

# Quick Guide #3 C-Leg<sup>®</sup> Patient Training Overview

*Use this guide as a checklist to ensure that all aspects of using the C-Leg have been reviewed with the patient before delivery of the C-Leg. Please remember to give the "Patient Information Sheet" to the patient.*

## **A: Charging the C-Leg**

### **1. Basic Charging Every Night**

Plug the charger into the wall. Connect the charger to the C-Leg. The C-Leg will vibrate. When charging has completed, the yellow light will turn off. Unplug the C-Leg and it will beep. The C-Leg is ready for daily use.

## **B: Training for the Gait Functions of the C-Leg**

### **1. Disengagement of Stance Flexion Resistance**

When statically adjusting the Maximum Toe Load feature, have the amputee flex the knee when they have full weight on the forefoot and the knee is in full extension. This will show the amputee the condition that must be met for stance to disengage in the C-Leg. Next, have the amputee stand with their feet side by side (and then repeat with the prosthetic foot out in front), have the patient try to flex the knee easily. Since it won't flex easily, the patient will start to realize the only conditions for stance disengagement.

### **2. Stumble Recovery**

While statically adjusting the Stance Flexion Damping feature, in the parallel bars, have the patient put the prosthetic foot in front and test the resistance of the knee by flexing the knee. The knee should have a slow enough yield so that the patients will have enough time to catch themselves in case of a stumble. Testing this feature in this manner can build confidence in the reliability of the Stance Flexion Damping feature.

### **3. Stance Flexion**

Stance Flexion is the flexing of the knee at Loading Response that occurs during normal gait. This motion helps to absorb shock and keeps the body's center of gravity on a more natural sinusoidal pathway. The Microprocessor Stance Control of the C-Leg allows Stance Flexion to occur. For many experienced amputees, Stance Flexion may not be a comfortable feeling. This stems from the fact that with most prosthetic knees, if the knee bends at Loading Response, a fall is almost always imminent. Therefore, trust in the reliability of the Stance Flexion

Damping feature of the C-Leg must be built-up over time. For many amputees this only comes with use of the C-Leg in many different situations. In many instances, Stance Flexion should only be introduced to the amputee after they have been using the C-Leg for some time.

Alignment is critical to achieving proper Stance Flexion. If the alignment is too stable, Stance Flexion will not occur. Shifting the knee axis further anterior or dorsiflexing the foot may help to create a less stable alignment. A less stable alignment has the added benefit of making it easier to initiate Swing Phase.

Foot selection is another important component of Stance Flexion. The softer the heel of a prosthetic foot (shorter heel lever), the less the tendency is towards Stance Flexion. A firmer heel of the prosthetic foot (longer heel lever arm) will encourage Stance Flexion. For example, the 1C40 foot has a very long heel lever to encourage Stance Flexion. A longer heel lever is also useful to preserve momentum early in the gait cycle, as the amputee does not "sit back" on the heel of the foot.



#### 4. Swing Phase Initiation

Because of the flexion resistance to either initiating or proceeding through Pre Swing that is inherent in many other prosthetic knee designs, many amputees may show poor gait habits through this part of the gait cycle.

a. Un-weighting the Prosthesis

This deviation is especially seen in patients that have become used to a weight activated brake. If this habit persists, Stance Phase disengagement with the C-Leg will be inconsistent since 70% of Maximum Toe Load may not be achieved with every step. Train the patient in the parallel bars by cueing the pelvis to rotate as the hip joint flexes to initiate knee flexion rather than lifting the leg to initiate knee flexion.

b. Excessive Force Used by the Hip Flexors During Pre Swing

Patients who are accustomed to a high flexion resistance will be in the habit of forcefully flexing the hip during Pre Swing. Because the C-Leg can have minimal resistance during Pre Swing, such forceful action is unnecessary and consumes more energy. Train the patient in the parallel bars by having them practice flexing the knee. Change the Initial Swing Flexion Damping from low (20) to high (50) settings so that the patient will feel the difference. Remind the patient that the lower setting is preferred, as it will consume the least amount of energy. Have the patient try to reduce the force of hip flexion as they practice proper hip rotation and easy hip flexion.

#### 5. Swing Phase Limb Activity

Many amputees will use forceful hip flexion during swing to ensure that the knee comes into full extension at Terminal Swing. This habit is a consequence of having the knee buckle when loading has been initiated on a flexed knee. The patient should be reminded that the C-Leg re-engages Stance Flexion Damping the instant the knee stops flexing at the end of Initial Swing. This means that Stance Flexion Damping will be available even if the foot catches during swing phase and the knee does not come into full extension at Initial Contact.

#### 6. Stance Phase Activities

There are two main training tools for Stance Phase Control: Stair Descent and Declines

a. Stair Descent Step Over Step

Stair descent is an excellent exercise to return the patient to a “normal” function and to build confidence in the reliability of the Stance Phase resistance of the C-Leg. Posture and foot placement are important points to emphasize with the C-Leg. The patient should maintain good upright posture so that the “nose is not out over the toes”. This will allow the patient to “ride” the C-Leg down to the next stair. Foot placement is the other important factor for stair descent training. The forefoot must be off the front of the stair to prevent disengagement of Stance Flexion Damping. Consistent foot placement takes practice until it is achieved. Remind your patient to use a handrail when descending stairs.

There will be patients who have not descended stairs foot over foot with a prosthesis. Often times these patients will request a higher level of Stance Flexion Damping to feel secure at first. Once they become accustomed to stair descent, they will usually request a lower setting.

Other patients will be using their prosthesis to “jack-knife” down the stairs. These patients will often request a lower Stance Flexion Damping with the C-Leg because it is much slower than the “free-fall” they experience with their current prosthesis. Remind the patient that “jack-knifing” down the stairs creates a lot of force on the joints of the lower limb and these forces could have a detrimental long-term cumulative effect.

Encourage the patient instead to “ride” the stance of the C-Leg to a low impact landing on the stair.

b. Declines

Declines such as ramps and hills are difficult for the transfemoral amputee because of the large flexion moment at Loading Response that they entail. With the C-Leg, the transfemoral amputee is able to descend the hill by “riding” the flexed knee down to the next Stance Phase. The patient must learn to let the knee flex early in Stance and then step across with the sound

limb. Pulling back on the prosthesis will create a “snowballing” effect, as the patients have to descend quickly to catch themselves. Start with a ramp that has a handrail so that the amputee can learn to put weight on the flexed knee as they descend down the decline. Remind your patient to use a handrail (when available) when descending ramps.



## 7. Walking Backwards

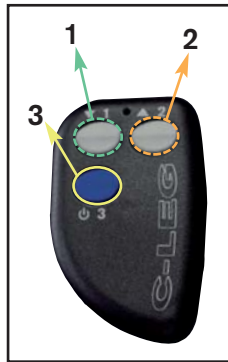
It is important to instruct your patient how to properly walk backwards. If the patient puts the prosthesis behind them and weights the toe, they could release Stance Flexion Damping. It is recommended instead to have the patient step back with the sound limb to avoid loading the toe of the prosthesis.

## 8. Using the Remote

Each C-Leg (metallic graphite color) comes with a remote that the C-Leg user can utilize to unlock further functions of the knee. These functions are:

- **Switching between 1st and 2nd Mode**
- **Enable and disable Standing Mode**
- **Change swing phase dynamics**

Communication between the C-Leg and the remote must be established before any of the functions can be activated. Communication is established by holding down the '3' key until the C-Leg vibrates. Communication between the C-Leg and remote will end after a short period of time in order to save battery power.



### Switching between 1st and 2nd Mode-

After communication has been established, hold down the '2' button until the C-Leg beeps twice to signal that the knee is in 2nd Mode. To change back to 1st Mode, communication must be established by holding down the '3' button and then the '1' button is held down until the knee beeps once to signify that the knee is in 1st Mode.

### Enable and disable Standing Mode-

Standing Mode allows the C-Leg user to lock the knee against flexion at an angle between 7 and 70 degrees of knee flexion.

Standing Mode must be enabled using the remote before the user can utilize this feature. Once Standing Mode has been enabled in the C-Leg it will stay enabled until it is disabled via the remote. After establishing communication with the C-Leg by holding down the '3' button, Standing Mode is enabled by holding down the '1' and '2' buttons until the C-Leg beeps three times and is disabled by holding down the '1' and '2' buttons until the C-Leg beeps one time. In addition, the knee must be in full flexion in order to enable or disable Standing Mode.

Once Standing Mode has been enabled through the remote, the C-Leg user will activate this function in the following manner:

Flex and hold the knee for 1 second. The knee must be flexed between 7 and 70 degrees and it is best to flex the knee just past the desired 'locked' angle. After holding the knee for 1 second, slightly extend the knee to the desired angle of knee flexion and hold the knee for .8 seconds. The C-Leg will vibrate and the flexion valve will close to block flexion of the knee.

To deactivate Standing Mode, the C-Leg user can either extend the knee quickly or extend the knee within 7 degrees of full extension.

### Change swing phase dynamics -

The final remote function is the ability to change the swing phase dynamics. The remote allows the C-Leg user to make changes to the swing flexion resistances set by the prosthetist. There are three possible settings that the remote can toggle through:

- **Standard** - This is the swing flexion settings programmed by the prosthetist.
- **Comfort** - This lowers the dynamic factor by one and increases the knee angle threshold by 5 from the Standard setting.
- **Dynamic** - This increases the dynamic factor by one and lowers the knee angle threshold by 5 from the standard setting.

The C-Leg user can toggle between these three settings using the remote. After activating communication with the C-Leg, holding down a combination of the '1' and '3' buttons will go to a lower swing phase adjustment and holding down a combination of the '2' and '3' buttons will go to a higher swing phase adjustment. The following beeps will sound when the changes have been made:

- Comfort (lowest) - 1 beep
- Standard (medium) - 2 beeps
- Dynamic (high) - 3 beeps

## C. Alerts to the User and Safe Mode

It is important to instruct the patient regarding the various alerts that the C-Leg system uses to inform the user about the current state of the C-Leg.

### 1. Safe Mode

When the battery is discharged or the C-Leg detects a malfunction in the system, the C-Leg goes into Safe Mode. When the C-Leg goes into Safe Mode the flexion valve goes to a high flexion resistance (the current adjustment for Stance Flexion



Damping) and stays in that position. In Safe Mode the C-Leg is very stable, but is still able to bend for sitting. Stance Flexion Damping does not disengage when the C-Leg is in Safe Mode.

## 2. Vibrations

### a. Battery Discharge

A series of vibrations are used by the C-Leg to inform the user of the current charge state of the battery in the C-Leg. The first warning is three short vibrations that occur approximately one hour from the battery going dead. The next warning is about one half hour later and is five longer vibrations. The final warning occurs as the C-Leg goes into Safe Mode and consists of 10 long vibrations.

### b. Hydraulic Cylinder Temperature

When the hydraulic cylinder of the C-Leg reaches 80 degrees Celsius (176 degrees Fahrenheit), the C-Leg will give a pulse vibration and will continue to do so until the hydraulic unit cools 10 degrees Celsius.

## 3. Beeps and Vibrations

There are three instances when there will be both beeps and vibrations in the C-Leg:

### a. Malfunctions

The C-Leg will beep and vibrate when there is a malfunction in the system and will attempt to go into Safe Mode. The C-Leg should be sent into Otto Bock for service if the warning beeps and vibrations occur. It is important to remind your patient that if they are walking and the C-Leg begins to beep and vibrate, they must stop and test to make sure that Safe Mode has engaged.

### b. Programming

Beeps and vibrations will occur in the C-Leg when initially logging into the Sliders program via the PC and also when program changes are being made to the C-Leg.

### c. Engaging and Disengaging 2nd Mode

When entering and leaving 2nd Mode there will be a sequence of beeps and vibrations that occur.

Remind your patient that plugging the C-Leg into the charger will automatically reset the C-Leg to 1st Mode.

## D. Basic Care of the C-Leg

There is no maintenance necessary by the patient when it comes to the C-Leg. However, there are certain guidelines that your patient should follow to ensure proper functioning of the C-Leg.

## 1. Storing the C-Leg

The C-leg should be stored with the hydraulic unit in a vertical position when charging or the prosthesis is not in use.

## 2. Avoid Exposure to Water and Other Fluids

Use of the “red plugs” will certainly help to prevent water damage to the C-Leg and it is important to remind your patient that the “red plugs” must always be in place in the C-Leg. However, it is vital to remind your patient that exposure to water always carries the risk of damaging the C-Leg and creating a malfunction. If the C-Leg is exposed to water or other fluid, have the patient dry the leg immediately and bring the prosthesis in so that it can be sent to Otto Bock for service. Exposure to water voids the warranty.

## 3. Avoid Strong Magnetic and Electrical Interference Sources

Since the C-Leg utilizes a magnetic sensor in the knee to read knee angle, large magnetic interference sources can cause false readings to occur. Strong magnetic or electrical interference sources could also possibly cause damage to the C-Leg and should be avoided. However, we have had no reports of damage to the C-Leg due to airport metal detectors.

