

The new C-Brace[®]

Physiotherapy training guideline

Quality for life



“The C-Brace® restores a feeling of safety so I can walk on uneven terrain again.”



Table of contents

Introduction

New horizons in orthotics.....	4
The C-Brace.....	5
Gait phases with the C-Brace.....	6
Training.....	7
The fitting process.....	8
Medical prerequisites.....	9
Definition of terms.....	10

Putting on the orthosis.....	11
------------------------------	----

Basic exercises

Stable standing.....	12
Stable standing with cards.....	12
Stable standing with dynamic arm movements.....	13

Sitting down and standing up

Sitting down.....	14
Standing up.....	14
Adjustment.....	14
Sitting down with cards.....	15
Sitting function.....	15

Stance phase training

Building trust.....	16
Walking on level ground.....	17
Stance phase flexion with support from the therapist.....	17
Stance phase flexion while walking.....	17
Exercises for stride length and gait width.....	18
Walking on uneven ground.....	18
Overcoming small obstacles.....	19

Initiating the swing phase

Exercise for initiating the swing phase.....	20
Consciously initiating the swing phase.....	21

Balance training

Exercises on the balance pad.....	22
Exercises on the MFT Fit Disc.....	22
Exercises on the large balance board.....	22
Tapping with yielding step.....	23
Skateboard exercises.....	23

Reducing assistive devices

Four-point gait.....	24
Two-point gait.....	24
Two-point gait with crutches reversed.....	24
Walking with two canes.....	24
Walking with horizontal cane.....	24
Walking with one cane.....	24
Walking without assistive devices.....	24

Intensive gait training

Walking with small steps.....	25
Walking in a figure 8.....	25
Reactive training.....	26

Walking backward

Walking backward on level ground.....	27
Walking backward with yielding step.....	27

Training on the stepper

Basic exercises on the stepper.....	28
Adapting the resistance.....	29
Mistakes.....	30

Training on the stairs

Ascending stairs.....	31
Descending one step at a time.....	32

Training on the ramp

Ascending a flat and steep ramp.....	33
Walking techniques for descending.....	34
Descending a flat ramp.....	34
Descending a steep ramp.....	35

Stance function

Intuitive stance function on level ground.....	36
Intuitive stance function on the ramp.....	36
Deactivating the stance function.....	37
Mistakes.....	37
Manual stance function on level ground.....	38
Manual stance function on stairs.....	38
Mistakes.....	39

Ground transfer

Kneeling.....	40
Standing-to-ground transfer.....	40

MyModes

Basic mode.....	42
Training mode.....	42
Freeze position.....	43
User defined.....	44

Outdoors.....	47
---------------	----

Activities of daily living.....	48
---------------------------------	----

Symbol key

 Joint unit locked	 Risk of falling
 Joint unit unlocked	 Important

New horizons in orthotics

C-Brace, the microprocessor-controlled leg orthosis, provides entirely new possibilities for freedom of movement. The C-Brace is the world's first mechatronic stance and swing phase control orthosis (SSCO®) system with 3D motion detection that controls both the stance and swing phase.

The functionality of conventional leg orthoses was previously limited to locking and releasing the knee joint. However, the C-Brace supports the user during the entire gait cycle and adapts to everyday situations in real-time. Flexion under load, navigating slopes, walking on uneven terrain, or going down stairs step-over-step – all this defines a new level of mobility.

The C-Brace is light and low-profile, giving users the option of wearing it underneath their clothing. Users can easily configure the joint settings using the Cockpit™ app, or by reading the status directly on the LED display. The new sensor technology is more intuitive to use, making the motion sequences more dynamic and sensitive.

Users also benefit from a considerably simplified fitting process. Orthotists will have the option to fabricate the C-Brace themselves using wet lamination.* Also, the individual settings for the user can be easily configured using the Setup app.

The support of a physiotherapist is indispensable when fitting the C-Brace. We look forward to working with you to restore the quality of life for users.

*The option for orthotists to fabricate the C-Brace themselves will be introduced in 2019. Not currently available.

C-Brace[®]



1 Thigh shell

Custom thigh shell made of carbon composite material, or wet laminate

2 C-Brace joint unit

Microprocessor-controlled hydraulics in the joint unit simulate the action of the quadriceps femoris muscle and hamstrings

3 Display

Shows the system's status and battery charge level

4 Stance and swing control microprocessor unit

The stance and swing control microprocessor unit receives and processes sensor signals, and controls walking with the C-Brace in real-time

5 Inertial motion unit (IMU)

The IMU in the joint unit measures the current position of the joint every 0.01 seconds

6 Medial support

17KF100=* in four versions

7 Lower leg shell

Custom fabricated lower leg shell made of carbon composite material, or wet laminate

8 Ankle joint

A single upright or double upright fitting on the ankle is possible, depending on the situation

9 Foot component

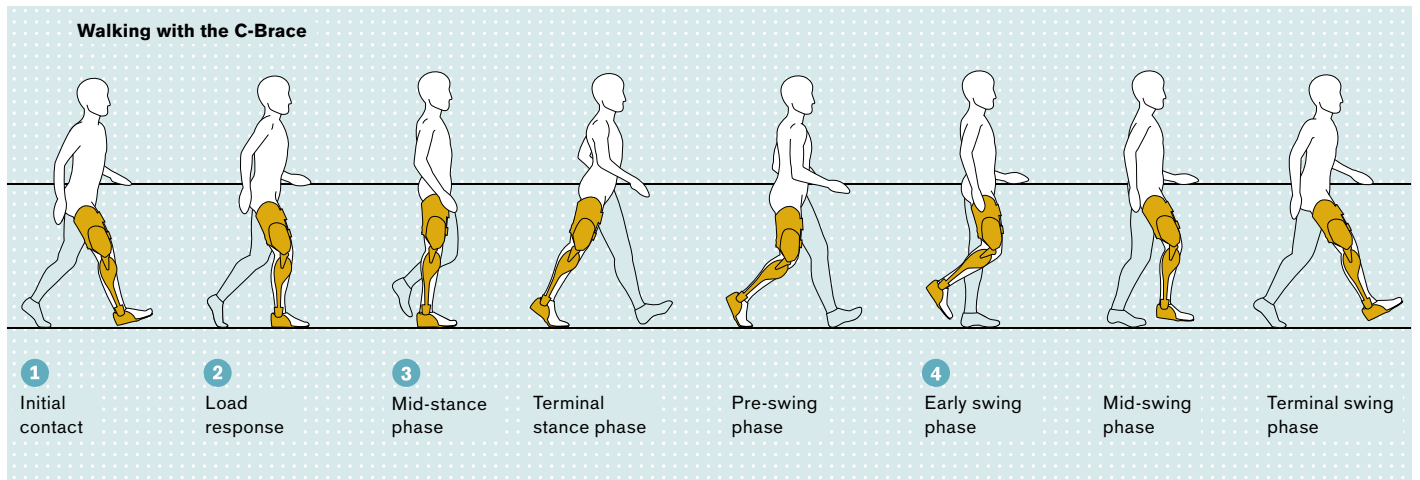
Custom fabricated foot component made of carbon composite material



The Setup app

Use a tablet to make individual settings for the user

Gait phases with the C-Brace[®]



1. Stance phase flexion resistance

Controlled stance phase resistance supports the knee extensors during heel contact

2. Stance phase flexion resistance for level walking

Additional resistance option supports the musculature as needed upon increased load transfer; time limitation for additional stance phase resistance

3. Stance phase extension resistance

Knee extension resistance in the stance phase for smooth, natural movement of the knee joint

4. Swing phase flexion angle

Controls the end of swing phase flexion for an optimized gait pattern

Training

Training takes place in two steps to help users benefit as much as possible from the C-Brace:

- Training without orthosis
 - Mobility, coordination, strength
- Training with the C-Brace
 - Familiarization with and use of functions

Physiotherapy training is an essential element of the fitting and varies depending on the user's physical condition and motivation. The therapy exercises performed without the orthosis are intended to improve mobility and muscle strength.

New options for users

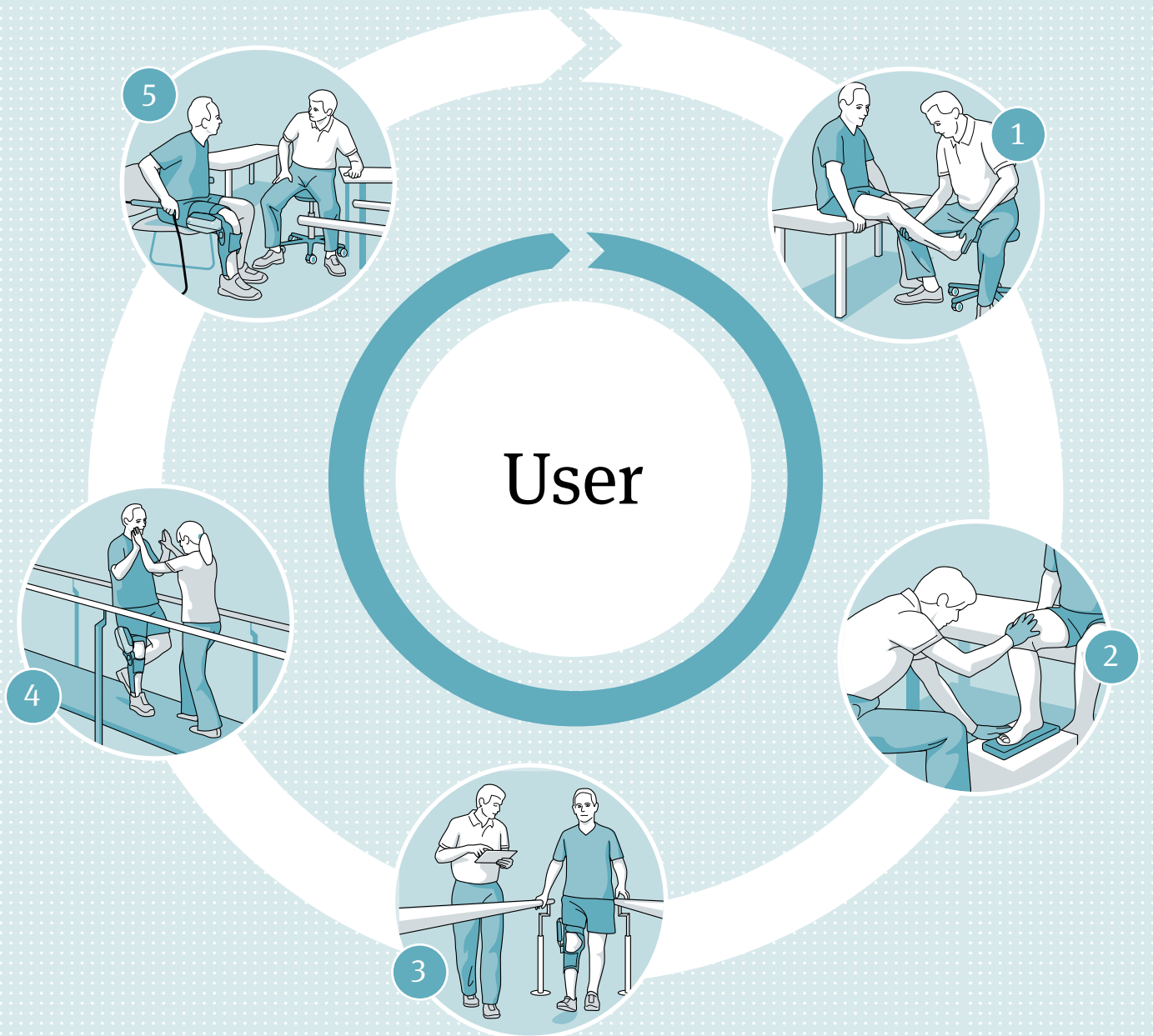
- Flexion under load is now possible for the first time. Including sitting down, descending stairs step-over-step, and walking down ramps.
- Controlled and stable gait characteristics on uneven terrain.
- Individual operating modes can be set by the orthotist and selected by the user according to the situation, e.g. cycling.

Positive results

- During therapy, a natural body posture is developed, which helps reduce excessive unilateral physical strain.
- Users efforts are reduced as compared to a locked orthosis, or SCO.
- Greater sense of security and newfound mobility enhances the users quality of life.
- Strengthening of muscles.
- Reduction of muscular atrophies.
- Increased mobility prevents contractures and joint damage.
- Cardiovascular capacity is retained for everyday activities.

Ultimately, the physiotherapist decides which exercises are best for the user based off their goals and objectives. The difficulty of the exercises can increase regularly, depending on the user's performance level. The exercises in this brochure are merely a training guideline and do not constitute medical advice.

The fitting process



1 Examination and fitting

Before a final recommendation can be made, the O&P professional needs to evaluate whether the C-Brace is suitable for the user. Ottobock provides a diagnostic trial tool to assist with this process and help determine if the user is a C-Brace candidate.

2 Measuring and production

The O&P professional takes the user's measurements, fabricates the plaster negative and positive, and first produces a test orthosis. This is followed by fabrication of the definitive orthosis using prepreg technology or with Orthopox epoxy resin. This process is also offered to O&P professionals through Ottobock's fabrication services.

3 Fitting and adjustment

Then comes the fitting of the definitive C-Brace orthosis. The O&P professional uses the Setup app to configure the system according to the user's needs. You, as the therapist, should be present during the final fitting and accompany the user's first steps.

4 Gait training and rehabilitation

Training with the C-Brace is an important element of the fitting process. The objectives are to teach the user how to use the system in cooperation with a trained therapist, to build confidence in the C-Brace (load transfer), and to practice the functions that are new to the user.

5 Service and clinical follow up

Ottobock recommends service inspections every two years for the C-Brace joint unit, and continuous follow up by the orthotist for settings and fit during the life of the product.



Candidates for C-Brace

The C-Brace should be considered for patients with peripheral or central neurologic conditions that result in weakness or paresis of the quadriceps and/or other knee extensor muscles including, but not limited to, lesions of the femoral nerve, incomplete spinal cord injury, as well as orthopedic conditions that result in uncontrolled knee flexion including but not limited to, failed knee joint replacement, and knee joint derangement that cause pain in which the quadriceps fail to keep the knee extended during stance phase.

Physical prerequisites

Candidates for a C-Brace must also meet the following criteria:

- Must be able to fully stabilize the trunk and to stand when knee flexion is blocked.
- The muscle strength of the hip extensors and flexors must permit the controlled swing-through of the affected leg.
- Patients with insufficient hip flexors and extensors to swing through the affected leg, but have the ability to advance the limb by compensatory trunk movement.

Contraindications

- A flexion contracture of more than 10 degrees in the knee and/or hip joint
- Hip flexor contracture that is not compensated by lumbar lordosis
- Fixed genuvarum/valgum greater than 10 degrees
- Hip extensor and hip flexor degree 0-3 (Exception: compensatory muscle may be used alternatively to advance limb during swing phase)
- Uncontrolled moderate to severe spasticity that interferes with proper functioning of the brace
- Quadriceps spasticity that interferes with loaded knee flexion and prevents reciprocal slope and stair descent
- Hamstring tone during terminal swing resulting in more than normal knee stance flexion
- Leg length discrepancy in excess of 6 inches
- Plantar flexor tone that interferes with rollover and results in early heel-off
- Bilateral patients with less than grade 3 hip flexors and hip abductors, and positive Trendelenburg present during ambulation
- Orthoprosthesis
- Cognitive inability or lack of care provider to charge battery on daily basis
- Cognitive inability to participate in gait training or physical therapy
- Body weight > 275 lbs

Definition of terms

Yielding (flexed knee) step

Microprocessor-controlled hydraulic resistance allows unlimited knee flexion during stance phase when the knee is loaded, by mimicking the eccentric contraction of the quadriceps. This provides assistance when walking on uneven terrain, and allows for reciprocal step-over-step gait for lowering the body down a stair or slope, which considerably reduces stress to the sound limb.

Swing phase initiation

The physiologic swing phase is not influenced by C-Brace. The patient must swing the limb forward. When swing phase is initiated, the microprocessor switches from high stance flexion resistance to low resistance in order to obtain sufficient ground clearance during swing phase. Five criteria have to be met to trigger swing phase initiation:

- Forward tilt of the thigh
- Forward movement of the thigh
- Knee extension
- Extension moment in the knee
- Rollover movement from the heel to the forefoot

Stumble recovery

The microprocessor swing control of the C-Brace has a stumble recovery feature that activates high knee flexion resistance immediately, if there is unexpected extension/ forward movement after heel rise. This allows the patient to fully load the orthosis with his/her body weight and recover from a possible stumble.

Putting on the C-Brace[®]



- Don the C-Brace while sitting with the orthosis joint flexed
- Start with the foot component and lower leg shell
- Close the thigh shell



- Close the lower leg shell and foot component
- Put on the shoe (if it is not on the foot component already)
- Stand up and check all closures

Basic exercises

The goal of the initial exercises with the C-Brace is for the user to achieve optimum balance and a symmetrical transfer of weight. The user has to become familiar with the C-Brace.

Start each exercise between parallel bars. Using the handrail for support at the outset is recommended. The more confidence the user develops in the C-Brace, the less you need to help.



1 Stable standing

The user tries to distribute their body weight evenly on both legs without holding on to anything. In the next step, the weight is shifted from one leg to the other. If the user masters this exercise without problems, you can apply slight and random resistance against the user's body at torso height with your hands.



2 Stable standing with cards

Two paper cards are a simple way of giving the user feedback on whether they are placing adequate weight on their leg with the orthosis. To do so, place a card under both the user's forefeet. If the weight on both legs is equal, the cards cannot be pulled out. If the card under the leg with the orthosis can be pulled out (❗), this is a sign the user is not placing enough weight on the orthosis. The goal of the exercise is to “hold” both cards still while standing by placing equal weight on both feet.



3 Stable standing with dynamic arm movements

If the user can maintain their body position well, practice dynamic arm movements with them: “drumming” rapidly with the forearms (“playing percussion”), dynamic movements with two gymnastics batons, or reactive exercises, e.g. throwing / catching a ball or balloon.

Sitting down and standing up

Select a chair with arm supports. Position it so it will not slide away. Ask the user to distribute their weight evenly on both legs before sitting down.

The configured stance phase flexion resistance brakes knee flexion while sitting down (simulates the eccentric muscular activity of the quadriceps femoris muscle).



1 Sitting down

- Both feet are in line with each other
- Put weight evenly on both legs while sitting down
- Move the upper body forward, the buttocks back toward the back of the chair (“nose toward feet”)
- Move the hands to the arm supports
- The arm supports are for safety, but not intended to hold their full weight



2 Standing up

- Both feet are in line with each other
- Bend the upper body forward and stand up with the support of the arms
- The arm supports are for safety, but the user should not push up to a standing position with the arms only
- If possible, also put weight on the orthosis leg while standing up



3 Adjustment

The O&P professional can individually adapt the stance phase flexion resistance to the user using the Setup app on the tablet



4 Sitting down with cards

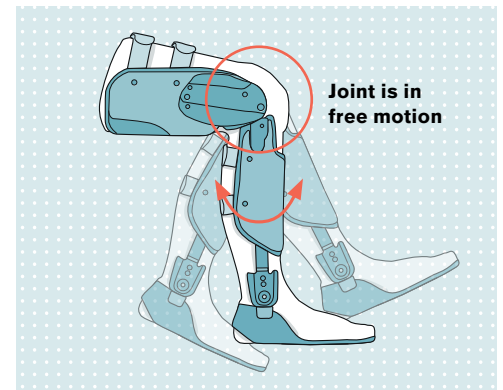
You can also use cards to check proper execution. The user should use the arm supports to help with sitting down at first. Use the cards to check whether equal weight is still being placed on both legs. Weight distribution is optimal if both cards are held securely with the feet while sitting down. If one card (❗) can be pulled out easily, the weight distribution still needs to be adjusted.



5 Sitting function

The sitting function is activated automatically when the thigh is close to horizontal and there is no load on the leg with the orthosis. The resistance in the flexion and extension directions is then reduced to a minimum. The sitting function can be turned off by the O&P professional using the Setup app.

- The lower leg can be moved freely while seated
- The sitting function is also active when sitting with the legs straight



Joint is in free motion

This function can be activated only when the joint unit is in basic mode.

A basic prerequisite is this function was enabled in the Setup app by the O&P professional and activated by the user via the Cockpit app.

Stance phase training

The user has already practiced knee flexion under load while sitting down and has felt the configured stance phase flexion resistance. In situations that normally require the muscle function of the quadriceps femoris muscle, the user will keep using this resistance. To strengthen the user's confidence in the C-Brace, stance phase flexion resistance should be emphasized at the beginning of stance phase training.



1 Building trust

Initially, the user stands in the stepping position while holding onto the parallel bars. The leg with the orthosis is in front. Secure and stabilize the user in the area of the knees and hips.



During the next step, the user puts weight on the C-Brace and pushes the knee forward into knee flexion. The user feels the resistance against knee flexion in doing so.



Important: Knee flexion is not limited. This means the user can fully bend their knee. Therefore, the knee should initially be bent only so it can still be kept stable while standing. Repeat this exercise several times. You can reduce the help provided as the user becomes more confident.



2 Level walking

Once the user is familiar with the basic functions: initiating the swing phase and stance phase flexion resistance, continue practicing and honing their ability to walk on level ground.

Exercise objectives:

- Stride length is appropriate and uniform
- Gait width is appropriate
- The foot, knee, and hip move in the sagittal plane (avoid circumduction and hip-hiking)



3 Stance phase flexion with support from the therapist

Once the motion sequence can be performed smoothly, the user should try to transfer this to walking between parallel bars. You can provide proximal support at the user's pelvis as they do so. Great emphasis should be placed on practicing the forward motion of the body's center of gravity. Also, check whether the user is able to control the movement in view of the muscle status.



4 Stance phase flexion while walking

Once the user is able to complete the motion sequence well, they have to practice alone between parallel bars with the therapist's supervision and gradually reduce the use of the arms.

Stance phase training



5 Exercises for stride length and gait width

If the gait width is too large, have the user walk between two ropes, sticks, or strips of tape on the floor. An appropriate gait width results in a better rollover motion of the foot, which forms one basis for optimal swing phase initiation by the joint unit. Depending on the previous fitting, the user may tend to take a very large step on the orthosis side. The disadvantage here is the body's center of gravity is not shifted over the foot on the orthosis side until very late. The user finds it more difficult to stabilize themselves. If the stride length varies significantly, you can use marks on the floor to provide the user with visual feedback. A metronome or music are also helpful for developing an even walking rhythm.



6 Walking on uneven ground

Once the user feels secure while walking on even surfaces, have them practice walking on uneven ground. The stance phase flexion resistance is highly advantageous for this. The user quickly gains full-surface contact with the sole of the foot, which enables them to better stabilize themselves.

Overcoming small obstacles

Overcoming small obstacles should be trained with the user in order to prepare for the challenges of daily life, such as uneven terrain or curbs. These exercises also promote trust in the orthosis. There are two ways to cross small obstacles: either with swing phase initiation or a yielding step.

Version 1



Version 2



7 Version 1: yielding step (knee flexed)

With the user, practice crossing small obstacles with the help of stance phase flexion resistance:

- Position a flat obstacle (such as a wooden board) between the parallel bars
- Step on the obstacle with the heel, provoking knee flexion
- Cross the obstacle with the orthosis joint flexed

8 Version 2: swing phase initiation (knee straight)

With the user, practice crossing small obstacles with swing phase initiation:

- Position a flat obstacle (such as a wooden board) between the parallel bars
- Step on the obstacle with the heel and leave the orthosis joint extended
- The swing phase is initiated automatically when the user crosses the obstacle

Initiating the swing phase

Five criteria have to be met so the user can initiate the swing phase of the orthosis joint:

- Forward tilt of the thigh
- Forward acceleration of the thigh
- Knee extension
- Extension moment in the knee
- Rollover movement from the heel to the forefoot

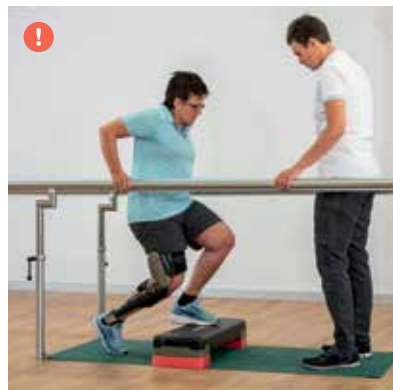


1 Exercise for initiating the swing phase

Start the exercise between parallel bars and make sure the user is using their hands for only minimal support. Then place an exercise ball in front of the user. The leg without the orthosis is in front in the step position. To initiate the swing phase, the user kicks the exercise ball using the leg with the orthosis.

It is important for the user to strike the ball from the front and not the side. The user will expend a great deal of energy at first. However, as time goes by, they should learn to do the exercise with as little effort as possible. Reduce the support you give as much as possible. If the exercise goes well, the user should try to apply what they have learned when walking.

Even users who otherwise walk with circumduction can usually activate the hip flexors well during this exercise. If no other option is available, the user can tilt the pelvis to initiate the flexion movement. If the user has difficulties initiating the swing phase, the reasons can usually be found in the stance phase. Stance phase training can help to improve the swing phase.



2 Consciously initiating the swing phase

In order to prepare the user for everyday situations and become more familiar with the joint unit's functionality, it is important to practice initiating the swing phase consciously between parallel bars. In certain situations, for example when climbing a step with the non-orthosis leg while the leg with the orthosis remains extended, all swing phase initiation criteria are met and the swing phase could be initiated unintentionally.

Balance training

In the training that follows (For example: On a stable or unstable surface, and in motion), the user gains even more confidence while standing. Select the exercises according to dexterity and skill. Make sure the user feels secure. Start each exercise between parallel bars.

Select an unstable surface, such as a rocker board, a wobble board or a soft balance pad. Repeat the previous exercises according to the user's performance.



• Exercises on the balance pad



• Exercises on the MFT Fit Disc



• Exercises on the large balance board

Tapping with a yielding step

The following exercises are geared especially toward improving stability in the stance phase. Place four locations on the floor, and have the patient toe tap each location using a yielding step. In turn, a focused stance improves swing phase initiation and thus promotes a more fluid gait. Begin the training between parallel bars.



Skateboard exercises

Initially, the user stands on a stable surface. The non-orthosis leg now performs the dynamic part of the exercise, first pushing the skateboard forward and back, then to the side. The user has to stabilize the orthosis leg in flexion / extension / abduction / adduction while doing so. To increase the level of difficulty, these exercises can be performed without holding on.



Reducing assistive devices

The goal of training is for the user to become as independent of assistive devices as possible, depending on their physical condition.

- The first training sessions take place between parallel bars
- Practice the four-point and two-point gait in the parallel bars
- Enhancement: walk around the outside of the bars with additional support from a crutch
- Enhancement: four and two-point gait with two crutches
- Enhancement: the same with two canes - this increases the level of difficulty as there is less support from the wrist and forearm; alternatively, use reversed forearm crutches
- Walking with just one cane is also an option - be sure to keep an eye on body symmetry in this case; one-sided loads should be avoided
- Depending on their physical constitution, the user may be able to walk without assistive devices



• Four-point gait



• Two-point gait



• Two-point gait with crutches reversed



• Walking with two canes



• Walking with horizontal cane



• Walking with one cane



• Walking without assistive devices

Intensive gait training

Every user has their own walking speed when it comes to everyday situations: crossing the street, the user should be able to change walking speeds. Start each exercise between parallel bars.

Start by practicing a fluid gait at a comfortable speed. Support the user's rhythm by snapping your fingers, clapping, or using a metronome or music.

During the next exercise, you will change walking speeds. Walk next to the user and ask them to keep pace with you while you speed up

or slow down. You can once again provide support through clapping or other sounds. Enhance the training by changing directions, walking in circles, doing a figure 8, or going around obstacles. Now, combine changes in direction and speed. This improves the user's cadence variation.



• Walking with small steps: the user should take as many steps as possible over a defined walking distance



• Walking in a figure 8

Intensive gait training



► Reactive training

The goal of reaction training (as simulated in the illustration with a rolling ball) is for the user to have sufficient control to safely stop with the orthosis leg when an obstacle suddenly appears. Example: a dog suddenly runs across the sidewalk.

The user walks a given route while the therapist is positioned low to the ground, and rolls a soft ball across the user's path. When the obstacle suddenly appears, the user attempts to slow their stride by a

yielding step with the orthosis leg. For this exercise, it is advisable to learn the motion sequence in advance under the therapist's supervision.

The training becomes more demanding when you perform all of these exercises on a soft, uneven surface: an exercise mat.

Walking backward

When walking backward, the user starts the movement with the non-orthosis leg. Using the handrail is highly recommended at the start of the learning phase. No swing phase is triggered in the joint unit while walking backward since the five initiation criteria are not met (no forward acceleration of the joint while walking backward).



▶ **Walking backward on level ground**



• **Walking backward with yielding step**

The therapist can support the user while learning to walk backward with a yielding step. The therapist can secure the foot of the orthosis leg to the floor using their own foot. This is because the user needs to learn the entire foot has ground contact during the yielding step, and flexion in the orthosis joint can be achieved. Once the user is able to do this well, they should practice the motion sequence alone.



Training on the stepper

User's should practice descending stairs step-by-step to build up the necessary confidence. This training can start between parallel bars or on the stepper.

Basic exercises on the stepper

With the set stance phase flexion resistance, the C-Brace helps the user descend stairs step-over-step by bending the leg with the orthosis. For many users, this can be a completely new experience that has not been possible for years. Because the ankle joint in the orthosis does not permit any or only insufficient dorsiflexion, only the heel should have contact with the step. This ensures fluid rollover when descending the stairs. Apply a strip of tape to the user's shoe to facilitate foot positioning. This provides the user with visual feedback; the foot is positioned so that the tape is lined up with the edge of the step. The marker is especially helpful when training on the stairs later. Once the foot is correctly positioned, the user steps down from the stepper with the non-orthosis leg. To do so, the user has to learn to permit knee flexion of the orthosis joint. Here, the hydraulics of the joint unit (stance phase flexion resistance) fulfill a function similar to the quadriceps femoris muscle by permitting controlled flexion of the orthosis joint under load.

During the motion sequence, make sure

- The user steps down vertically and does not just “fall” forward in the direction of movement
- The user maintains the leg axis: the foot, knee, and hip remain in frontal and transverse plane alignment

At first, you can support foot placement and guide the knee during the movement. However, you should gradually reduce your support. Apply a strip of tape to the floor to help the user with the stride length.





Changing knee flexion resistance

If the user has a great deal of difficulty sinking into the orthosis knee joint at the proper rate, the O&P professional should check the stance phase flexion resistance. If the resistance is too high or too low, this could make the user insecure.

Possible clinical indications that stance phase flexion resistance is set too high:

- The user sinks into the orthosis knee joint poorly; the motion sequence is very slow
- The user demonstrates strong external rotation of the leg when flexing it under load

Possible clinical indications that stance phase flexion resistance is set too low:

- The user sinks into the orthosis joint very quickly
- The user feels insecure and holds on to railing tightly

The therapist and O&P professional must set the stance phase flexion resistance to suit the user's current training condition and phase of training. With an initial fitting, the settings should be checked regularly at the outset.

Training on the stepper

Mistakes

Descending stairs with the C-Brace often requires a lot of practice and trust for the user. They are usually not able to put a load on the leg with the orthosis under flexion because of their experience with their previous KAFO.

The following five mistakes often occur at the outset of training. For all of these mistakes, repeat the exercise with the correct foot position.



- **Foot too far back**
The danger with this is the swing phase may be initiated unintentionally. This is very dangerous on stairs and must be avoided.



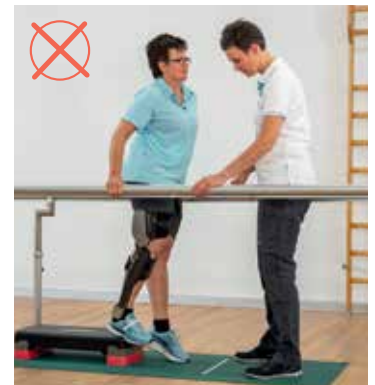
- **Foot too far forward**
When the foot is placed too far forward on the edge of the step, it may slide off the step under load, which results in a risk of falling.



- **“Angling”**
In this example, the user does not have the confidence to put weight on the leg with the orthosis. The user attempts to reach the safety of the floor with the sound leg. Here, the great risk is the swing phase may be initiated unintentionally, since the orthosis joint is in extension.



- **Hip extended**
In this example, the user extends the hip due to fear. The swing phase initiation criteria are met. There is a great risk of initiating the swing phase on the stairs.



- **Falling forward with the entire body**
Due to fear, the user simply lets themselves fall forward. The criteria for the swing phase are met, so a subsequent swing phase could be initiated unintentionally.

Training on the stairs

Progress to training on the stairs. First, repeat the same training steps you performed with the user between parallel bars. Next, increase the number of steps. Then, place special emphasis on maintaining the leg axis, the foot position, the user's safety, and a fluid motion sequence.



• Ascending one step at a time



• Ascending step-over-step

Ascending stairs

There are two ways to ascend stairs with the C-Brace: one step at a time, or step-over-step. Only users who meet certain muscular prerequisites (sufficient knee and / or hip extension) can ascend stairs step-over-step.

Training on the stairs

Descending one step at a time

When descending stairs, the user starts with the contralateral leg. The focus of the exercise is foot placement.

As with the previous exercises on the stepper, a strip of tape serves as useful visual feedback.



• Assistance with the foot position



• Securing at the pelvis and knee



• Support with flexion under load



• Once the user is confident enough on the stairs, descending stairs step-over-step without assistance by the therapist is the final stage and crowning discipline. Note that users always use the handrail for safety reasons when taking the stairs.

Training on the ramp

The user can navigate ramps of various inclination angles with the C-Brace. Stance phase flexion resistance provides support so the user can bend the leg with the orthosis under load. As previously on the stairs, the user has to relearn this motion sequence.



Important: Using the handrail is mandatory for safety reasons.

Ascending a flat and steep ramp

With the C-Brace, the user can ascend a ramp using swing phase initiation. Walking is equivalent to walking on even ground. Depending on how strong the extensor chain in the user's leg is, either long or short steps can be taken with the orthosis leg.

Training on the ramp

Walking techniques for descending

There are two different walking techniques for descending a flat ramp: With version 1, the user initiates a normal swing phase in the orthosis joint similar to walking on level ground.

With version 2, the user has to flex the orthosis joint under load.

Always check:

- The leg axis is maintained
- The trunk is upright
- The line of vision is to the front
- Walking step-over-step

Users can navigate steep ramps only using stance phase flexion resistance (version 2). Train with various walking speeds: small steps at a lower speed and larger steps at a higher speed.



• Descending a flat ramp

It is important for the user to practice both walking techniques on the flat ramp. Descending with swing phase initiation usually occurs automatically (version 1). Descending with the yielding step (version 2) is more difficult and takes practice. In this picture, the user is practicing the yielding step.



- Various kinds of support help the user gain confidence when descending.



- When carrying the exercise ball, the user does not see their feet. That makes walking more difficult, and the user learns to fully trust the orthosis.

Descending a steep ramp

Safely descending a steep ramp is possible only with the help of a yielding step. That means consciously sinking into stance phase flexion resistance during the stance phase.

Support from the physiotherapist for safety is very important on the steep ramp at the outset. As on the stairs, users were not able to descend a ramp step-over-step with their previous orthosis and have to relearn the motion sequence.



Important: Using the handrail is mandatory for safety reasons.

• One of the therapist's hands is positioned on the user's pelvis. The other hand secures and controls the flexion of the orthosis joint on the lower leg orthosis shell.

• **Gradually reducing support**
Once the user has attained sufficient confidence, the support can be gradually reduced. The goal is for the user to descend the ramp independently.

Stance function

The stance function is a functional supplement to the basic mode. This makes it easier for the user to stand for a longer time. The joint can be blocked at a flexion angle between 5° and 65°.

- If the stance function is not enabled by the O&P professional in the Setup app, users cannot activate or deactivate it independently using the Cockpit app
- This function can be executed only when the joint unit is in basic mode
- It is not activated in the sitting position

There are two different stance functions: intuitive and manual.

Intuitive stance function on level ground

To activate intuitive stance, the user has to let the orthosis joint come to rest in the flexed position (between 5° and 65°). Then, the C-Brace is blocked in the flexion direction. As soon as the user moves the orthosis joint again, the resistance immediately decreases gradually to

the stance phase flexion resistance setting and the stance function is terminated. The joint unit activates or deactivates the stance function automatically.

Intuitive stance on the ramp

When the user stops on a steep ramp, the orthosis joint comes to a halt. The orthosis joint is slightly flexed and intuitive stance is activated automatically. The user can put weight on the orthosis side, providing relief for the non-orthosis leg.





- Version 1**
 Taking a step with the orthosis leg immediately deactivates the stance function.



- Version 2**
 By taking a step with the contralateral leg, stance phase flexion resistance is automatically used so a controlled yielding step forward can be taken.

Deactivating the stance function

There are two ways to deactivate the stance function. Practicing both versions with the user is highly recommended for safety reasons.



Mistakes

For a fluid motion sequence during the rollover movement, the user should avoid active hip and knee extension. The five swing phase initiation criteria may be met and a swing phase could be initiated. This bears a considerable safety risk and should be avoided.

Stance function

Manual stance function on level ground

Activating the manual stance function requires the same procedure as for intuitive stance. Allow the leg with the orthosis to come to rest between 5° and 65° of flexion. However, the manual stance function is automatically deactivated only through extension in the orthosis joint or by repositioning the leg (e.g. taking a step).

Manual stance function on stairs

With this execution, the user is able to deactivate manual stance correctly. Since the user starts with the orthosis leg (repositioning the leg), the manual stance function is deactivated automatically and stairs can be descended safely.





Mistakes

In this incorrectly executed and dangerous example, the user attempts to deactivate the manual stance function by taking a yielding step.

Important: Please practice consciously with the user! To deactivate manual stance, the orthosis joint has to be extended or the entire leg must be repositioned.

Ground transfer



Kneeling

Kneeling with the C-Brace is no problem. To do so, the user positions themselves in the step position with the orthosis leg in front. Using the resistance, the user goes into the half kneeling stance. Using two chairs is recommended to learn this motion sequence.

Standing-to-ground transfer

The series of images shows one way to get from standing to the floor and back with the C-Brace, and the leg extended using the help of a chair. This sequence can be adapted individually by the therapist or user.



The next series of photos shows a way to get from a standing position to the floor and back with the C-Brace without using assistive devices. This sequence can be individually adapted, as for the standing-to-floor transfer with the leg extended and a chair.



• The sitting function is activated when sitting with the legs extended.

MyModes

Basic mode

Basic mode is intended for daily use. The parameters configured by the O&P professional describe the dynamic and safe behavior of the C-Brace in the gait cycle. These parameters act as basic settings for automatically adjusting the resistance behavior to the current motion situation (e.g. walking on level ground, ramps, slow walking speed). The stance function and / or the sitting function can also be activated / deactivated.

Training mode

In training mode, the joint is flexion blocking in the stance phase and no yielding stance phase flexion is possible. Swing phase initiation is possible in basic mode. In this mode, stairs or ramps can be descended only one step at a time for unilateral users when active. Bilateral users cannot go down the stairs when in training mode.

- 1) Open the Cockpit app and select training mode. A confirmation signal sounds to indicate the switch to training mode.
- 2) The joint unit is flexion blocking in the stance phase, and the leg with the orthosis can swing forward freely in the swing phase.

The support of stance phase flexion resistance for sitting down is not possible in this mode.



• Activating training mode using the Cockpit app



• Joint unit locked in the stance phase

Freeze position

In this mode, C-Brace users can freeze the joint unit in any position, which means locking the joint unit completely. Then, it cannot be moved in either flexion or extension direction.

This may be used for gardening, yoga, or strength training, as shown in this example. It is very easy to activate. Place the C-Brace in the desired position, then click the “Freeze position” menu item, confirm, and start training.

After completing the exercise, unfreeze the position with two clicks. To do so, switch to basic mode and click for final confirmation.



MyModes

User defined

This mode is intended for specific motion patterns or postures (such as bowling or cycling). The O&P professional can configure this MyMode individually using the Setup app on the tablet. Users can make minor changes directly using the Cockpit app.

With the Setup app, the O&P professional can change the “Flexion resistance increase” and “Basic flexion resistance” in the 4th MyMode “User defined.” This user defined MyMode blocks knee flexion at the desired angle, but allows passive knee extension to occur.



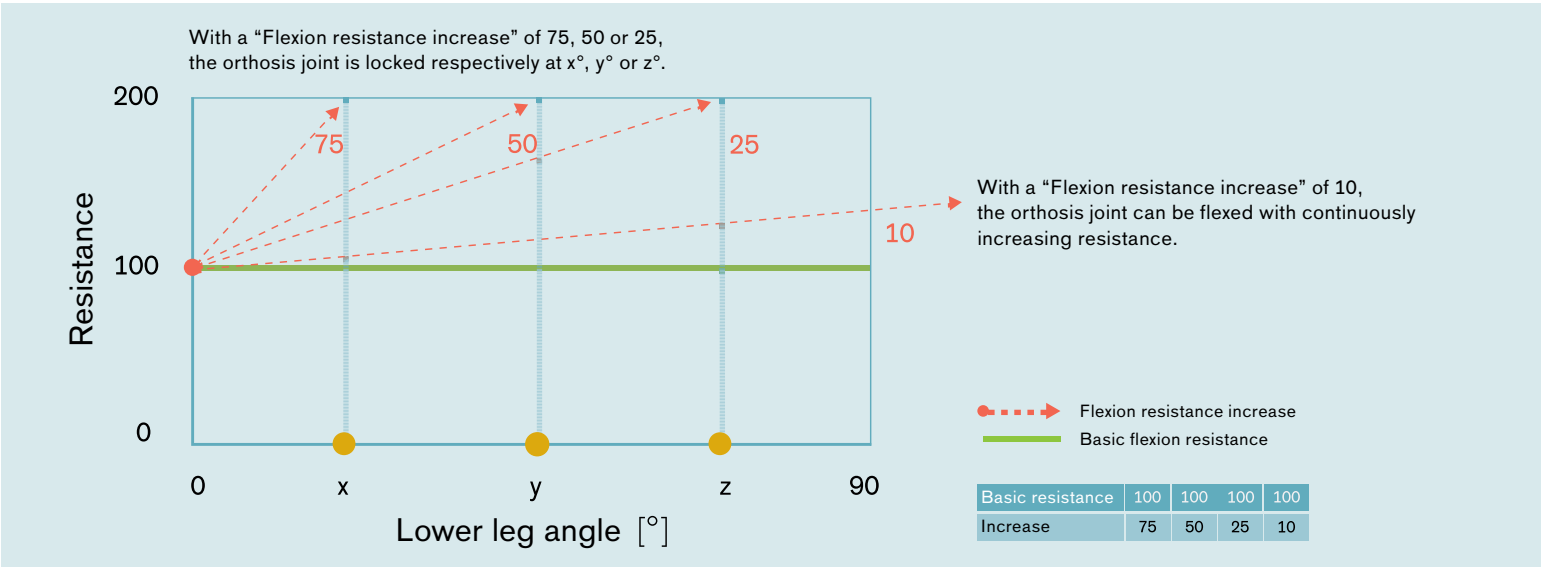
“Basic flexion resistance” parameter

This parameter is used to set the basic resistance at the start of flexing the orthosis joint. The higher the value, the greater the resistance against flexion.



“Flexion resistance increase” parameter

This parameter is used to set the increase in the flexion resistance (starting from the parameter “Basic flexion resistance”) while flexing the orthosis joint. The flexion resistance increases continuously along with the flexion angle until the orthosis joint no longer can flex beyond the chosen flexion angle. Thus, the flexion angle at which the orthosis joint stops flexing depends on the settings for the parameters “Basic flexion resistance” and “Flexion resistance increase.”





• **Example: bowling**

For bowling, the recommended configuration of the “Basic flexion resistance” and “Flexion resistance increase” is so the flexion resistance increases continuously with increasing knee flexion, until the orthosis joint blocks flexion at the desired flexion angle.



• **Example: ergometer**

In this example of the 4th MyMode for training on the ergometer, both the “Basic flexion resistance” and “Flexion resistance increase” are zero.

i Important: Directly before getting off, basic mode should be activated using the Cockpit app.

Outdoors

Training should be moved outdoors as soon as possible. Design the training according to the work and family situation, and the user's recreational activities. Initially, use the same assistive devices during outdoor training as you did indoors. If the user requires only balance support, walking poles are a good option.

The goal is for the user to move about safely both indoors and outdoors. Everyday life offers many challenges that have a different effect on training compared to indoors. Outdoor training offers a very good indication of whether the orthosis settings are appropriate for the user.

Practice

- Walking on different surfaces
- Changes in direction
- Changing walking speed
- Overcoming obstacles
- Walking on slopes of varying inclines
- Walking up and down stairs



• Ascending a ramp



• Descending a ramp



• Walking down a steep hill on uneven terrain



• Taking a walk on a gravel path while engaged in conversation



• Wooden bridge

Activities of daily living

After successful training, activities of daily living should no longer be an obstacle for the user. Whether moving about within the office, taking a leisurely walk, or attending an after-work event, the C-Brace supports the user in all life situations.



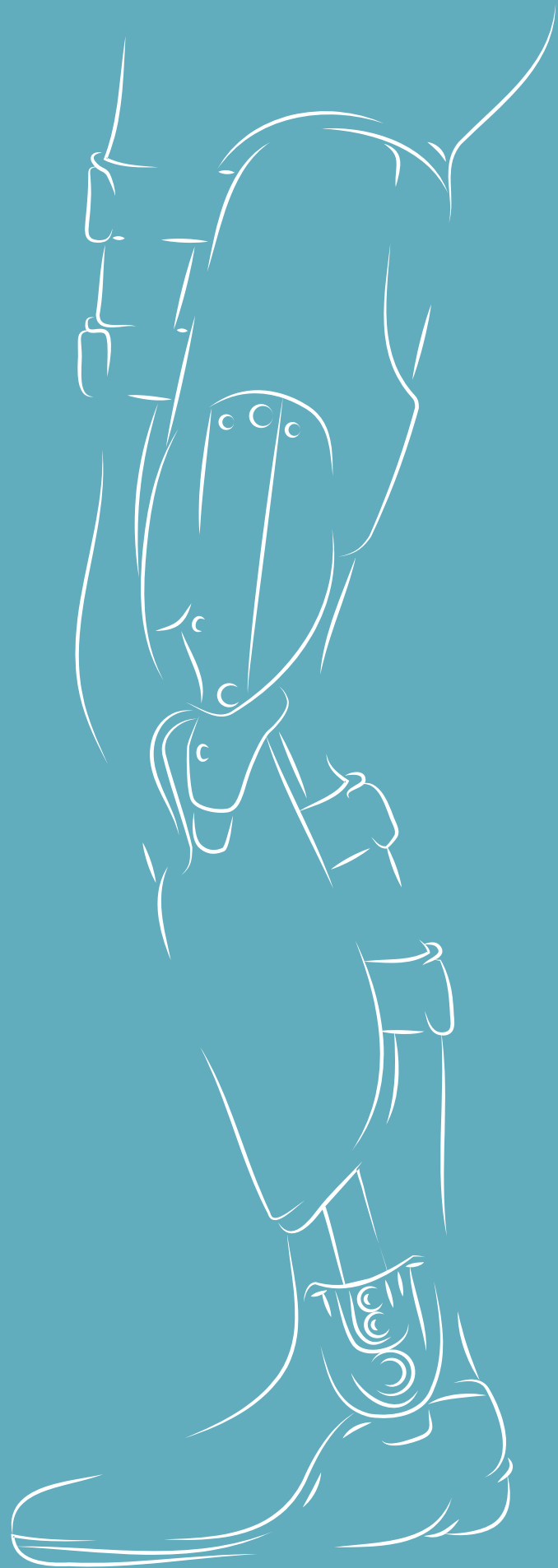
• Opening a door by stepping back



• Talking on the telephone while taking a walk on a gravel path



• Intuitive use of the stance function in conversation at a high top table



Notes

A series of horizontal dotted lines for writing notes.

Notes

A series of horizontal dotted lines for writing notes.

Please contact us if you have any further questions or would like more information.