectomy amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
- Hand casting – casting without the aid of any form of jig with blocks, or sling suspension.

Indications Contradications
- Patient with little soft tissue, whether muscular or skeletal in build
- Patient does not fit into the jig (e.g. child or large adult)
- Patient needs support during casting
- Soft tissue that requires supporting within the socket
- Limb system requires the use of a jig and wedges to achieve a specific hip angle

Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
### Hip disarticulation and hemipelvectomy jig with wedges

#### Casting Guideline - HD C HDP 02

**Guideline Statement**

Hip disarticulation and hemipelvectomy sockets should be cast using a jig with wedges for any patient with a hip disarticulation or hemipelvectomy amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Jig with wedges** – a weight-bearing platform on which the patient sits, that allows the positioning of anterior and/or posterior angled blocks, the anterior block being at the angle recommended by the hip joint manufacturer (Fig. 1). Sometimes the posterior wedge may be replaced with a wide elastic sling section.

#### Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to position hip joint, (component supplier recommendation)¹</td>
<td>Soft or excessive abdominal tissue¹</td>
</tr>
<tr>
<td>Patients with good muscle tone¹</td>
<td></td>
</tr>
<tr>
<td>Need to provide relief for ischial tuberosity</td>
<td></td>
</tr>
<tr>
<td>Less effort when walking⁷</td>
<td></td>
</tr>
</tbody>
</table>

#### Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

---

### Hip disarticulation and hemipelvectomy suspension

#### Casting Guideline - HD C HDP 03

**Guideline Statement**

A suspension casting technique should be used for any patient with a hip disarticulation or hemipelvectomy amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Suspension casting technique** – a method of casting that supports the patient’s residual limb in a sling, from a hoist or a frame (Fig. 2).

#### Indications

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient requires volumetric loading e.g. hemipelvectomy amputee⁶</td>
<td>Limb system requires hip joint position to be defined during casting¹</td>
</tr>
<tr>
<td>Soft or excessive abdominal tissue¹</td>
<td></td>
</tr>
</tbody>
</table>

#### Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

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[Fig. 1](#) Posterior wedge, or this may be replaced with a bracket clamping a wide elastic sling, the other end of which is attached to the underside of the anterior block

[Fig. 2](#) Suspension sling

[Fig. 2](#) Suspension frame

Images courtesy of Martin Bionics
References - Hip disarticulation and hemipelvectomy prescription and casting guidelines


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**Feet**

**Prescription Guideline Title** | **Ref Number**
--- | ---
Solid Ankle Cushion Heel Feet (SACH) | HW P FEE 01
Uniaxial feet | HW P FEE 02
Multiaxial feet | HW P FEE 03
Energy storing feet | HW P FEE 04
Patient adjustable feet | HW P FEE 05

**Knees**

**Prescription Guideline Title** | **Ref Number**
--- | ---
Monocentric knees | HW P KNE 01
Polycentric knees | HW P KNE 02
Semi-Automatic Knee Locks (SAKL) | HW P KNE 03
Hand Operated Knee Locks (HOKL) | HW P KNE 04
Weight-activated stance control units | HW P KNE 05
Mechanical constant friction units | HW P KNE 06
Extension bias assist devices | HW P KNE 07
Pneumatic swing control units | HW P KNE 08
Hydraulic swing control units | HW P KNE 09
Hydraulic swing and stance control units | HW P KNE 10
Microprocessor control units | HW P KNE 11

**Functional Adapters**

**Prescription Guideline Title** | **Ref Number**
--- | ---
Shock absorber | HW P ADA 01
Torque absorber | HW P ADA 02
Rotation or turntable adapter | HW P ADA 03

**Sport and Leisure**

**Prescription Guideline Title** | **Ref Number**
--- | ---
Water activity prosthesis | HW PWAP 01
In the overview for generic prosthetic hardware there are just five categories of feet listed. In order to accommodate the variety of prosthetic feet currently available in each category, it has been necessary to apply fairly broad definitions to them. What follows is an attempt to define each of those categories as well as possible and to leave you to consider for yourself which category a particular product may best fit into. Many feet boast several features and, as a result, are appropriate to more than one category, but the illustrated examples are clearly appropriate to the category. They have been selected for that reason alone and are not being promoted by these guidelines above any other product.

**SACH**

Solid Ankle Cushion Heel feet have been in existence for some considerable time and their full name almost defines them, though most are often abbreviated to the word SACH.

The term ‘Solid Ankle’ simply means that there is no movement in any plane at the ankle itself, hence any function of the foot is contained within the structure of the foot, as it is designed to allow progression from heel strike to toe off.

The most obvious of these is the ‘Cushion Heel’ which absorbs the forces at heel strike by deformation of the material from which the heel is made. Some feet have an adjustment screw in the heel which has the effect of making the heel cushion firmer or softer.

The material of the forefoot is generally reinforced internally to provide sufficient support to progress the patient from mid-stance towards toe off, with a toe break of softer material at the end of the internal reinforcement that allows smooth progression to the toe off itself.

In some cases the material from which the reinforcement is made is such as to provide some energy retention and the term ‘Dynamic Sach’ is used to describe them. Due to their simple construction SACH feet are fairly lightweight, robust and inexpensive.

**Uniaxial**

The principle of the uniaxial foot predates the SACH foot by many years. Originally they were made of wood with a single pivot at the ankle, allowing dorsiflexion and plantar flexion controlled by a rubber heel and forefoot bumpers, with a toe break containing another rubber bumper.

By adjusting the size or firmness of the bumpers the characteristics of the foot could be adjusted to suit the individual.

There are several modern versions of the uniaxial foot and all take advantage of this adjustability of function, with the benefit of better materials from which to produce the bumpers and pivot bearings.

These feet often incorporate other features such as a replaceable cosmetic foot shell, flexible pivot bushes which allow some inversion and eversion, a full length forefoot keel providing a measure of energy retention and return, and an adjustment at the heel strike bumper which allows a subtle increase or decrease in the firmness of the action.

The uniaxial foot provides the benefit of adjustability within a reasonably lightweight, simple and durable construction.
Multiaxial

As the name implies, these feet provide dorsiflexion, plantar flexion, inversion and eversion. The aim of this is to provide a foot action which is compliant enough to accommodate uneven surfaces, whilst still providing the support and control required. In the simplest examples this is provided by an ankle unit with two rubber components which can be exchanged for softer or firmer options, dependant on the needs of the individual.

The product illustrated incorporates a replaceable foot shell and a full length, two-part forefoot keel, assisting inversion and eversion of the forefoot on uneven terrain. Also there are three different bumpers and two sets of pivot bushes, all of which can be changed to accommodate the needs of the user.

Energy storing

Feet of this type are normally produced from a carbon fibre composite, since it is a material which can return over 90% of the energy absorbed by bending it and is also a very light material.

This type of foot was originally highly priced and aimed at the needs of the high-activity patient. Often under pressure from the users themselves, many early versions of these feet were over prescribed, being fitted to inappropriate patients, or with the spring strength set too high.

Even when correctly prescribed these products were not always very forgiving on uneven ground. However, over the years new designs have been introduced which aim to meet the needs of the less active individuals, and also to provide better compliance on uneven surfaces, without reducing the effectiveness of the energy retention and return.

As a consequence there are now a large number of options available, aimed at meeting the needs of patients over a wide range of activity levels, with prices becoming increasingly more competitive.

Patient adjustable

The ability for patients to adjust their prosthetic feet has been in demand, with the most popular being adjustable heel height.

Modern styles of footwear for men and women have produced the problem that changing footwear creates a change of prosthetic alignment, which at best may be a little uncomfortable and at worse, unwearable or dangerous.

Very few of the devices tried have been ideal and durability has often been an issue. The actual function of the foot is sometimes compromised by extreme changes in heel height and the function of both the adjustment and the feet themselves is sometimes a compromise.

More recent attempts have been better and new products, from patient adjustable ankles for use on a variety of feet, to new feet with better compliance and energy retention, and even units with electronically-controlled systems of adjustment seem to be appearing more regularly.

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Prescription Guideline - HW P FEE 01

Guideline Statement

A SACH foot should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- SACH foot – see overview.
- Lower limb amputation - ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

Indications

<table>
<thead>
<tr>
<th>Patients who would benefit from a low maintenance durable foot</th>
<th>Patients who require energy return (high activity patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who are expected to be indoor walkers, SIGAM C or below</td>
<td>Patients who require a greater range of movement at the ankle joint (e.g. walking on uneven terrain)</td>
</tr>
<tr>
<td>For use with a water activity limb</td>
<td>Patients who want to walk at varying and fast speeds</td>
</tr>
<tr>
<td>Patients who require a lightweight foot</td>
<td>Patients who cannot tolerate the decreased stride length of a SACH foot</td>
</tr>
<tr>
<td>Patients who would benefit from shock absorption properties of the foot when walking at lower speeds</td>
<td>Patients with a weak or compromised contralateral limb (a SACH foot results in greater transfer of weight to and increased stance time on the sound side)</td>
</tr>
</tbody>
</table>

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
### Prescription Guideline - HW P FEE 02

**Guideline Statement**

A uniaxial foot should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Uniaxial foot – see overview.
- Lower limb amputation - ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who require stability during stance (provided by the foot moving to plantigrade quickly)</td>
<td>High activity patients (SIGAM E-F)</td>
</tr>
<tr>
<td>Patients who would benefit from plantar or dorsiflexion resistance being set to their specific need</td>
<td>Patients who would find regular maintenance inconvenient</td>
</tr>
<tr>
<td>Patients requiring M-L stability at ankle during stance phase (e.g. hip disarticulation)</td>
<td>Where the space available is insufficient to allow the use of a foot with a uniaxial mechanism</td>
</tr>
<tr>
<td>Patients who require the main characteristic of the foot to be its lightness&lt;sup&gt;5&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

### Prescription Guideline - HW P FEE 03

**Guideline Statement**

A multiaxial foot should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Multiaxial foot – see overview.
- Lower limb amputation - ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who regularly walk on uneven terrain&lt;sup&gt;1,4,5&lt;/sup&gt;</td>
<td>Patients who require no ankle movement for maximum return with an energy storing foot</td>
</tr>
<tr>
<td>Patients who participate in outdoor activities where multiaxial movement at the ankle is a benefit e.g. golf&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Patients who would find regular maintenance inconvenient</td>
</tr>
<tr>
<td>Patients with moderate to higher activity (SIGAM D-F)&lt;sup&gt;1,4&lt;/sup&gt;</td>
<td>Patients who require the main characteristic of the foot to be its lightness</td>
</tr>
<tr>
<td>Patients who prefer the gait symmetry provided by the multiaxial movement&lt;sup&gt;15&lt;/sup&gt;</td>
<td>High activity patients who require energy absorption and return at heel strike, as opposed to early plantar flexion</td>
</tr>
<tr>
<td>Patients who require stability during stance (provided by the foot moving to the plantigrade position quickly)</td>
<td>Where the space available is insufficient to allow the use of a foot with a multiaxial mechanism</td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
### Energy storing feet

**Prescription Guideline - HW P FEE 04**

**Guideline Statement**

An energy storing foot should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Energy storing foot – see overview. There are many different types of energy storing feet, each with different properties. This guideline is an overview of all the different types. Characteristics of each individual foot should be taken into account when prescribing.
- Lower limb amputation – ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
</table>
| Patients with higher activity (SIGAM E and above)                         | Lower activity patients (SIGAM C and below)
| Patients who benefit from reduced energy expenditure on walking (more significant at higher walking speeds) | Patients who cannot tolerate extra forces on residual limb generated by full length toe lever |
| Patients who would benefit from shock absorption properties of the foot   | Patients who do not like cosmetic appearance of foot                |
| Active patients with transfemoral amputations who would benefit from longer stride length and lower energy expenditure | Patients who are only able to walk at slow walking speeds           |
| Patients who benefit from durability of foot (reduced lifetime cost)       |                                                                      |
| Patients who benefit from stride length symmetry                          |                                                                      |
| Patients who regularly walk long distances                                 |                                                                      |

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

### Patient adjustable heel height feet

**Prescription Guideline - HW P FEE 05**

**Guideline Statement**

A patient adjustable heel height foot should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Patient adjustable heel height foot – see overview.
- Lower limb amputation – ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

**Indications**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who require the ability to adjust the alignment of the foot to accommodate different shoe heel heights</td>
<td>Patients who are unable to satisfactorily align the foot in a safe position for walking</td>
</tr>
<tr>
<td>Patients who regularly walk barefoot; the ability to adjust the foot avoids knee hyperextension or abnormal forefoot contact</td>
<td>Patients who require a lightweight foot</td>
</tr>
<tr>
<td>Activities that require a different foot angle to walking (e.g. horse riding, skiing)</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
References - Prosthetic feet prescription guidelines


There are many different types of prosthetic knee joint available, but they can all be categorised by the way in which the joint can be flexed and extended. They are either monocentric, moving around a single axis, and/or polycentric, where there are several axes of movement.

These categories can then be subdivided into the various methods of controlling the knee, both in the stance phase (when the patient’s weight is loaded through the knee), and the swing phase (when the knee is unloaded and free swinging). There are some knees which incorporate the control of both the stance and swing phase within one system, which we have categorised as dual control. These include the microprocessor controlled knee units.

Monocentric knee joints

A monocentric, or single axis knee, flexes and extends freely around a single pivot. At its simplest it is a low maintenance, lightweight knee, with stance phase stability achieved by positioning the knee unit with respect to the weight line and by means of the patient’s own muscular control.

The knee is stable when the ground reaction force (GRF) - the line through which the patient’s body weight appears to act at any given point in the stance phase - passes anterior to the knee centre. More complex single axis knee units have added stance phase and swing phase control.

Polycentric knee joints

A polycentric knee joint mimics the anatomical knee joint by having more than one axis. Most polycentric knee joints have four points of rotation connected by links or bars, and are also known as four-bar knees. The instantaneous centre of rotation (ICR) of the knee changes its position as the knee flexion angle increases or decreases, thus simulating the anatomic axis of motion more closely.

The instantaneous centre of rotation (ICR) of a polycentric knee is the point around which the knee appears to be bending at any given point in time, and is located at the intersection of a line defined by the anterior articulations and a line defined by the posterior articulations.1

The more anterior the ground reaction force is, with reference to the ICF, the greater the knee extension moment developed in early stance and the more stable the prosthesis becomes. As the stance phase progresses, the ICF moves anterior to the GRF and the resulting flexion moment makes knee flexion easier during late stance.1

As well as enhanced stance phase stability and easier flexion at late stance, the geometry of a polycentric knee causes the prosthetic shin to shorten as knee flexion increases and this enhances toe clearance at mid swing phase.2

Polycentric knees also benefit patients with a knee disarticulation or long transfemoral residual limbs, since they are constructed such that when flexed they are extremely compact, resulting in a more cosmetic appearance when sitting. Generally, they also have a large degree of flexion and these two things combine to allow a patient to kneel more easily.
Swing phase control

Semi-automatic knee lock (SAKL)

This is a knee unit which incorporates a spring loaded locking device. This device automatically locks with a distinctive click when the knee is in full extension, thus preventing flexion in both the stance and swing phases of the gait. The patient can manually unlock the knee by operating a lever attached to the outside of the socket in order to sit down.

This knee mechanism provides maximum stability in stance. The semi-automatic knee lock design is usually lightweight, but the resulting locked knee gait compromises toe clearance in swing phase. Therefore the prosthesis is often made slightly shorter than the sound side limb to compensate for this.3

Manual or hand operated knee lock (HOKL)

Fitted to a free knee mechanism, this device allows the patient to lock the knee manually, giving them the option of walking with the knee locked or unlocked.

For example, the patient might use the free knee indoors, or on smooth surfaces, but use the knee locked on irregular or uneven ground. The free knee element of such units usually offers only simple swing and stance control.

Weight-activated braking

This method of achieving knee stability during stance phase involves a braking mechanism that is activated when weight is applied through the knee to prevent the knee unit from buckling. As load is applied to the prosthesis, friction in the brake increases such that the knee will lock when the patient’s body weight is on the prosthesis, thereby preventing knee flexion. The degree of friction is adjustable to the body weight of the particular patient. The free knee element of the HOKL unit shown above is weight activated.

Geometric locking design

Some polycentric knees include a geometric locking design which engages at initial heel strike if the knee is fully extended and the ground reaction force is posterior to the knee centre.

This is not just the geometric stability that is normally associated with polycentric units, but is a positive change in the geometry which completely prevents knee flexion, until it disengages when the knee is in full extension and the vertical load through the foot falls anterior to the knee axis, just prior to toe off.

Stance phase control

Mechanical constant friction

This is usually a very simple device that applies pressure against the knee pivot and provides some damping of the swing phase motion. The friction can be adjusted to enable the patient to walk reasonably well, but since it gives uniform resistance throughout the gait cycle, it will only allow one fixed cadence (walking speed). If the cadence increases, heel rise will become excessive and thus prolong the swing phase, but with increased terminal impact. Extension bias assist devices are commonly added to these units to limit heel rise (see next section).

The unit shown has a friction adjustment that simply pinches the bottom pivot and an internal extension assist spring.

Extension bias assist devices

Extension bias assist devices help advance the limb during early swing phase and limit heel rise. Two basic types of extension bias devices are used: internal and external. An internal unit is often a compression spring built into the knee mechanism, whilst the external device may be no more than an elastic pick up strap attached to the anterior section of the socket and to the shin.

Pneumatic knee units

As the name would suggest, pneumatic control cylinders use air to achieve the desired swing phase control characteristics. These characteristics are achieved by controlling the air movement in a cylinder from one side of a piston to the other through adjustable valves. When the knee flexes the piston is pushed down into the cylinder, compressing the air and creating a partial vacuum above it.

The pressure difference creates resistance to knee flexion, which is controlled by the rate of flow through the flexion valve. Knee extension is similarly controlled by the rate of air flow through the extension valve as the piston moves up the cylinder. Pneumatic knees are fairly cadence responsive, but because air is compressible, they can be overpowered by more active users. They tend to be lighter and less expensive in comparison with hydraulic units.

Hydraulic knee unit

Hydraulic knee units function in a similar way to pneumatic ones, but use a fluid instead of air. When the knee flexes a rod moves a piston down the cylinder and forces hydraulic fluid through an adjustable flexion valve from below the piston, into the cylinder above the piston.

The reverse applies as the piston moves upwards during extension, forcing the fluid through the extension valve. The degree of resistance can be controlled by adjusting the flexion and extension valves and is dependent on the rate of movement of the piston, the resistance increasing with increased speed of walking and decreasing as the walking speed slows. Therefore hydraulic fluid control tends to be more responsive to changes in walking speed than pneumatic control, but may be more susceptible to significant changes in temperature.
Hydraulic swing and stance control

These knee units provide both stance and swing phase control from one hydraulic cylinder. This incorporates a stance control piston on one end of the piston rod and swing phase control unit at the other end of the piston rod, such that the piston rod is dual purpose.

The swing control piston forces fluid through the upper passages and valves of the cylinder, to function in a similar way to the hydraulic knee control in swing phase. The lower stance control piston operates in the lower chamber of the cylinder. Fluid in the lower chamber can only flow through the stance control piston valve, which closes to a preset position at heel strike, reducing the rate of flow and preventing sudden flexion of the knee. This gradually yielding stance resistance is designed to assist in walking down slopes and descending stairs leg over leg. The patient also has the option to shut the stance yield altogether, in order to prevent flexion, or remove both stance and swing resistance for selected activities. Hans Mauch developed the first clinically effective stance and swing control hydraulic knee in the 1950s.1

Microprocessor control knee unit

The microprocessor control knee is a more recent development that uses built-in electronic sensors to collect real-time data and thereby, control stance and swing phase. The Endolite Intelligent Knee was one of the first microprocessor controlled pneumatic knee units. This uses a single built-in sensor to detect when the knee was in full extension and adjusts a pneumatic swing control cylinder accordingly.1 In use, a built-in computer chip adjusts the pneumatic resistance of the cylinder, optimising the swing phase characteristics to allow a broad range of gait speeds from very slow to very fast.1

The prosthetist is able to specify several different optimal adjustments during dynamic alignment that the computer chip later selects and applies according to the pace of ambulation the user chooses.1 A more advanced type of computer controlled prothetic knee and shin system is the C-leg from Ottobock. It incorporates an on-board microprocessor, hydraulics, pneumatics, and servo motors.2 A microprocessor controls the single axis knee with hydraulic stance and swing phase control as well as the automatic servo adjustment of the hydraulic resistance valves. This design is unique in that it uses multiple sensors that are integrated into the prothetic shin structure to gather and calculate biomechanical data such as the amount of vertical loading, the sagittal plane ankle moment, and the position, direction, and angular acceleration of the knee joint.1

This data is sampled 50 times per second, allowing the computer to readjust the knee accordingly.1,3 Electronic sensors in the C-leg collect real time data, which is then sent to the hydraulic damper to control stance and swing phase movements.4 On the negative side, microprocessor controlled knee units are expensive, add weight and require regular charging and maintenance.

References - Prosthetic knee joints overview

4. Transfemoral prosthetics (Above-knee prosthetics), National Centre for training and education in prosthetics and orthotics, knee mechanisms, p9-29.
Monocentric knee units

Prescription Guideline - HW P KNE 01

Guideline Statement

A monocentric knee unit should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

• Monocentric knee unit – see overview.
• Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who would benefit from a light-weight knee (will depend on the swing or stance controls)¹</td>
<td>Patients with long residual limbs</td>
</tr>
<tr>
<td>Small/petite adults or children who require small and lightweight knee (will depend on the swing or stance controls)²</td>
<td>Patients who have difficulty in clearing ground in swing phase</td>
</tr>
</tbody>
</table>

Exceptions

• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
• Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Prescription Guideline - HW P KNE 02

Guideline Statement

A polycentric knee unit should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

• Polycentric knee unit – see overview.
• Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who prefer cosmetic appearance of low profile knee when sitting (knee disarticulation, long transfemoral)¹,²</td>
<td>Patients who require knee stability when knee is not in full extension</td>
</tr>
<tr>
<td>Patients who would benefit from stance stability of geometric locking design¹,²</td>
<td>Patients who cannot initiate or control knee flexion in late stance</td>
</tr>
<tr>
<td>Patients who require limb shortening to aid toe clearance at mid swing¹,²,³</td>
<td>Patients with poor control of limb during gait affecting ability to stabilise knee</td>
</tr>
<tr>
<td>Patients who would benefit from initiation of knee flexion during late stance¹,²</td>
<td></td>
</tr>
<tr>
<td>Patients who prefer the more anatomically correct gait of a polycentric knee</td>
<td></td>
</tr>
<tr>
<td>Patients who require durability and reliability (stability minimally affected by wear on knee)</td>
<td></td>
</tr>
</tbody>
</table>

Exceptions

• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
• Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Semi-Automatic Knee Locks (SAKL)

Prescription Guideline - HW P KNE 03

Guideline Statement
Semi-automatic knee locks should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
- Semi-Automatic Knee Lock (SAKL) - a type of prosthetic knee joint that automatically locks on extension of the knee and must be manually unlocked by the patient.

Indications
- Patients with poor stability (safety issue)
- Patients with weak musculature on amputated side
- Patients who have low predicted mobility
- Patients with weak musculature on contralateral side
- Patient preference
- Older (geriatric) patients, as it enables a higher walking velocity with lower effort
- Patients with low patient confidence
- Patients with large hip flexion contracture >30 degrees
- Patients where a lightweight prosthesis is required

Contradications
- Patients who are unable to reliably lock/unlock the knee e.g. cognitive impairment
- Patients who are unable to reliably lock/unlock the knee
- Patients who are unable to reliably lock/unlock the knee e.g. uneven ground, changing medical condition
- Patients who are unable to reliably operate a HOKL for example patients with short term memory loss
- Patients in the early stages of rehab where predicted final mobility level exceeds current ability, for example free knee use is predicted, but not initially achievable due to other complications

Note: Whilst consensus was not reached, concern regarding the ability of the patient to operate the thigh release if their hand function is poor was expressed and needs to be taken into consideration.

Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Hand Operated Knee Locks (HOKL)

Prescription Guideline - HW P KNE 04

Guideline Statement
Hand operated knee locks should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
- Hand Operated Knee Lock (HOKL) - any prosthetic knee joint that has the option of being a locked knee or a free knee through manual operation by the patient.

Indications
- Patients requiring the option of maximum stability on occasions e.g. uneven ground, changing medical condition
- Geriatric patients who may occasionally require to use a locked knee to reduce effort or increase walking speed
- Patients in the early stages of rehab where predicted final mobility level exceeds current ability, for example free knee use is predicted, but not initially achievable due to other complications
- Patient preference

Contradications
- Patients with low cognitive ability who are unable to determine when it is appropriate to lock and unlock the knee safely
- Patients above SIGAM E since they should benefit from swing phase control not available in knees with a HOKL
- Patient preference Poor muscle control

Note: Whilst consensus was not reached, concern regarding the ability of the patient to operate the thigh release if their hand function is poor was expressed and needs to be taken into consideration.

Exceptions
- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**Prescription Guideline - HW P KNE 05**

**Guideline Statement**

A weight-activated braking stance control unit should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Weight-activated braking stance control unit – see overview.
- Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who are capable of walking with free knee but require enhanced stability</td>
<td>Patients who require initiation of flexion in late stance</td>
</tr>
<tr>
<td>Patients who prefer the reassurance of stance phase stability</td>
<td>More active patients* (SIGAM E-F)</td>
</tr>
<tr>
<td>Patients with weak hip musculature</td>
<td>Patients who would find regular attendance for maintenance inconvenient</td>
</tr>
<tr>
<td>Patients with medium activity level (SIGAM D–E)</td>
<td></td>
</tr>
<tr>
<td>Patients with a short residual limb</td>
<td></td>
</tr>
</tbody>
</table>

*This will often depend on patient preference.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

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**Prescription Guideline - HW P KNE 06**

**Guideline Statement**

A mechanical constant friction swing-control unit should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- Mechanical constant friction knee unit – see overview.
- Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to moderate activity level (SIGAM B–E)</td>
<td>Patients who require cadence responsiveness</td>
</tr>
<tr>
<td>Patients who require a lightweight knee¹</td>
<td>Patient who is unable to control prosthetic knee stability¹</td>
</tr>
<tr>
<td>Patients who require a durable knee¹</td>
<td>Patients who do not like the terminal impact of knee (certain knee types)</td>
</tr>
<tr>
<td>Patients requiring the ability to self adjust swing of knee (only certain knee types)</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Prescription Guideline - HW P KNE 07

Guideline Statement
Extension bias assist devices should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

• An extension bias assist device – see overview.
• Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who prefer sense of stability gained from strong extension (terminal impact)</td>
<td>Patients with high activity level (SIGAM E and above)</td>
</tr>
<tr>
<td>Patients with short residual limbs or weak hip flexors</td>
<td>Patients who require variable cadences*</td>
</tr>
<tr>
<td>Patients who require a low maintenance and durable knee</td>
<td></td>
</tr>
</tbody>
</table>

*Where the extension assist is the sole or main swing phase control.

Exceptions

• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
• Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Prescription Guideline - HW P KNE 08

Guideline Statement
A pneumatic swing phase control unit should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

• Pneumatic swing control unit – see overview.
• Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who benefit from preset cadence of knee*1</td>
<td>Patients who overpower the knee unit$^{12}$</td>
</tr>
<tr>
<td>Slow to moderate cadence walkers$^{2}$</td>
<td>Patients who need lighter knee than hydraulic$^{11}$</td>
</tr>
<tr>
<td>Patients who are exposed to extremes of temperature in their work or leisure</td>
<td></td>
</tr>
</tbody>
</table>

*These are general guidelines that may not apply to all knees in this category.

Exceptions

• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
• Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Hydraulic swing control units

Prescription Guideline - HW P KNE 09

Guideline Statement

Hydraulic swing control units should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- A hydraulic swing control unit – see overview.
- Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>More vigorous walker¹²</td>
<td>Patients who require a lightweight knee¹²</td>
</tr>
<tr>
<td>Patients who walk at rapid or varied cadences¹²</td>
<td>Patients who are exposed to extremes of temperature in their work or leisure²</td>
</tr>
<tr>
<td>Patients who would benefit from smooth swing phase²</td>
<td>Patients who wish to run</td>
</tr>
</tbody>
</table>

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

Hydraulic swing and stance control units

Prescription Guideline - HW P KNE 10

Guideline Statement

Hydraulic swing and stance control units should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- A hydraulic swing and stance control unit – see overview.
- Lower limb amputation - transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who benefit from yield function (e.g. going down stairs/slopes)²</td>
<td>Patients who require a lightweight knee¹²</td>
</tr>
<tr>
<td>Active amputees (SIGAM E-F)¹²</td>
<td>Patients who are exposed to extremes of temperature in their work or leisure²</td>
</tr>
<tr>
<td>Patients who would benefit from switching off stance control for some activities (e.g. cycling)</td>
<td>Patients who need a low profile build option to maintain a good cosmetic appearance</td>
</tr>
<tr>
<td>Patients with bilateral limb loss that would benefit from yield for moving from standing to sitting²</td>
<td>Patients who require variable cadence¹</td>
</tr>
<tr>
<td>Patients who participate in sports and outdoor activities²</td>
<td>Patients who require stance stability offered by the yield function²</td>
</tr>
<tr>
<td>Patients who would benefit from ability to lock knee for some activities²</td>
<td>Patients who would benefit from ability to lock knee for some activities²</td>
</tr>
</tbody>
</table>

Exceptions

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Microprocessor control knee units

Prescription Guideline - HW P KNE 11

Guideline Statement
A microprocessor control knee unit should be prescribed for any patient requiring a prosthetic knee joint when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions
• Microprocessor control knee unit – see overview.
• Lower limb amputation – transfemoral and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic knee.

Indications | Contradications
--- | ---
Patients who walk at rapid and varied cadences | Patients who may be exposed to water**
Patients who would benefit from good gait symmetry at various cadences | Patients who usually walk at one speed**
Patients who would benefit from reduced energy consumption in walking | Inability to regularly charge batteries
Patients who would benefit from stumble recovery | Patients who require a lightweight prostheses
Patients who would benefit from enhanced stability on uneven ground | Patients who may be exposed to high magnetic fields
Patients who prefer confidence of extra stability | Patients who would find regular maintenance inconvenient
Bilateral amputee who is capable of walking | Patients with limited mobility** (SIGAM grades A-C)
Patients who regularly walk in more demanding environments (hills, slopes, stairs) | High-activity patients (SIGAM grades E-F)**

*This is the recommended range, however individual patient goals must be considered, for example patients who wish to run would not necessarily benefit from microprocessor control.
** Water resistant MPK’s now available.

Exceptions
• Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
• Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed correctly, safely and consistently before proceeding.
• Where an alternative approach is seen to be more suitable according to the indications/ contraindications of its guideline.

References - Prosthetic knee prescription guidelines
There are three main types of functional adapter that can be used when producing a prosthesis:

**Shock absorber**

As well as allowing torsional rotation, these units are intended to provide shock absorption at heel strike, by means of a sprung telescopic element. The rotational force of the spring and the force required to compress the unit can generally be adjusted independently in many designs, by swapping the compression spring or rotational rubbers.

The unit illustrated can be set up with different lateral and medial rotational forces. This may, for example, allow a greater lateral rotation force to be chosen to prevent excessive rotation at toe off, but provide a lesser rotational resistance appropriate to the patient’s golf swing.

**Torque absorbers**

Torque absorbers are generally designed to take the place of a standard tube clamp adapter and allow rotation in both directions against a resistance, which will return the unit to the neutral position once the rotational force is removed.

The force exerted by the resistance is sometimes adjustable. They may be installed to reduce the effects of rotational forces on the residual limb or on other components in the build, or to allow the rotation required for a specific activity, such as golf. To this end they are sometimes included as an integral part of a prosthetic foot.

**Rotation/turntable adapter**

A rotation adapter or turntables are designed to allow the patient to rotate one element of their prosthesis against another. By depressing the button on the side of the unit, rotation can be achieved, but the unit automatically locks again when rotated back to the original position. Since they are often installed above the knee joint, they are generally designed to add as little as possible to the build height. If positioned between the prosthetic knee and the socket, the rotation of the knee, shin and foot section enables the user to lift the foot onto the other knee when sitting, perhaps for the purpose of changing footwear, or when repositioning a patient adjustable foot, or simply to sit cross-legged.

It can also be useful where the patient needs to tuck the shin and foot out of the way when driving, or working in confined spaces. If positioned below the knee, in a transfemoral or transtibial prosthesis, the foot can then be rotated, thereby making kneeling easier.

---

**Guideline - HW P ADA 01**

**Guideline Statement**

A shock absorber should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Shock absorber** – see overview.
- **Lower limb amputation** – ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

**Indications**

- Patients who regularly have to dismount from a height e.g. horse rider, lorry driver
- Patients who regularly participate in high impact activities e.g. basketball, tennis
- Patients who would benefit from reduced interface pressures and shear forces
- Patient preference for greater comfort

**Contradications**

- Patients who could not manage extra weight of the component
- Insufficient build length for component
- Where the shock absorption counteracts the action of other components such as an energy storing foot

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
**Torque absorber**

**Prescription Guideline - HW P ADA 02**

**Guideline Statement**

A torque absorber should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Torque absorber** – see overview.
- **Lower limb amputation** - ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
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<tbody>
<tr>
<td>Patients who regularly participate in activities which require torsional movement (e.g. golf)*</td>
<td>Patients who could not manage extra weight of the component</td>
</tr>
<tr>
<td>Patients who require prosthetic replacement of hip rotation (e.g. hip disarticulation, hemipelvectomy or congenital hip deficiency)</td>
<td>Insufficient build length for component</td>
</tr>
<tr>
<td>Where rotational shear forces at the socket interface may cause discomfort or tissue breakdown</td>
<td>Where the rotational movement has a detrimental effect on the patient’s functional ability (e.g. lateral deflection at end of stance phase or feeling of instability or loss of control in gait)</td>
</tr>
<tr>
<td></td>
<td>The desired cosmetic cover would be damaged or would prevent rotation (decision will also involve patient preference)</td>
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</tbody>
</table>

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.

**Rotation/turntable adapter**

**Prescription Guideline - HW P ADA 03**

**Guideline Statement**

A rotation or turntable adapter should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

**Definitions**

- **Rotation or turntable adapter** – see overview.
- **Lower limb amputation** - ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contradications</th>
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</thead>
<tbody>
<tr>
<td>Transfemoral patients who require rotation for a regular activity (e.g. sitting cross-legged, driving, praying, donning shoes)*</td>
<td>Poor cognitive ability – unable to operate component safely and effectively</td>
</tr>
<tr>
<td>Patients who require regular kneeling (e.g. gardening, praying) and benefit from the foot being rotated**</td>
<td>Poor manual dexterity – unable to operate component safely and effectively</td>
</tr>
<tr>
<td></td>
<td>Patients who could not manage with extra weight of component</td>
</tr>
<tr>
<td></td>
<td>Insufficient build length for component</td>
</tr>
<tr>
<td></td>
<td>The desired cosmetic cover would be damaged by or would prevent rotation</td>
</tr>
</tbody>
</table>

*With the device fitted proximal to the knee joint.
**With the device fitted distal to the knee joint or in transtibial use.

**Note:** Otto Bock does not recommend distal fitting of their rotation adapter and therefore, in this case, a risk assessment would be needed.

**Exceptions**

- Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis.
- Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding.
- Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline.
Water activity limb are designed to be worn in wet environments, with the exact design varying according to need.

**Endoskeletal**

By combining waterproof structural components with waterproof feet, and knees where required, can provide a limb for use in water, but also one which will allow a satisfactory and safe gait for most of the users other activities. These can be made to be more cosmetic using a clip on cover.

**Exoskeletal**

A common form of water activity limb is a conventional style limb with a hollowed out shin and water inlets, in an attempt to reduce buoyancy for those who wish to paddle or swim. This is combined with a SACH or dynamic SACH foot. Otto Bock also produces two knee options that can be built into a transfemoral prosthesis in a similar fashion.

**LA ankle™**

This is a specific component available for water sports which unlocks from a plantigrade position (foot at 90 degrees to shin) to allow plantar flexion (toes pointing down) - a suitable position for use with a flipper. This works well with the Trulife Seattle Lightfoot, since it can be bolted directly to the keel, lowering the position of the ankle pivot, thereby making the fully plantar flexed foot more natural in appearance and functionally more effective.

**Freedom Innovations Freestyle swim foot**

This foot and ankle combination is designed for use with a flipper, but is also a fairly dynamic, energy storing foot that allows the wearer to go from swimming to active walking, without the need to change their prosthesis.
Process and procedures for prescription of a water activity limb

1. A referral may come either from the patient/user or a member of the multidisciplinary team who has identified the need.

2. A consultation should be arranged with appropriate members of the multi-disciplinary team.

3. The need and indications should be discussed including an explanation of the limiting factors.

4. The present day-to-day prosthesis should be viewed to see if slight modification may serve the specific purposes.

5. A model of the water activity limb, if available, should be demonstrated to show its mechanics and limitations.

6. The specific indications should be documented if a water activity limb is prescribed.

7. Ensure follow-up to identify use and maintenance regime for prosthesis if necessary.

Alternatives – limb/cast covers

If a water activity limb is not suitable, there are clear cast/prosthesis covers for adults (Fig. 1) or Sealskinz socks for children (Fig. 2), from Limbo products or other online retailers.

Prescription Guideline - HW P WAP 01

Guideline Statement

A water activity prosthesis should be prescribed for any patient with a lower limb amputation, when some or all of the indications are observed, whilst ideally none of the contraindications are exhibited.

Definitions

- Water activity prosthesis – see overview.
- Lower limb amputation – ankle disarticulation and higher levels of amputation, or where there is a congenital shortening allowing space for a prosthetic foot.

Indications

| Occupational reasons where a waterproof limb is essential or reduces health and safety risk |
| Specific water activity sport or leisure which necessitates the use of a water activity limb |
| Where risk analysis identifies that due to an associated medical or physical condition, participation in an activity or leisure pastime presents a health and safety risk as a major issue and a water activity limb can significantly reduce these risks |
| Social reasons where health and safety risk is a significant issue |
| Where other measures to address disability or handicap are impossible or impractical, e.g. where adaptation like fitting appropriate sitting shower facility is inadvisable |
| Social reasons for leisure and psychological well-being |

Contradications

| Exceptions |
| Those patients who are deemed medically unfit, unwilling, or because of their current lifestyle or circumstances, unsuitable for the provision of a prosthesis |
| Poor cognitive ability and compromised hand function may, in some cases, be contraindications for prosthetic rehabilitation. The MDT must assess whether the patient has the level of ability required with or without a carer, to use the prosthesis being prescribed, correctly, safely and consistently before proceeding. |
| Where an alternative approach is seen to be more suitable according to the indications/contraindications of its guideline. |

References - Water activity limb prescription guidelines

**Glossary**

**Abduction**
Movement away from the midline of the body.

**Acrylic Resin**
Thermosetting resin used in fabrication of an acrylate laminate prosthetic socket.

**Adapter**
Device used to connect a prosthetic socket to the components of the prosthesis.

**Adduction**
Movement toward the midline of the body.

**Adductor longus tendon**
The origin of this tendon is located high in the front of the groin. It functions with the muscles here to adduct the thigh.

**Alignment**
Attaching and assembling prosthetic components in order for them to align with the body in a correct position.

**Ambulation**
The act of walking.

**Amputation**
The loss of a body extremity by surgery or trauma.

**Ankle block**
Connector between prosthetic foot and shin.

**Anterior**
On the front side of the subject.

**Anterolateral**
A position on the front and outside of the specific subject.

**Anteromedial**
A position on the front and inside of the specific subject.

**Articulation**
The point at which two bones make contact.

**Atrophy**
Muscle shrinkage due to lack of use.

**Bench Alignment**
Initial alignment of prosthetic components before fitting to the individual.

**Bespoke**
Custom-made.

**Bilateral amputation**
Amputation of both left and right limbs (upper or lower).

**Build-up**
Area where plaster/other material is used to relieve an impingement or prominence.

**Bulbous residual limb**
Refers to the residual limb being larger in circumference at the end than at the top.

**CAD/CAM**

**CAD/CAM mill**
Machine that carves to a specific shape.

**CAD/CAM scanner**
Laser scanner used to electronically capture the measurements and shape of specific body parts.

**Calcaneocuboid**
Relating to the calcaneus and the cuboid bones in the foot and ankle.

**Carbon fibre**
Material used for structural reinforcement in laminated sockets or in manufacture of prosthetic parts. This material is very strong, though can be brittle and therefore needs mixing with other materials for strength.

**Cast/negative model**
Plaster shell removed from the residual limb.

**Cast/positive model**
Plaster or foam model of a specific subject.

**Cast rectification**
Functional changing of the shape of a cast to apply pressure in tolerant areas and relieve sensitive areas.

**Casting procedure**
Technique of getting a 3-dimensional body impression using plaster of paris.

**Check socket**
A socket made of clear plastic used to evaluate the fit of the socket design to the residual limb. This material is brittle, therefore cannot be used in the definitive limb unless well enforced.

**Circumduction**
During gait the affected limb will swing outward and then back in through the swing phase.

**Circumference**
Measurement around a specific part of the body.

**Clam shell design**
When two pieces of material come together to support a specific body structure.

**Component**
General term to describe prosthetic parts which make up a prosthesis.

**Condyle**
Rounded part of the bone normally located at the joint.

**Congestion**
Where tightness or constriction of the upper part of the residual limb causes the accumulation of excessive blood or tissue fluid in the distal end of the residuum.

**Conical residual limb**
Refers to the residual limb being smaller in circumference at the end than at the top.

**Contracture**
Tissue shortening that causes a loss of normal joint range, for example the knee joint cannot be fully straightened. This is often seen after amputation surgery due to shortening of muscles or tightness following prolonged sitting.

**Contralateral**
The unaffected limb or side of the body.

**Congenital**
Occurring at or before birth.

**Coronal plane**
Perspective of looking from the front (observes abduction/adduction).

**Cosmetic cover**
Soft or flexible cover used to protect the prosthesis as well as make the prosthesis look more realistic.

**Cuff**
Used in prosthetics to provide a circular strap enclosure of the thigh.

**Cylindrical residual limb**
Refers to the residual limb being similar in circumference at the end and at the top.

**Disarticulation**
An amputation through a joint.

**Distal**
A relative term used to describe the point on a limb which is farther away from the body in relation to another part of that limb.

**Doffing a prosthesis**
Taking off a prosthesis.

**Donning a prosthesis**
Putting on a prosthesis.

**Donning aid**
Tool used to help put on something.

**Dorsal**
The back side of.

**Dorsiflexion**
Lifting of the toes/ankle toward the ceiling.

**Durometer**
Term used to describe how soft or hard materials are.

**Dysvascular Amputee**
An individual with the loss of a limb secondary to circulatory impairment.

**Early Walking Aid**
A temporary artificial limb that is fitted soon after surgery; this adjustable prosthesis is worn as the residual limb and is healing for early walking practice at physiotherapy sessions.

**Endoskeletal design**
A prosthetic limb that is constructed using a tube or pylon as the support structure; this allows for the easy adjustment and exchange of components. An endoskeletal system can be covered with cosmetic foam that is shaped to match the sound side limb.

**Energy return**
A spring-like feeling of return from a specific type of foot.

**Epiphysis**
The expanded end of a long bone at the articulation. During the period of growth the epiphysis is either entirely cartilaginous or is separated from the shaft by a cartilaginous disk.

**Equinovarus**
A foot deformity in which the heel is turned inward and the foot is plantar flexed.

**Equinus**
A toe down position of the foot, in which the forefoot is lower than the heel.
Exoskeletal design
A prosthetic limb made without a pylon or easily interchangeable components; finished as a hard outer with no internal components.

Extension
A straightening of the joint.

Extension assist
Prosthetic knee joints which have a mechanism to help extend the knee.

Extension moment
Force (torque) causing extension (straightening of joints).

Fabrication
Process of creating an end product.

Femoral condyle
The bulbus part of the lower end of the femur that attaches to the knee joint.

Fibula
The small support bone that runs along the outside of the leg just below the knee.

Fibular head
The prominent bone on the outside of the leg just below the knee.

Flexion
Bending of a joint, such as the knee or the elbow, which decreases the angle between the two parts.

Follicitus
Inflammation of the hair follicles which may lead to deeper abscesses; often caused by bacteria.

Framed socket
A rigid material encompassing a flexible plastic inner portion to a prosthetic socket.

Gait
Walking.

Gait analysis
The study and evaluation of how a person walks.

Gait deviation
Undesired movements during walking.

Gait pattern
Specific trait of how a specific individual walks.

Gait training
Usually consists of several sessions on learning how to walk with a prosthesis with your physiotherapist.

Gluteal muscles
Muscles of the buttocks that are largely responsible for extending the thigh.

Hamstrings
The thigh muscles that run behind the knee to control the knee bending.

Hallux valgus deformity
The migration of the great toe over towards the direction of the 2nd toe.

Heel off/heel rise
Part of stance phase when the heel comes off the ground when walking.

Heel strike
Part of stance phase when the heel contacts the ground when walking.

Hemipexectomy
Amputation of one leg together with removal of the half of the pelvis on the same side of the body.

Hip disarticulation
Amputation of the entire leg through the hip joint.

Hip dysplasia
When the hip becomes dislocated.

Hygiene
Term used to describe how well a person cleans themselves or their prosthesis.

Hypertension
Beyond the normal range of extension.

Initial swing
Part of swing phase when the leg begins to swing forward during walking.

Insenate
Lack of feeling or sensation in a part of the body.

Insole
Orthosis that is placed inside the shoe for the foot to stand on; provides support or cushioning.

Instability
Specific part of body that has poor control or insufficient support.

Interface
The material that is used between the prosthesis and the skin.

Ishial containment (socket)
A transfemoral (above knee) prosthetic socket design that incorporates part of the ischium of the pelvis to increase stability during gait.

Ishial seat/shelf/support
The part of a prosthetic socket that supports the ischial tuberosity.

Ishial tuberosity
Bony landmark at posterior aspect of ischium of the pelvis, the bone may be felt when sitting.

Ishial weight-bearing
Weight transfer at the ischium (in a prosthetic socket).

I.S.N.Y.
Icelandic-Scandinavian Socket design modified by New York University.

Keel
Inner component of prosthetic feet.

Knee sleeve
A soft material stretched over a transtibial (below knee) prosthetic socket and up onto the thigh that supports the knee joint and helps the leg stay on.

Laminate
Fabrication technique that uses resin reinforced fibers to make a custom prosthetic socket.

Lateral
An anatomical term to describe something which is toward the outside, away from centre.

Leather
Cured animal hide.

Leg length discrepancy
When one leg is longer than the other.

Lever arm
Term used in prosthetics to describe length of residual limb. The longer the lever arm, the more leverage and stability.

Limb
Arms or legs; extremeties.

Liner - silicone/gel
A thin layer of soft material that covers the residual limb to provide padding and suspension and often with a locking system to connect the liner to the prosthesis.

LISFRANC amputation
Amputation through the tarsometatarsal joint; through the middle of the foot.

Longitudinal
In a lengthwise direction.

Lordosis
Posterior curvature of the spine.

Lower leg
Part of the leg below the knee joint.

Medial
Towards the centre line, middle.

Medial Tibial Plateau
Located just on the inside of the lower leg below the knee.

Metapysis
The growing portion of a bone.

Metatarsal heads
Located at the ball of the foot as the distal end of the metatarsals.

Metatarsus
Collective term for the five bones in the middle of the foot, located between the tarsals and the phalanges.

Mid-patella tendon
The soft tendon located just under the knee cap.

Mid-stance
When the foot is flat on the floor during walking.

Mid-swing
When the foot is off the floor and in the middle of swing during walking.

Modification
Process of manipulating plaster or foam into a desired shape.

Myostatic contracture
Permanent shortening.

Negative pressure
A type of pressure that occurs when air is trapped inside a socket and causes a suction.
Pain felt in the portion of the limb which has been removed.

**Phantom Pain**

The bones of the toes.

**Plantar**

Toward the sole; occurring on the sole of the foot.

**Plantar flexion**

Movement of the foot at the ankle joint directed toward the ground.

**Plumb line**

Vertical reference line.

**Polyester**

A chemical resin that is used in fabrication of prostheses.

**Polyethylene**

A flexible type of plastic that is used in prosthetics.

**Polypropylene**

A more rigid type of plastic used in the fabrication of prostheses.

**Popliteal**

Pertaining to the area behind the knee sometimes called the knee pit. The concave shallow depression located here is called the popliteal fossa.

**Posterior**

Toward the back of the subject.

**Posterolateral**

A position on the back and outside of the specific subject.

**Prescription**

A plan of care written by a physician or other health care professional.

**Pronation**

The pronated foot is one in which the arch tends to collapse. As the foot strikes the ground the arch flattens somewhat in order to absorb shock, and to assist in balance during mid-stance; this is called pronation.

**Prostrate**

Laying face downward.

**Prosthetic components**

The parts that make up the artificial limb. For example, foot, ankle, socket, tube etc.

**Prosthetics**

Science and practice of evaluating, measuring, designing, fabricating, assembling, fitting, adjusting, or servicing prostheses.

**Prosthetic residual limb sock**

A sock knitted to fit the shape of the residual limb worn inside the socket. The sock reduces the friction between the residual limb and the socket, absorbs sweat and can be used to replace lost volume in the socket due to shrinking of the residual limb.

**Prosthetic technician**

Person trained to fabricate, repair and maintain prostheses under the supervision of a prosthetist.

**Prosthesis**

An artificial medical device used to replace a missing limb or body part such as artificial limbs, hands, fingers, feet or toes.

**Prosthesis controlled by an outside force**

Prostheses controlled by an outside force.

**Patellar-tendon**

Soft tendon located just below the knee cap.

**Patellar-tendon-bearing prosthesis**

A prosthesis designed for weight-bearing at the patella tendon.

**Perineum**

The groin area that is located between the legs.

**Peroneal muscle**

Two muscles located on the outside of the leg below the knee to the ankle. These muscles assist to raise the foot during walking.

**Phalanges**

The bones of the toes.

**Phantom Pain**

Pain felt in the portion of the limb which has been removed.

**Phalanges**

The bones of the toes.

**Pertaining to bone.**

**Osteo**

**Open-end socket**

Prosthetic socket with an open distal end.

**Oedema**

An abnormal accumulation of fluid beneath the skin or in one or more cavities of the body.

**Oblique**

At a slanting angle; not horizontal or vertical.

**Oblique**

Pertaining to bone.

**Oblique**

Pertaining to bone.

**Odeoma**

An abnormal accumulation of fluid beneath the skin or in one or more cavities of the body.

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Silesian belt
Strap that wraps around the waist to suspend the prosthesis.

Silicone
Chemical material with rubber-like mechanical properties.

Silicone liner
Liner with suspension or soft tissue replacement properties.

Silicone suspension sleeve
A silicone sheath that stretches over a transtibial (below knee) prosthetic socket and up onto the thigh that supports the knee joint and helps the leg stay on.

Socket
Prosthetic "container" for the residual limb.

Sound-side leg
Non-amputated side/limb.

Stance
Act of standing.

Stance phase
Phase of walking while the foot is in contact with the ground.

Static alignment
Initial alignment of prosthetic components before fitting to the individual.

Suction socket
Prosthetic socket with suspension supported by vacuum, using a one-way valve in the socket and either the skin, a silicone liner or an airtight sleeve to maintain the vacuum.

Supination
The supinated foot is one in which the arch is high. As the foot is in contact with the floor after mid-stance towards push off the foot supinates to create a firm base from which to push off.

Supine
Laying face upwards.

Supracondylar
Above the condyles.

Suspension
The way in which the prosthesis is held onto the residual limb.

Suspension sleeve
A tubular knee sleeve used for suspension. Also used to keep air from getting into the socket in suction suspension.

Swing phase
The phase of walking when the foot is not in contact with the ground.

Swing phase control
Mechanism used in a prosthesis that controls the swing of the knee joint by increasing or decreasing the speed.

Symes amputation
An amputation level that is performed through the ankle joint.

Talonavicular
Pertaining to the talus and the navicular bones.

Talus
The bone on which the lower leg articulates at the ankle.

Tarsal
One of the seven bones of the ankle.

Tarsometatarsal
Pertaining to the tarsus and the metatarsus.

Tarsus
A collective term for the seven bones which make up the ankle, including the talus, calcaneus, navicular, cuboid, medial cuneiform, intermediate cuneiform and lateral cuneiform.

Terminal swing
The part of walking at the end of swing phase when the foot is just about to contact the floor.

Tibia
Bone located on the front of the leg below the knee. Also known as shin bone.

Tibial condyle
Top wide part of the tibia.

Tibial crest
Front edge of the tibia (shin) bone.

Tibial tuberosity
Prominent front edge of the tibia located at the proximal end of the bone, just below the knee.

Total contact socket
Socket providing equal surface contact all over.

Transfermoral
A type of amputation that occurs above the knee.

Transtibial
A type of amputation that occurs below the knee.

Triceps surae
The muscle of the calf made up of two muscles combined, the gastrocnemius and the soleus muscles.

Unilateral
One-sided.

Upper extremity
Arm.

Valve
Device to control release of air in an AK socket to facilitate suction.

Vaulting
Undesirable gait deviation when walking with a prosthesis. To walk up into the toes on the sound side in order to contact ground through swing phase on the prosthetic side.

Volume fluctuation
When oedema in the leg causes swelling or shrinkage within the residual limb.

Volume loss
The reduction of oedema or atrophy of muscle throughout residual limb after an amputation.

Walking aid
A tool used to support a person when walking.

Weight-activated safety knee
A type of prosthetic knee that brakes when weight is applied through it.

Weight-bearing
Term used to tell an individual to transfer weight to a specific leg.

The Best Practice Guidelines were first published in 2011. All information correct at time of printing. For more information, contact Steeper Group.