

Physical Examination for MS Patients

Multiple sclerosis is a disease with a progression that is individual and difficult to predict. Therefore, certain aspects must be considered in the orthotic treatment of MS patients in order to achieve the best possible treatment result for the patient. An important factor in the physical exam is the consideration of muscular fatigue. In this online tutorial, you will first collect the patient data including the muscle strength without taking muscular fatigue into account. The muscle strength is assessed again after the state of fatigue has been reached.

In the [Orthotic Treatment Sheet for MS Patients](#), you can record the data collected during this physical exam.

In our [MS Guide](#), you will also find a concept for the physical exam and orthotic treatment of patients with multiple sclerosis.

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Gesellschaft für Entwicklung und Vertrieb
von orthopädietechnischen Systemen mbH

Dorette-von-Stern-Straße 5
21337 Lüneburg

☎ +49 4131 24445-0
☎ +49 4131 24445-57

✉ info@fior-gentz.de
🌐 www.fior-gentz.de



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Gesellschaft für Entwicklung und Vertrieb
von orthopädietechnischen Systemen mbH

Dorette-von-Stern-Straße 5
21337 Lüneburg

☎ +49 4131 24445-0
☎ +49 4131 24445-57

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Body Weight

Determine the body weight. Foreseeable changes, like a weight gain due to growth, should be taken into consideration.

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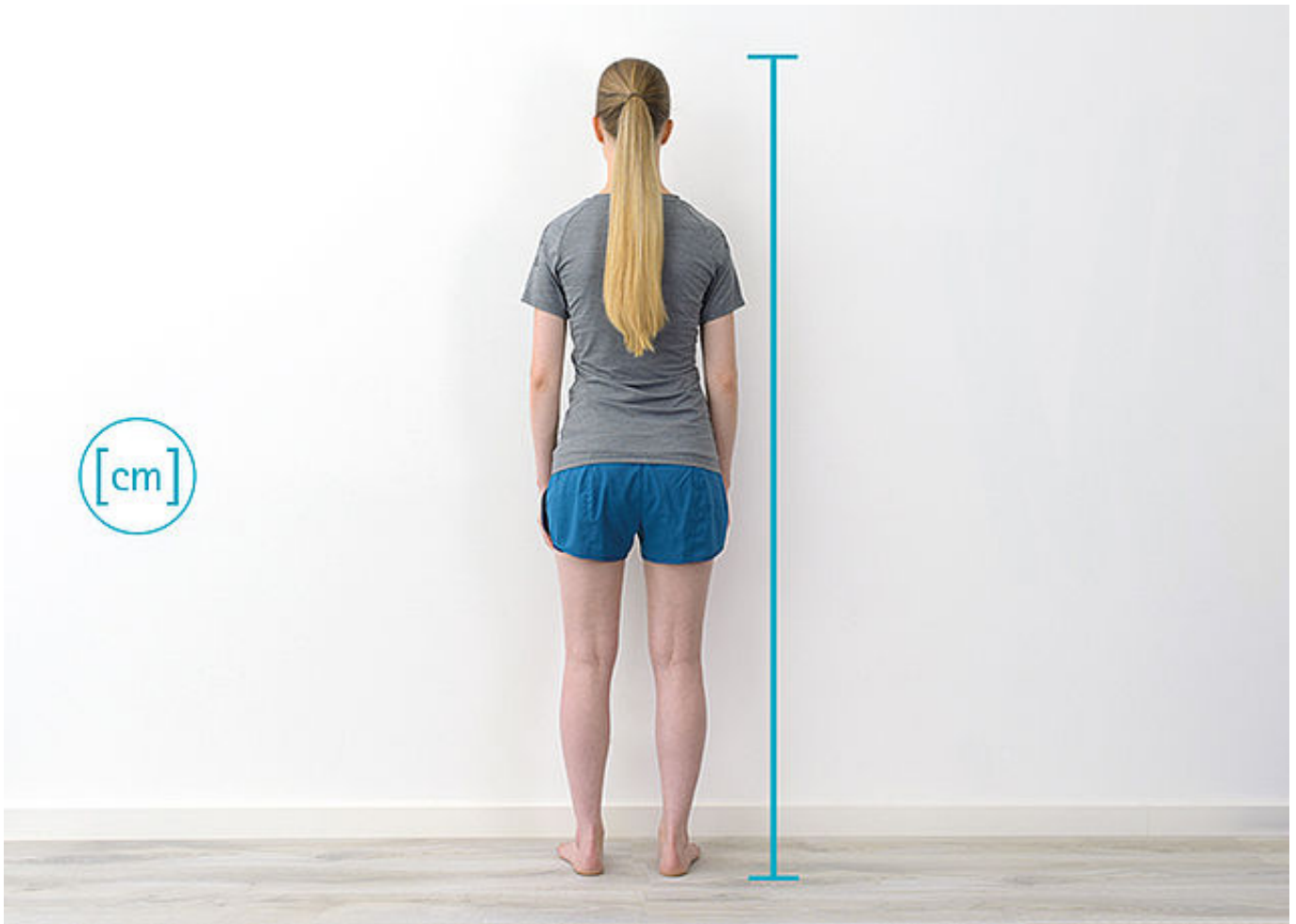
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von orthopädietechnischen Systemen mbH

Dorette-von-Stern-Straße 5
21337 Lüneburg

☎ +49 4131 24445-0
☎ +49 4131 24445-57

✉ info@fior-gentz.de
🌐 www.fior-gentz.de

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Body Height

Determine the body height. Foreseeable changes, like a change in height due to growth, should be taken into consideration.

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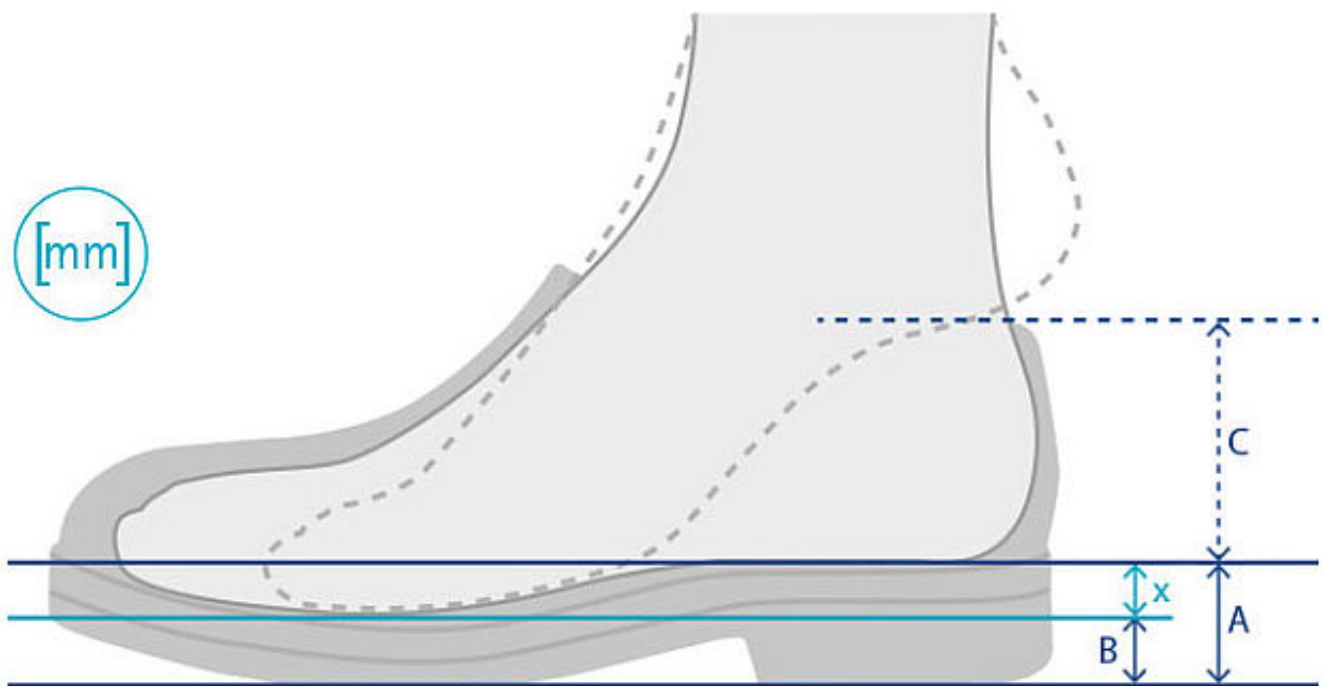
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Dorette-von-Stern-Straße 5
21337 Lüneburg

☎ +49 4131 24445-0
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✉ info@fior-gentz.de
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Pitch and Height Compensation

Determine the pitch x of the shoe (difference between heel height A and sole thickness B in the ball area). Measure A and B and apply the formula $x = A - B$. Transfer the determined pitch to the h-Cast.



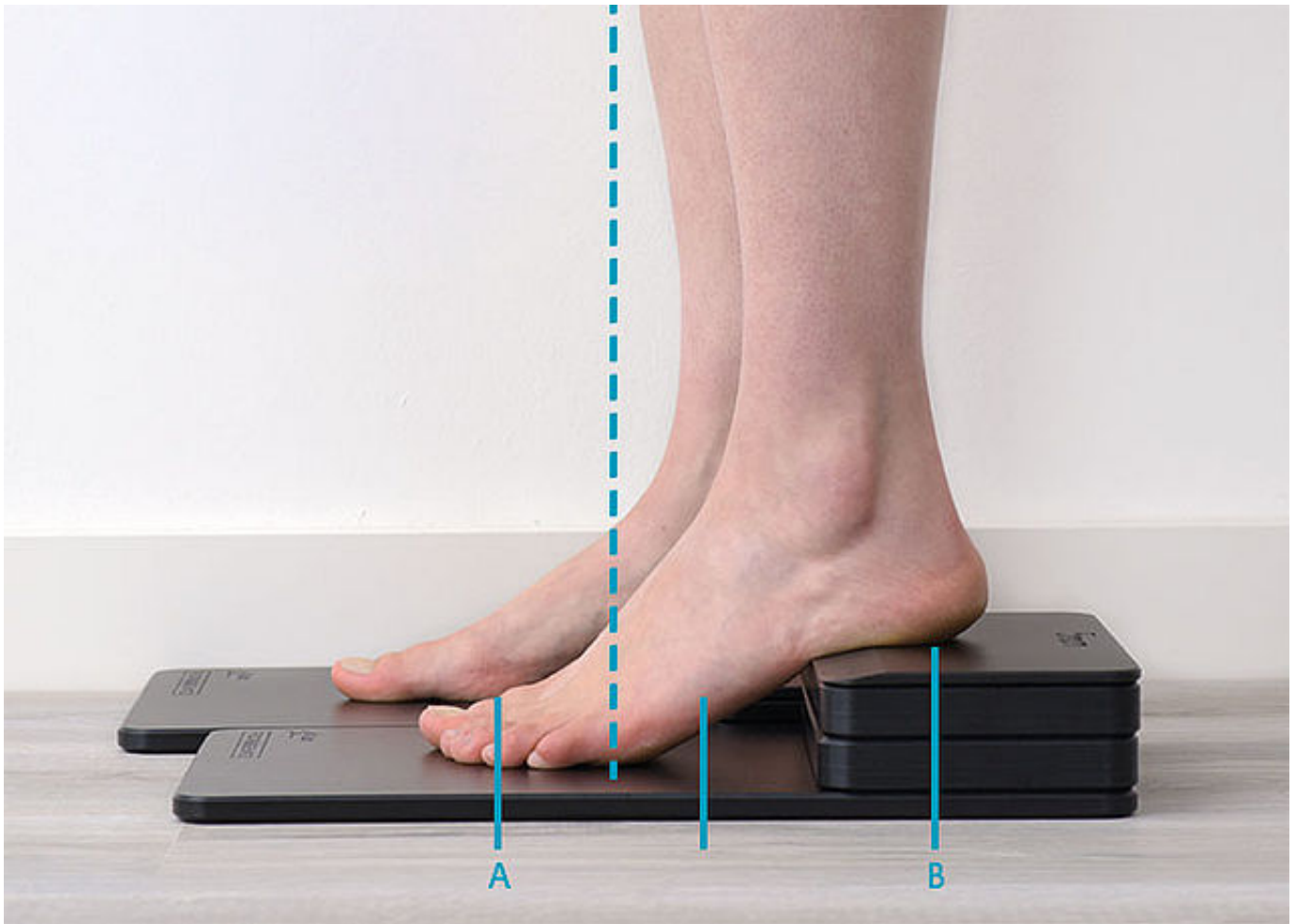
Leg Length/Height Compensation

The patient is standing on the h-Cast. Check whether the patient is in a vertical position, for example by using a plumb laser. The plumb bob should fall from the 7th cervical vertebra (C7) through the cleft between the buttocks and the middle of the supportive area of both feet. If this is not the case, the patient needs a height compensation (for example due to a unilateral contracture). Determine the height compensation (see C at step 1) and transfer it to the h-Cast. Check the result.



Shoe Size

Determine the shoe size (S1). If the feet differ in length, write down the larger shoe size.



Length Difference

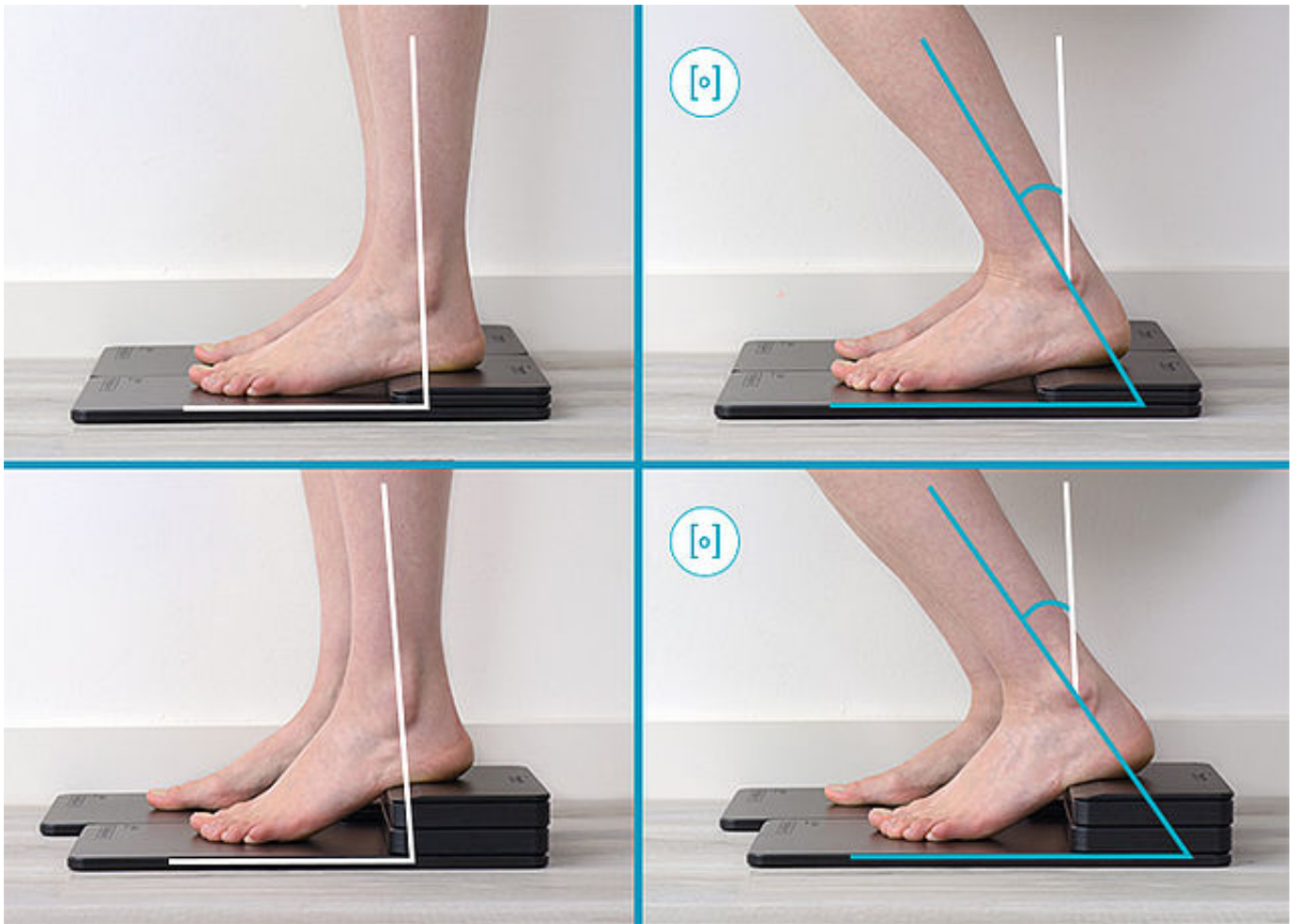
Have the patient stand on two h-Casts. Ensure the correct position of the plumb bob. It should fall posteriorly from the 7th cervical vertebrae C7 through the rima ani to the middle of the supportive area of both feet and on the sagittal plane, from the ear through the greater trochanter to the front half between the functional rolling-off line A and the heel lever B.



Length Difference

Determine the length difference L. To do so, measure S1 and S2 and apply the formula $L = S1 - S2$. Write down the length difference L in order to be able to compensate the difference during the following steps.

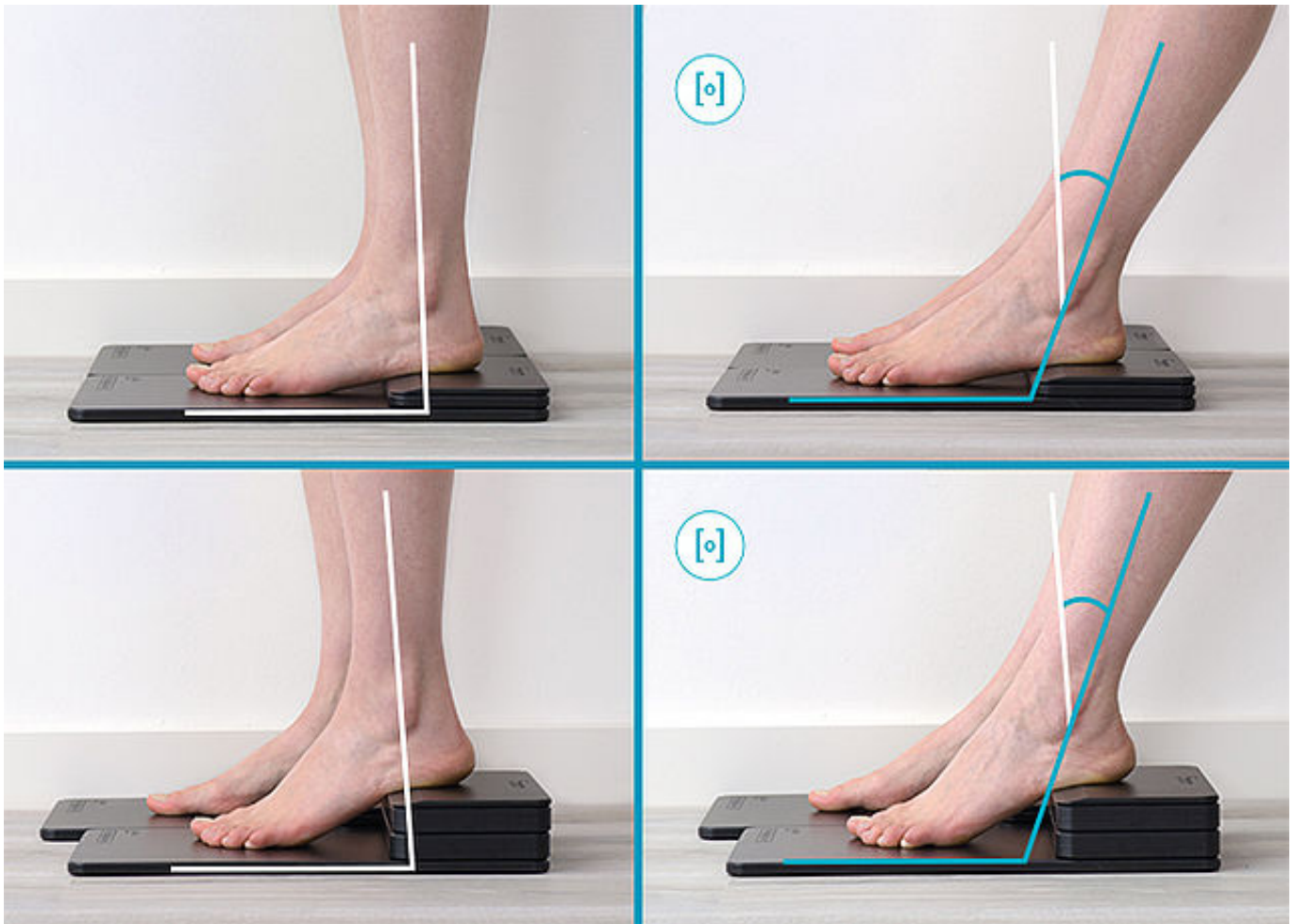
Important: For a symmetrical stride length, the leverage ratio should be the same on both sides. To achieve that, the rolling-off line's position and the heel lever must be adjusted if there is a functional shortening (e.g. due to a height compensation).



Range of Motion in the Upper Ankle Joint in Dorsiflexion

The range of motion in the upper ankle joint is measured based on the individual normal posture. Position the patient on the h-Cast, while considering the leg length/height compensation and the shoe's pitch.

Measure the range of motion in the upper ankle joint in dorsiflexion based on the individual normal posture.



Range of Motion in the Upper Ankle Joint in Plantar Flexion

The range of motion in the upper ankle joint is measured based on the individual normal posture.

Position the patient on the h-Cast, while considering the leg length/height compensation and the shoe's pitch.

Measure the range of motion in the upper ankle joint in plantar flexion based on the individual normal posture.

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Dorette-von-Stern-Straße 5
21337 Lüneburg

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☎ +49 4131 24445-57

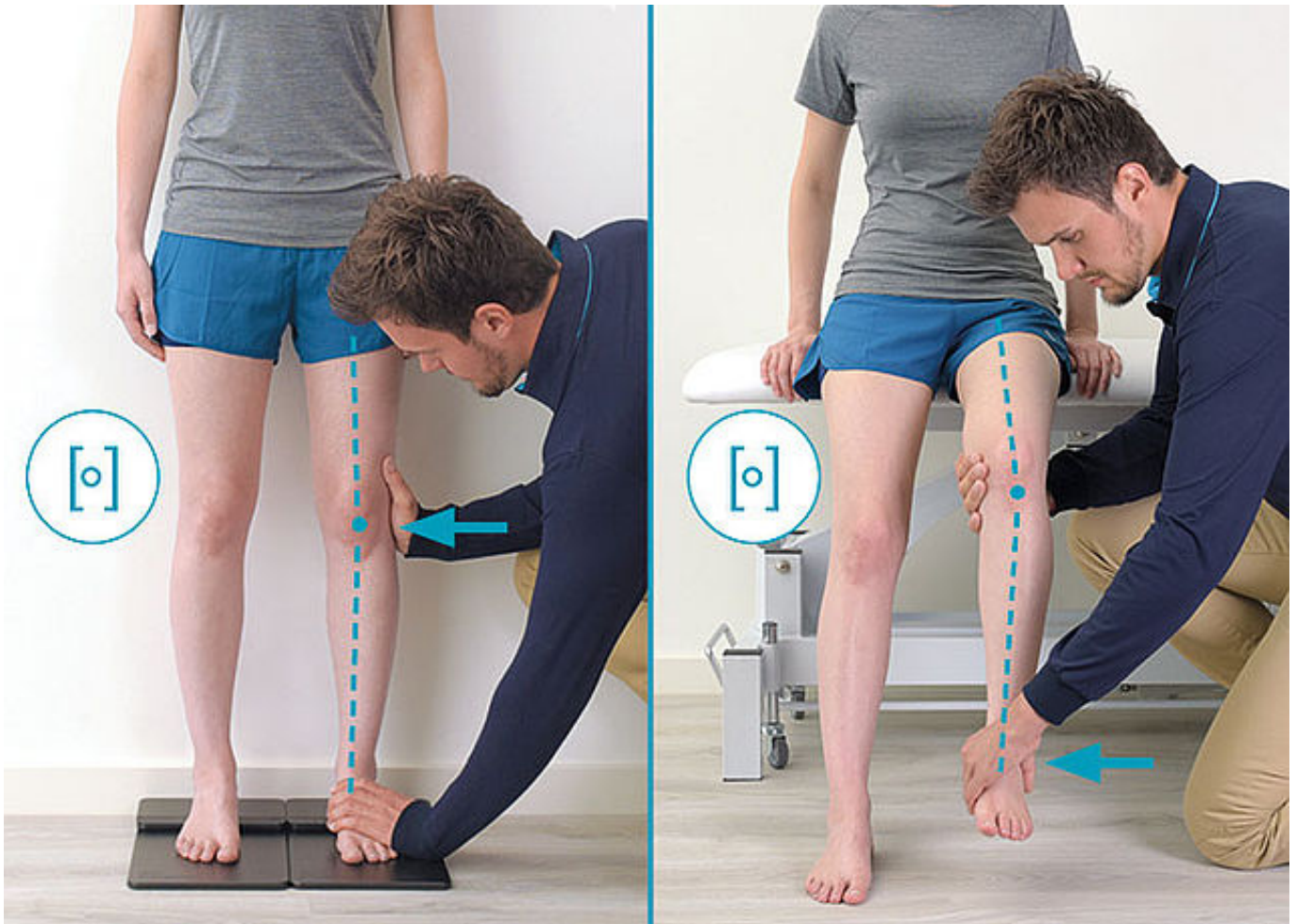
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Deformities

The patient is standing on the h-Cast. Determine into which direction the leg axis deviates from the neutral position, if any.



Varus Deformity – Maximum and Corrected

If there is a varus deviation, correct it as best as possible and determine the value of the corrected varus deformity. If the deformity cannot be corrected, we still recommend using the box on the orthotic treatment sheet to document the assessed data. Then, determine the maximum varus deformity without load on the leg. If the values coincide, there is a deformity, but no instability.



Valgus Deformity – Maximum and Corrected

If there is a valgus deviation, correct it as best as possible and determine the value of the corrected valgus deformity. If the deformity cannot be corrected, we still recommend using the box on the orthotic treatment sheet to document the assessed data. Then, determine the maximum valgus deformity without load on the leg. If the values coincide, there is a deformity, but no instability.

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☎ +49 4131 24445-0
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Hyperextension – Maximum and Corrected

Measure the maximum knee hyperextension. Correct the position, if possible, in order to achieve a physiological knee angle. Due to patient-specific characteristics, this cannot be achieved in some cases. In any case, determine the corrected hyperextension (e.g. 4°). All values above 0° flexion constitute a neutralisation of the hyperextension and are noted as 0°.



Extension Limitation of the Hip

Apply the Thomas test to assess the extension limitation of the hip. The patient is lying on their back. Place one hand under the lumbar vertebrae to check the delordosing of the lumbar spine. Bring the leg not to be tested into hip flexion with the knee bent. The hip flexion angle is measured on the side to be tested. Please note that the assessed extension limitation of the hip can affect the individual normal posture in the sagittal plane.



Extension Limitation of the Knee

The patient is standing on the h-Cast. Adjust it accordingly to take all influencing factors, like the extension limitation of the hip, into consideration. Measure the knee angle. It deviates from the physiological angle if there is an extension limitation in the knee and/or hip. Pain can also lead to a deviation.

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☎ +49 4131 24445-57

✉ info@fior-gentz.de
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Dorsalextension

Dorsiflexion

Extension dorsale

Estensione dorsale

Dorsaalextensie





Dorsiflexion – Muscle Strength 5 and 4

The patient is lying on their stomach. The foot of the leg to be tested is hanging over the edge of the stretcher. Hold the lower leg in place with one hand without restricting the muscle function. Push against the dorsum of the foot with the other hand. Have the patient bring the foot in dorsiflexion. At complete range of motion against gravity with full resistance, the muscle strength is 5. At range of motion against gravity with some resistance, the muscle strength is 4.



Dorsiflexion – Muscle Strength 3

The patient is seated. The lower legs hang over the edge of the stretcher. Hold the lower leg in place with one hand without restricting the muscle function. Have the patient bring the foot in dorsiflexion. At range of motion against gravity, the muscle strength is 3.



Dorsiflexion – Muscle Strength 2

The patient is lying on the side of the leg to be tested. Place one hand under the foot so that it does not rest on the stretcher anymore. Have the patient bring the foot in dorsiflexion. At range of motion with gravity eliminated, the muscle strength is 2.



Dorsiflexion – Muscle Strength 1 and 0

The patient is lying on the side of the leg to be tested. Place one hand under the foot so that it does not rest on the stretcher anymore. Have the patient bring the foot in dorsiflexion. Palpate if there is any muscle activity. At slight contraction with no joint motion, the muscle strength is 1. At no evidence of contraction, there is a total paralysis and the muscle strength is 0.

Plantarflexion

Plantar flexion
Flexion plantaire
Flessione plantare
Plantairflexie





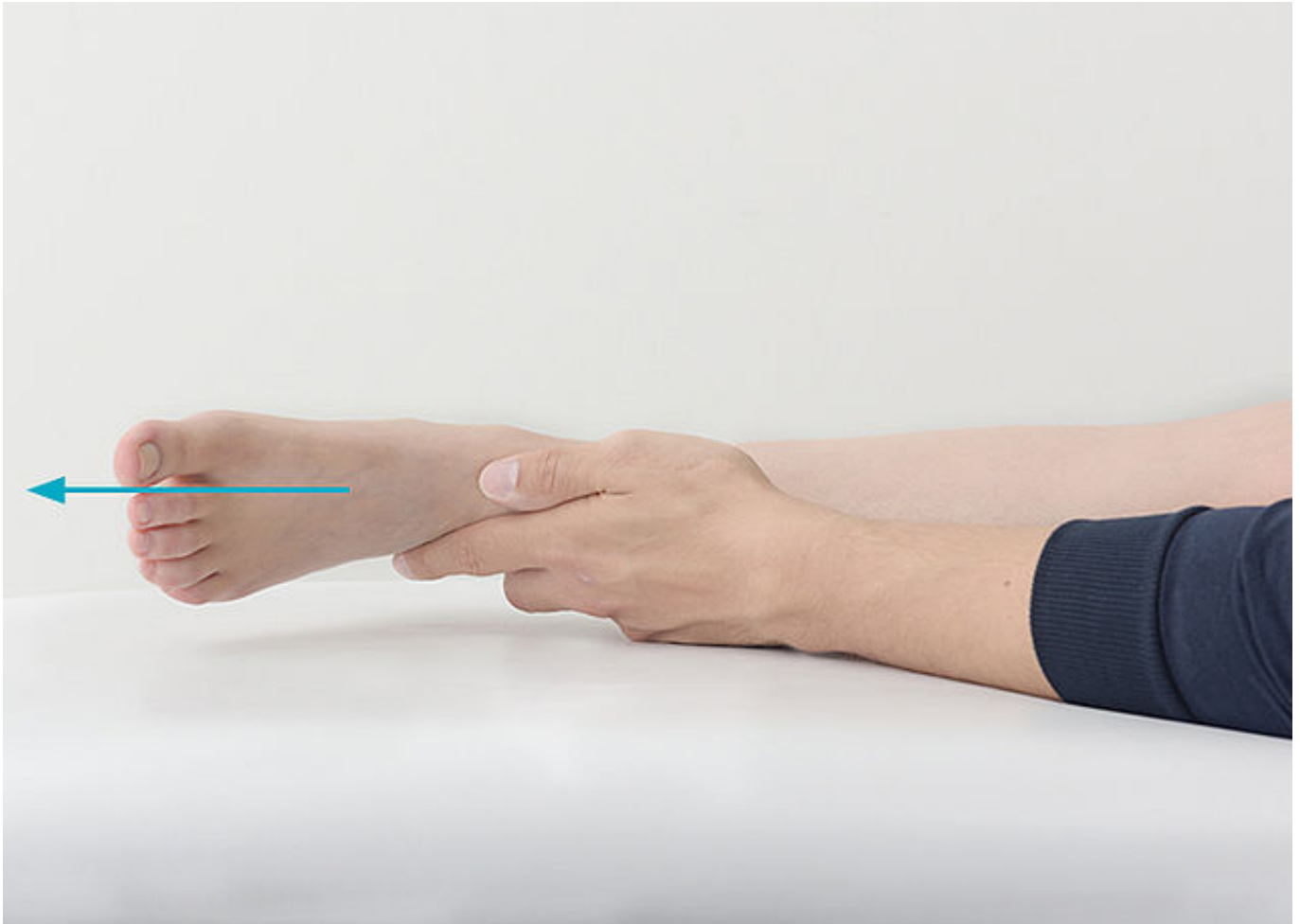
Plantar Flexion – Muscle Strength 5 and 4

The patient is lying on their stomach. The foot of the leg to be tested is hanging over the edge of the stretcher. Hold the lower leg in place with one hand without restricting the muscle function. Push against the forefoot from below with the other hand. Have the patient bring the foot in plantar flexion. At complete range of motion against gravity with full resistance, the muscle strength is 5. At range of motion against gravity with some resistance, the muscle strength is 4.



Plantar Flexion – Muscle Strength 3

The patient is lying on their stomach. The leg to be tested is flexed. Have the patient bring the foot in plantar flexion. At range of motion against gravity, the muscle strength is 3.



Plantar Flexion – Muscle Strength 2

The patient is lying on the side of the leg to be tested. Place one hand under the foot so that it does not rest on the stretcher anymore. Have the patient bring the foot in plantar flexion. At range of motion with gravity eliminated, the muscle strength is 2.



Plantar Flexion – Muscle Strength 1 and 0

The patient is lying on the side of the leg to be tested. Place one hand under the foot so that it does not rest on the stretcher anymore. Have the patient bring the foot in plantar flexion. Palpate if there is any muscle activity. At slight contraction with no joint motion, the muscle strength is 1. At no evidence of contraction, there is a total paralysis and the muscle strength is 0.

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✉ info@fior-gentz.de
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Knieextension

Knee extension

Extension du genou

Estensione del ginocchio

Knie-extensie





Knee Extension – Muscle Strength 5 and 4

The patient is seated. The lower legs hang over the edge of the stretcher. Hold the thigh in place with one hand without restricting the muscle function. Push against the lower leg above the foot with the other hand. Have the patient bring the knee in extension. At complete range of motion against gravity with full resistance, the muscle strength is 5. At range of motion against gravity with some resistance, the muscle strength is 4.



Knee Extension – Muscle Strength 3

The patient is seated. The lower legs hang over the edge of the stretcher. Hold the thigh in place with one hand without restricting the muscle function. Have the patient bring the knee in extension. At range of motion against gravity, the muscle strength is 3.



Knee Extension – Muscle Strength 2

The patient is lying on the side of the leg not to be tested. Support and lift the upper leg. Hold the pelvis in place with the other hand without restricting the muscle function. The leg to be tested is slightly flexed. Have the patient bring the knee in extension. At range of motion with gravity eliminated, the muscle strength is 2.



Knee Extension – Muscle Strength 1 and 0

The patient is lying on their back. The leg to be tested is slightly flexed in the hip and in the knee. The other leg remains extended. Have the patient bring the knee in extension. Palpate if there is any muscle activity. At slight contraction with no joint motion, the muscle strength is 1. At no evidence of contraction, there is a total paralysis and the muscle strength is 0.

Knieflexion

Knee flexion

Flexion du genou

Flessione del ginocchio

Knieflexie





Knee Flexion – Muscle Strength 5 and 4

The patient is lying on their stomach. One foot is hanging over the edge of the stretcher and the leg to be tested is flexed. Hold the thigh in place with one hand without restricting the muscle function. Push against the lower leg close to the foot with the other hand. Have the patient bring the knee in flexion. At complete range of motion against gravity with full resistance, the muscle strength is 5. At range of motion against gravity with some resistance, the muscle strength is 4.



Knee Flexion – Muscle Strength 3

The patient is lying on their stomach. One foot is hanging over the edge of the stretcher and the leg to be tested is flexed. Hold the thigh in place with one hand without restricting the muscle function. Have the patient bring the knee in flexion. At range of motion against gravity, the muscle strength is 3.



Knee Flexion – Muscle Strength 2

The patient is lying on the side of the leg not to be tested. The upper leg is slightly flexed. Support and lift the upper leg. Hold the pelvis in place with the other hand without restricting the muscle function. Have the patient bring the knee in flexion. At range of motion with gravity eliminated, the muscle strength is 2.



Knee Flexion – Muscle Strength 1 and 0

The patient is lying on their stomach. One foot is hanging over the edge of the stretcher and the leg to be tested is slightly flexed. Support the flexed leg with one hand. Have the patient bring the knee in flexion. With the other hand, palpate if there is any muscle activity. At slight contraction with no joint motion, the muscle strength is 1. At no evidence of contraction, there is a total paralysis and the muscle strength is 0.

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Dorette-von-Stern-Straße 5
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☎ +49 4131 24445-0
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✉ info@fior-gentz.de
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Hüftflexion

Hip flexion

Flexion de la hanche

Flessione dell'anca

Heupflexie





Hip Flexion – Muscle Strength 5 and 4

The patient is lying on their back. The lower legs are hanging over the edge of the stretcher. Hold the pelvis in place with one hand without restricting the muscle function. Push against the thigh close to the knee with the other hand. Have the patient bring the hip in flexion. At complete range of motion against gravity with full resistance, the muscle strength is 5. At range of motion against gravity with some resistance, the muscle strength is 4.



Hip Flexion – Muscle Strength 3

The patient is lying on their back. The lower legs are hanging over the edge of the stretcher. Hold the pelvis in place with one hand without restricting the muscle function. Have the patient bring the hip in flexion. At range of motion against gravity, the muscle strength is 3.

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Dorette-von-Stern-Straße 5
21337 Lüneburg

☎ +49 4131 24445-0
☎ +49 4131 24445-57

✉ info@fior-gentz.de
🌐 www.fior-gentz.de





Hip Flexion – Muscle Strength 2

The patient is lying on the side of the leg not to be tested. The leg to be tested is slightly flexed in the hip and in the knee. Support and lift the upper leg with one hand. Hold the pelvis in place with the other hand without restricting the muscle function. Have the patient bring the hip in flexion. At range of motion with gravity eliminated, the muscle strength is 2.



Hip Flexion – Muscle Strength 1 and 0

The patient is lying on their back. Hip and knee are slightly flexed. Support the flexed knee with one hand. Have the patient bring the hip in flexion. With the other hand, palpate if there is any muscle activity. At slight contraction with no joint motion, the muscle strength is 1. At no evidence of contraction, there is a total paralysis and the muscle strength is 0.

Hüftextension

Hip extension

Extension de la hanche

Estensione dell'anca

Heupextensie





Hip Extension – Muscle Strength 5 and 4

The patient is lying on their stomach. The feet are hanging over the edge of the stretcher. Push against the thigh close to the knee with one hand. Have the patient bring the hip in extension. Make sure that the pelvis stays on the stretcher. At complete range of motion against gravity with full resistance, the muscle strength is 5. At range of motion against gravity with some resistance, the muscle strength is 4.



Hip Extension – Muscle Strength 3

The patient is lying on their stomach. The feet are hanging over the edge of the stretcher. Have the patient bring the hip in extension. Make sure that the pelvis stays on the stretcher. At range of motion against gravity, the muscle strength is 3.



Hip Extension – Muscle Strength 2

The patient is lying on the side of the leg not to be tested. The upper leg is slightly flexed. Support and lift the upper leg with one hand. Hold the pelvis in place with the other hand without restricting the muscle function. Have the patient bring the hip in extension. At range of motion with gravity eliminated, the muscle strength is 2.



Hip Extension – Muscle Strength 1 and 0

The patient is lying on their stomach. Have the patient bring the hip in extension. Palpate if there is any muscle activity. At slight contraction with no joint motion, the muscle strength is 1. At no evidence of contraction, there is a total paralysis and the muscle strength is 0.

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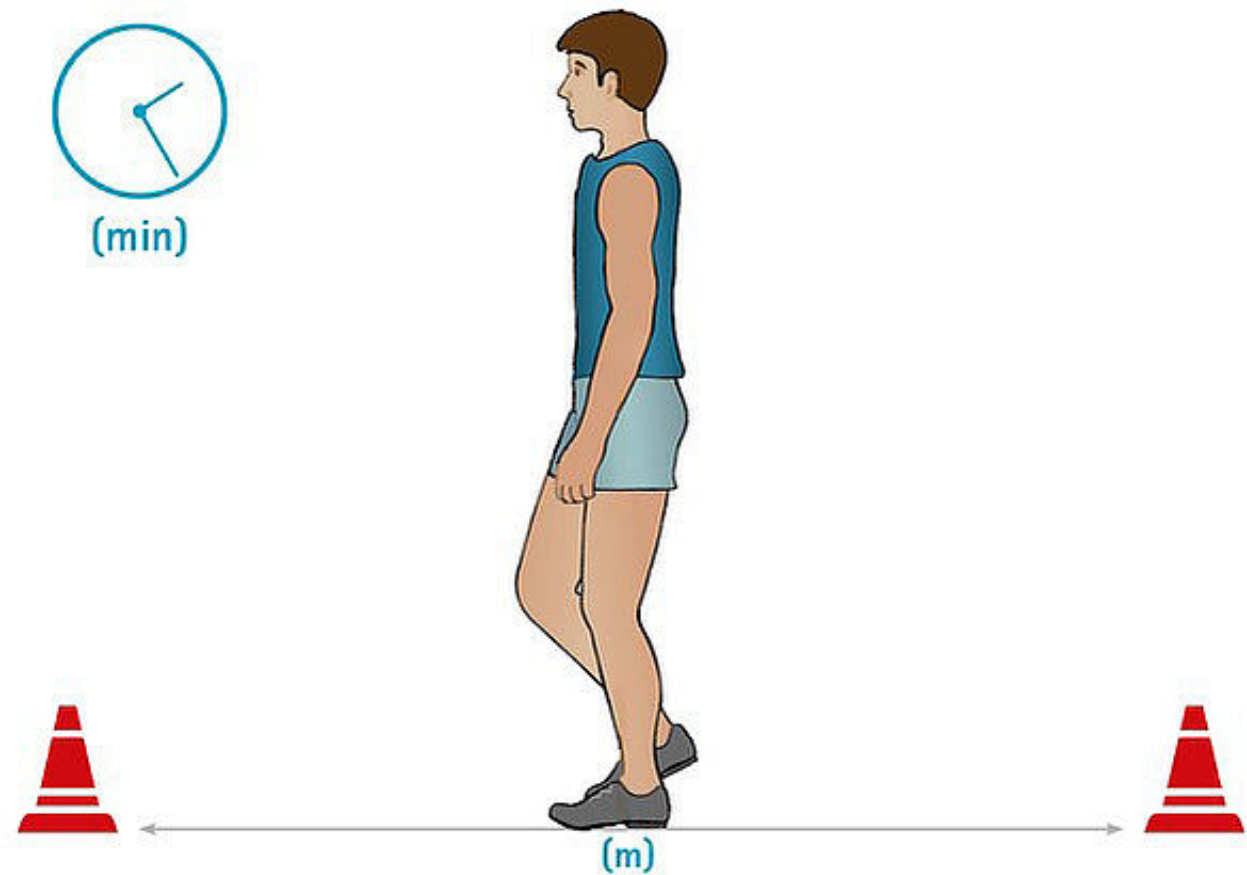
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✉ info@fior-gentz.de
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Use the 6-minute walk test to induce muscular fatigue. During this test, the patient walks up and down a previously defined route until the six minutes are over or the patient is too exhausted to continue walking. Write down the distance covered and – if the test is terminated early – the time passed. Afterwards, immediately determine the entire muscle strength again (all steps from “Muscle Strength – Foot”, “Muscle Strength – Knee” and “Muscle Strength – Hip”) before continuing with the next step (Activity Level).



1



2



3



4

Activity Level

Evaluate the activity level together with your patient while taking into consideration foreseeable changes.



1



2



3



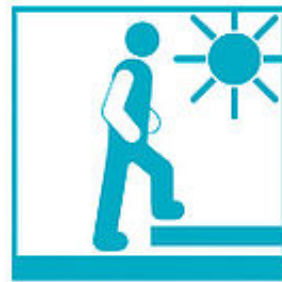
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1. Indoor Walker

The patient has the ability or the potential to make transfers and to move with an orthosis on even surfaces at low walking speed. Ambulation is possible for a very short distance and duration due to the physical condition of the patient.



1



2



3



4

2. Restricted Outdoor Walker

The patient has the ability or the potential to move with an orthosis at low walking speed and is able to overcome small environmental obstacles such as curbs, single steps or uneven surfaces.



1



2



3



4

3. Unrestricted Outdoor Walker

The patient has the ability or the potential to move at medium to high and also varying speed and to overcome most environmental obstacles. Additionally, the patient can walk on open terrain and perform professional, therapeutic and other activities, which do not apply an above average mechanical load on the orthosis.



1



2



3



4

4. Unrestricted Outdoor Walker with Especially High Demands

The patient has the ability or the potential to move with an orthosis like the unrestricted outdoor walker. Additionally, the increased functional demands can generate high impact loads, tension and/or deformation on the orthosis. These patients are mainly athletes and children.

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✉ info@fior-gentz.de
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Ap Measurement at Knee Height

Determine the ap measurement by using a calliper.

Measure on the slightly flexed knee when the muscles are relaxed. Measure at a right angle from the knee fold to the longitudinal axis of the lower leg and parallel to the movement direction.

*Note: In order to avoid measuring errors, **do not** use the patella as a basis for determining the ap measurement as the patella's position can vary (e.g. in case of luxations, TEPs and patella alta).*

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Dorette-von-Stern-Straße 5
D-21337 Lüneburg

Tel.: [+49 4131 24445-0](tel:+494131244450)
Fax: [+49 4131 24445-57](tel:+4941312444557)
E-Mail: [info\(at\)fior-gentz.de](mailto:info(at)fior-gentz.de)

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☎ [+49 4131 24445-0](tel:+494131244450)
☎ [+49 4131 24445-57](tel:+4941312444557)

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