PAD Guide

A Concept for the Orthotic Treatment of Patients with Peripheral Arterial Disease

Introduction

Our latest guide focuses on a disease that is commonly known by a different name in German because peripheral arterial disease (PAD) is often referred to as *Schaufensterkrankheit* (lit. translation: shop window disease): after walking a certain distance, the patient experiences pain in the leg and stops walking. To make it less obvious, they pretend to be looking into a shop window. After a few minutes the pain has subsided and the patient moves on. The temporary pain when walking which underlies this disease, also called intermittent claudication, is already a symptom of the second stage of PAD. At this stage at the latest, the patient should consult a physician for a detailed examination and diagnosis.

The occlusion of the blood vessels that causes this disease is a serious health threat for those affected. At an advanced stage, the resulting wounds can quickly lead to complications and even amputation. Furthermore, PAD has a unique status as it represents a link between other diseases: in most cases, it develops based on an existing diabetes condition and in turn is the cause of polyneuropathy [1]. All of these conditions have specific yet different symptoms and can be treated with modern and dynamic ankle-foot orthoses (AFOs).

Although diagnostics and treatment options are already very advanced, modern AFOs have not yet been taken into account in the medical device supply – neither for PAD nor for polyneuropathy. The dynamic properties of modern neuro orthoses significantly contribute to compensating for balance disorders and minimising the overall pressure on the sole of the foot when walking. With our PAD Guide, we are taking a further step into an area which previously has not been a typical case for an AFO. The overwhelmingly positive feedback from physicians, our customers and their patients confirms that we are on the right track.

Take a chance on this new option for medical devices and make everyday life easier for your patients with PAD. As always, we look forward to your feedback and experiences – on one of our social media channels or directly.

Your FIOR & GENTZ team

Content

[1] Ziegler AS (2003): *Axonale Polyneuropathie bei peripherer arterieller Verschlusskrankheit.* Dissertation. Medizinische Fakultät, Universität Ulm.

More than 230 million people worldwide suffer from peripheral arterial disease (PAD). The percentage of the total population is between 3-10%, although the frequency increases with age and is already at 15-20% in people over 70. Unlike the arterial occlusive disease, this chronic circulatory disorder occurs in the extremities – 90% in the legs and only 10% in the arms. Also frequently referred to as intermittent claudication, PAD is the occlusion of the peripheral vessels (arteries). In addition to the typical symptoms, this occlusion can also cause damage to the nerves, leading to polyneuropathy [1]. PAD cannot be cured, but its progression can be prevented.

Causes

Alongside an ischaemic stroke and a heart attack, PAD is a manifestation of arteriosclerosis or its symptomatic form, atherothrombosis. At 95%, arteriosclerosis is the main cause of PAD. Other causes may be:

- inflammatory causes,
- genetic causes,
- traumatic causes and,
- fibromuscular dysplasia.

Risk Factors

Risk factors indicate which individuals have a comparatively high probability of being affected by a disease. As arteriosclerosis is the main cause of PAD, the risk factors for PAD are also the causes of arteriosclerosis. These include:

- diabetes (mellitus),
- smoking,
- elevated blood lipid levels (hyperlipidaemia),
- high blood pressure (arterial hypertension) and in general,
- advanced age.

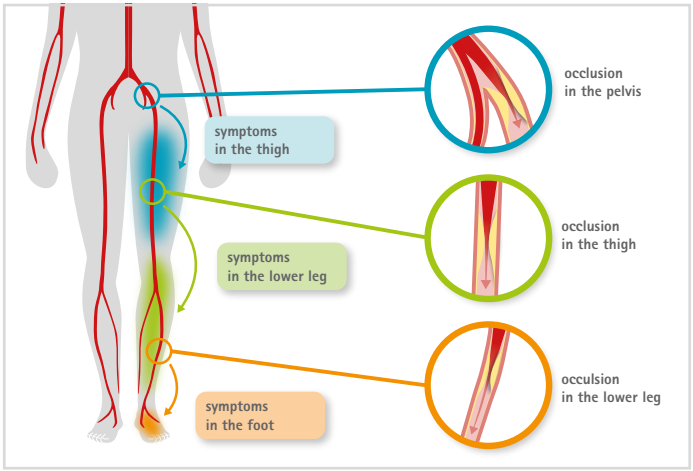
There are different reports on the gender split: some sources report that four times as many men suffer from PAD than women; in other sources, the prevalence is higher in women over the age of 75 than in men. In addition, smoking is often the cause of arteriosclerosis in men and obesity in women.

Classification according to Levels

PAD can affect vessels in different parts of the body, often referred to as levels. If two or more levels are affected, it is known as multi-level PAD. In relation to the lower extremities, there are the following levels:

- arteries in the pelvic area,
- thigh arteries,
- lower leg arteries.

The symptoms depend on the location of the vascular occlusion and always occur one level below: pelvis → thigh; thigh → calf; calf → foot

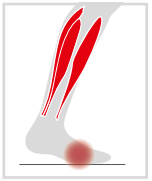


Symptoms

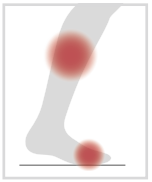
PAD usually progresses gradually, depending on how quickly and severely the vessels constrict and the blood flow is restricted. The type and severity of PAD is categorised into 4 stages using the Fontaine classification.

Stage I: The patient is considered asymptomatic. Initial symptoms, such as cold feet or skin changes, pale skin or poorly healing wounds, are not recognised as signs, so a diagnosis is usually a matter of chance.

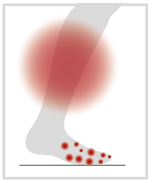
Stage II: Those affected become aware of PAD. Due to the lack of oxygen supply, the muscles below the constriction ache cramp-like under strain, for example when walking. A temporary limp (intermittent claudication) may occur. At rest, the pain disappears again. In addition, functional limitations of the gait can occur due to weakness of the foot lifting and calf muscles. Depending on the pain-free walking distance (>/< 200m), the stage is divided into a and b.



Stage III: The blood flow is so severely impaired that the typical pain also occurs at rest, when lying down and at night.



Stage IV: In the most severe stage of PAD, the tissue is severely damaged. Poorly healing ulcers occur and life-threatening infections can develop. In the case of complete occlusion, the tissue dies completely, resulting in necrosis.



Classification of PAD

According to Fontaine		According to Rutherford	
Stage	*Clinical Picture*	*Degree/ Category*	*Clinical Picture*
I	asymptomatic	0/0	asymptomatic
II	intermittent claudication • for walking distances > 200 metres (stage IIa) • for walking distances < 200 metres (stage IIb)	I/1	minor intermittent claudication, Doppler > 50mmHg
		I/2	moderate intermittent claudication
		I/3	severe intermittent claudication, Doppler < 50mmHg
III	pain at rest with the affected limb in a horizontal position	II/4	pain at rest
IV	necrosis (tissue loss), gangrene • IVa: trophic disorder, dry necrosis • IVb: bacterial infection of the necrosis, wet gangrene	III/5	distal atrophic lesion with acral tissue loss
		III/6	proximal lesion (extending beyond the level of the metatarsal bones)

Diagnostics

A detailed and thorough examination is an essential part of the diagnosis of PAD. For example, risk factors are recorded and the time of onset of symptoms is analysed. An examination of the extremities provides information about the disease (skin colour, trophic disorder, etc.). During palpation, the pulse status of various vessels, the reduced sensitivity and temperature of the skin are determined. Certain vessels can also be auscultated, but determining the ABI is a much more accurate method.

ABI (Ankle Brachial Index)

For the ABI (Ankle Brachial Index), differences in the occlusion pressure between the arm and lower leg at rest are determined using a blood pressure cuff and Doppler equipment. The ratio in a healthy vascular situation is approximately 1 (0.9 to 1.2). The threshold values for the diagnosis of PAD are as follows:

- < 0.9 → mild PAD
- < 0.75 → moderate PAD
- < 0.5 → severe PAD

The ABI is a very precise and effective method: The sensitivity is approximately 95% (at rest, ABI value < 0.9 for the occurrence of at least 50% vascular occlusion), the specificity is almost 100%.

Imaging Procedures

Colour-coded duplex sonography (CCD) is mainly used in treatment planning to determine stenoses and sites of increased flow velocity. This non-invasive procedure is the first choice for diagnosis of many vascular diseases despite the risks involved (e.g. radiation, sound waves, magnetic fields and the use of contrast agents). If the examination results of the CCD are insufficient, an additional magnetic resonance (MR) or computer tomography (CT) angiography of the vessels is performed. Intraarterial digital subtraction angiography (DSA) is an invasive procedure and is still considered the standard in terms of accuracy and clarity of vascular visualisation.

Conservative Treatment According to S3 Guideline

As PAD cannot be cured, treatment is focussed on managing the symptoms, delaying the progression of the disease and avoiding amputation. However, the treatment methods of early pressure relief and compensation of paralyses using devices are not yet included in conservative PAD treatment. Recommendations for medical foot care are also not included. The treatment of PAD is divided into three categories (conservative, interventional and surgical measures) in the guideline for the treatment of PAD from the German Society of Angiology - Society for Vascular Medicine (S3 guideline) [2] and only contains the following measures:

Conservative Treatment

- nicotine avoidance,
- regulation of blood lipid levels and high blood pressure,
- gait training (requirement: patient is asymptomatic, stage I or II),
- wound treatment by wound manager (stage IV): removing wound residue, keeping wounds clean and closed → reducing the risk of infection,
- pressure relief (stage IV).
- Medication treatment ...
  - of the risk factors: diabetes, high blood pressure (AC inhibitors) and elevated blood lipid levels (statins).
  - of PAD: antiplatelet agents such as ASA or clopidogrel (stage II), prostaglandin E antagonists (stage III, only if interventional treatment fails) or systematic administration of antibiotics to treat wounds (stage IV).

Interventional Treatment

In stage III, a PTA (= percutaneous transluminal angioplasty) is used to expand a partial or complete vascular occlusion using a balloon catheter: This presses the stenosis against the vessel wall.

Surgical Treatment

At the site of the stenosis, the damaged vessels are replaced by the body's own or foreign structures (high-performance plastics) or a bypass is installed.

[2] Lawall H, Zemmrich C et al. (2015): *S3-Leitlinie 065-003: Diagnostik, Therapie und Nachsorge der peripheren arteriellen Verschlusskrankheit.* Deutsche Gesellschaft für Angiologie - Gesellschaft für Gefäßmedizin.

Orthoses as Part of the PAD Treatment

So far, orthoses have rarely been used as part of an advanced PAD treatment although there is great potential for improving many of the symptoms associated with the disease. Patients suffer from the following restrictions, for example:

Pain when Walking

Pain in the foot and lower leg when walking is often a determining factor in the diagnosis of PAD. The symptoms are indicative of claudicatio intermittens. It is treated with gait training, which reduces the pain in the legs when walking. Unfortunately, no orthotic treatment has been provided to date.

Muscle Weakness and Stumbling

The foot lifting muscles (dorsiflexors) are often weakened early on in stage II. This weakening leads to a visible drop foot and stumbling when walking and, just like the muscle pain, to a reduction in the patient's activity. The inactivity of the weakened muscles causes muscle atrophy. A dynamic orthosis can restore foot lifting, support the patient's activity and thus prevent fatigue and muscle weakening. However, there is no or far too little orthotic treatment here either.

Balance Issues due to Paralyses

In many cases, the weakening of the foot lifting muscles (dorsiflexors) is followed by an additional weakening of the calf muscles (plantar flexors). Depending on the course of the disease, this can result in paralysis, which leads to balance issues and a lack of stability when standing and walking. Unlike the weakness of the foot lifting muscles with the distinct symptom of a drop foot, the serious issue of calf muscle weakness unfortunately remains undiagnosed in most cases, as it is not easily identified externally. Even if the weakness of the calf muscles has been identified, insufficient knowledge of the possibilities of modern orthotic treatments often leads to the use of inadequate devices such as simple foot lifter orthoses, which are unable to compensate for the balance issues.

Wounds and Harmful Pressure Peaks on the Foot

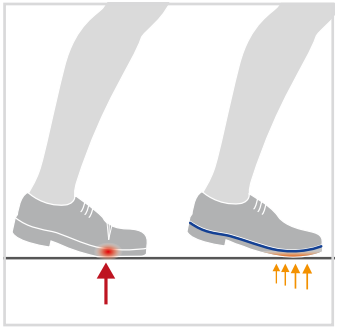
If diabetes is the cause of PAD, a diabetic foot orthotics (DFO) is an essential part of the treatment with medical devices. The DFO consists of several layers of soft foam and is primarily used to redistribute pressure on the sole of the foot. Unfortunately, orthoses are rarely used for the treatment of diabetic foot syndrome.

Problems with Previously Used Orthoses

Paralysis Compensation
Many patients with PAD develop a weakness of the foot lifting muscles during the course of the disease, which is usually treated with a simple foot lifter orthosis. Such devices compensate for a drop foot, allowing the leg to swing freely without stumbling.

During the course of the disease, a weakness of the calf muscles can also develop, which often remains undiagnosed. Foot lifter orthoses orthoses compensate for the weakness of the dorsiflexors, but have no influence on the plantar flexors. A weakness in this muscle group causes the forefoot lever to be deactivated. The resulting instability when standing and walking cannot be corrected with a simple foot lifter orthosis. In addition, such an orthosis cannot be adjusted to changes in the course of the disease. This is why it is important to thoroughly examine the patient and consider modern treatment options with an orthosis.

Pressure Relief and Redistribution
Unfortunately, the gold standard for patients with PAD and diabetic foot syndrome has been the use of a diabetic foot orthotic alone, with or without customised orthopaedic shoes. This treatment redistributes the plantar foot pressure and reduces pressure peaks and pressure points.



However, these types of treatments cannot reduce the overall pressure exerted on the foot by the body weight. The pressure is merely redistributed and thus inevitably increases in other areas of the foot. Although a sufficient reduction of the overall pressure or a pressure relief of the entire foot is necessary to reduce the risk of partial foot amputation and to ensure aspects such as the patient's mobility and quality of life long-term.

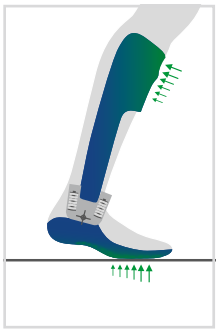
Requirements for Orthoses

Orthoses for PAD patients should fulfil a specific therapeutic purpose. To do so, they must have functions that can be used to achieve specific goals. From stage II of PAD at the latest, patients experience substancial restrictions when walking. In addition, there are the balance disorders caused by polyneuropathy and the necessary pressure relief in the case of possible diabetic foot syndrome. In order to be able to address these restrictions in the best possible way, orthoses must:

1. compensate for existing balance disorders,
2. compensate for paralyses of both the foot lifting and calf muscles,
3. reduce pressure peaks on the foot sole when walking and support pressure redistribution and
4. be adaptable to the course of the disease.

In modern orthoses, the necessary functions are provided using the corresponding functional elements of the system ankle joints, which have the following positive effects on the patient:

- counteract fatigue in the foot lifting and calf muscles,
- retain the ability to walk,
- strengthen the affected muscle groups by activating them,
- improve balance when standing and walking.



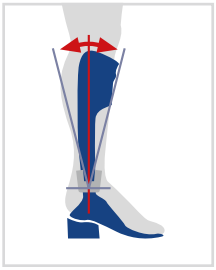
In addition, a dynamic orthosis with the corresponding functional element can significantly contribute to the redistribution and reduction of plantar foot pressure in patients with diabetic foot syndrome: a custom-made orthosis with an anterior shell and rigid foot piece, the dynamics of which are realised, for example, via the NEURO SWING system ankle joint with precompressed spring units, transfers part of the overall pressure exerted on the foot directly into the ground. This results in a reduction in the pressure exerted on the foot. The rigid foot piece also allows the already reduced pressure to be distributed even further over the entire foot area. The treatment is completed by a customised foot orthotic that can be integrated into the foot piece.

It is a great advantage to use a system joint of the NEURO SWING range to produce an orthosis, as the precompressed spring units mounted in the system joint not only compensate for a restricted foot lifting, but also activate the forefoot lever. The spring units are strong enough to counteract the body weight. This brings the body into a stable balance and restores the supportive area, enabling standing upright, straight and thus secure stance. The gait improves significantly and the orthosis ensures a lower energy consumption when walking. This becomes visible when the heel is lifted during heel-to-toe movement. The necessary resistance for both directions of motion (dorsiflexion and plantar flexion) can be adapted to the individual muscle weakness of both muscle groups independently of each other using the exchangeable spring units.

In order to optimally adapt the orthosis to the patient's requirements, the NEURO SWING system ankle joint has two basic adjustment options that can be changed independently of each other and do not influence each other:

1. Adjustable Alignment

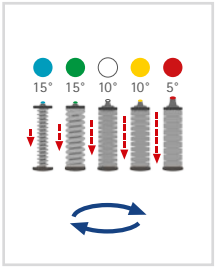
Thanks to the adjustable alignment of the NEURO SWING system ankle joint, the orthosis can be individually adjusted to the patient's pathological gait. Should the gait change, a quick response can easily be made by adjusting and tuning the orthosis.



adjustable alignment

2. Variable Spring Force

The spring force in plantar flexion and dorsiflexion can be individually adjusted to the patient's requirements thanks to the exchangeable, precompressed spring units. A total of five different spring units is available for the NEURO SWING system ankle joint, ranging in strength from normal to extra strong and with a range of motion from 15° to 5°.



variable spring force

The NEURO SWING system ankle joint is available in five models, each in up to six system widths. In order to be able to select the suitable system width according to the determined patient data, please use the FIOR & GENTZ Orthosis Configurator.

Orthosis Configurator

www.orthosis-configurator.com

NEURO SWING

With its adjustable alignment, adjustable range of motion and the exchangeable, precompressed spring units, the NEURO SWING is the ideal system joint for a flexible treatment. Another advantage is the plug + go modularity, which allows a conversion to any other system joint in the plug + go series in just a few simple steps.

NEURO SWING 2

With the NEURO SWING 2, the alignment, range of motion and spring force are also adjustable. In addition, it has an integrated noise reduction and is therefore the ideal choice for people who appreciate silent locomotion. Like the NEURO SWING, it is part of the plug + go series and can be converted if required.

NEURO SWING Carbon

The NEURO SWING Carbon is the water-resistant NEURO SWING model. With its adjustable alignment and exchangeable, precompressed spring units it offers the same advantages as the NEURO SWING, but can also be used in wet and outdoor areas thanks to the carbon fibre reinforced joint case. The range of motion of the NEURO SWING Carbon is not adjustable.

NEURO HiSWING

With the NEURO HiSWING, the first hydraulic ankle joint has been developed. The ankle joint angle can be adjusted by the patient themself using the hydraulic mechanism, which makes it possible to climb stairs and hike in uneven terrain with less effort. The orthosis can easily be adapted to different heel heights and offers more comfort when sitting.

NEURO HiSWING R+

The NEURO HiSWING R+ is a microprocessor-controlled system ankle joint that can easily be adapted to walking on uneven terrain and stairs thanks to its integrated hydraulic component. The patient can adjust the lower leg-to-plumb line angle using the User app or gesture control. The easy control and fast reactions enable safe and, as much as possible, natural walking on different terrains.

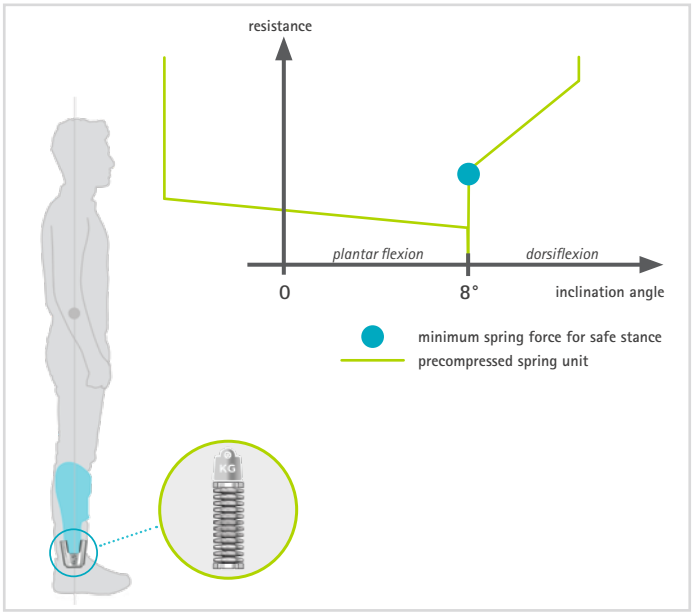
NEURO SWING | NEURO SWING 2 | NEURO HiSWING

Precompressed Spring Units

In order to bring the body into a stable balance in case of a weakness of the calf muscles (plantar flexors), the orthosis must activate the missing forefoot lever. Precompressed spring units provide the necessary resistance without restricting the range of motion in the ankle joint too much. Depending on the spring units used, these provide a basic resistance at the required level. A higher level is achieved in motion by overcoming the basic resistance. Different basic resistances can be generated by individually combining the precompressed spring units in the two directions of motion.

Effects on Stance

An AFO with NEURO SWING system ankle joint replaces the patient's lost stability and balance. This makes it possible to stand upright and safely. Since only the orthosis is required as a medical device and no others, such as crutches or walkers, the hands are free for everyday tasks.

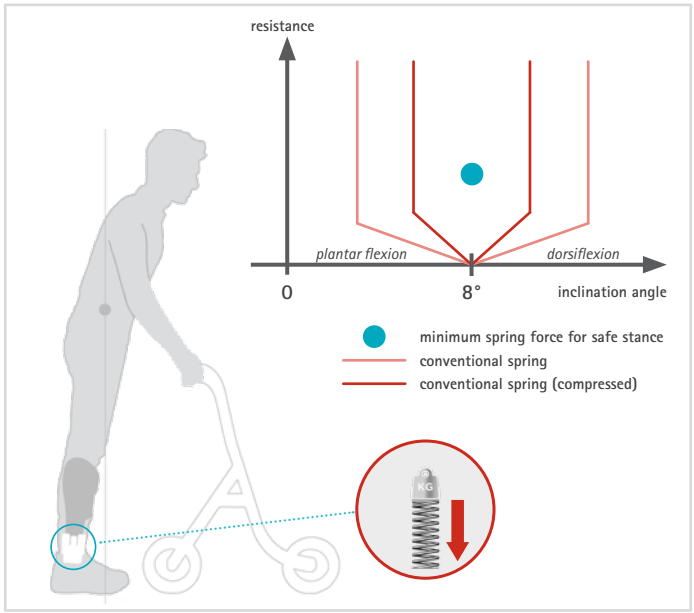


Non-Precompressed Springs

The standard springs of conservative ankle joints are not precompressed and therefore offer no basic resistance. If the calf muscles (plantar flexors) are weak, it is therefore not possible to activate the forefoot lever. Usually, such springs are subsequently compressed due to insufficient resistance, which does not increase the basic resistance, only the resistance against the ankle movement (feather constant). At the same time, the available range of motion is reduced. The maximum compression of the spring is thus achieved earlier. In addition, the resistance against the ankle movement is the same in both directions of motion, although different resistances are required for a physiological gait. The same issue applies to all jointless orthoses. These are also not precompressed and offer no basic resistance in the alignment.

Effects on Stance

An AFO with a conservative ankle joint and all jointless orthoses do not replace the patient's lost stability and balance. This makes it difficult to stand upright and safely and requires the use of medical devices such as crutches or walkers. The hands are therefore needed for support.



To determine the level of support provided by a custom-made orthosis and to avoid under- or oversupply, the impaired muscle groups must be identified using a muscle function test according to Janda before planning the treatment – in particular the muscle strength of the foot lifting muscles (dorsiflexors) and the calf muscles (plantar flexors).

A visual analysis can also be helpful:
The weakness of the calf muscles leads to easily recognisable instability when standing. If the patient is unable to shift their centre of gravity forward above the toes, while maintaining an upright posture and without the aid of crutches or a walker, the calf muscles are weakened and the patient does not have a stable balance. When walking, this instability is compensated for by overextending the knee (hyperextension).

In PAD patients, the dorsiflexors are often affected, which is characterised by a foot drop, which results in the development of compensation mechanisms.

Orthosis Configurator

In addition to the muscle strength of the six major muscle groups in the leg, further patient data is collected as part of a comprehensive examination during the planning of the orthosis. This data is important for calculating the required functionality, the level of support and the expected load on the orthosis. The FIOR & GENTZ Orthosis Configurator does this calculation for you. During the configuration, you will receive recommendations on the orthosis type, construction, system joints, system width, the spring units to be used ,if applicable, and many other orthosis data.

With the Orthosis Configurator, you can create a reproducible orthosis and save the orthosis data – an important element for your documented treatment. Use the completed Orthotic Treatment Sheet and visit the Orthosis Configurator via our website or at www.orthosis-configurator.com. You will then be guided through the following steps:

1 Patient Data
In the first step, you enter all patient data that are relevant for planning your orthosis.

2 System Components
In this central step, you receive recommendations regarding the orthosis' design and choice of system components. The recommendations are functionally adjusted to the patient data and will withstand all expected loads.

3 Individual Adjustments
In the third step, you can adapt the shape and material of your system joints.

4 Result
In the last step, you can save or send your configuration result or print it for your treatment documentation. You can furthermore generate a calculation and order products directly from our webshop.

Orthosis Configurator

[3] Janda V (1994): *Manuelle Muskelfunktionsdiagnostik*, 3rd edition. Berlin: Ullstein Mosby.

System Knee Joints with plug+go MODULARITY

Flexible Treatment now also at Knee Level

plug + go Modularity

Due to the progression of the restrictions, or more precisely paralyses, the plantar flexors can also be affected in addition to the dorsiflexors. In these cases, PAD patients require a higher level of support to stabilise the knee and ankle joint. Such orthoses require functional elements that provide a dynamic resistance against the dorsiflexion and thus activate the forefoot lever. The plug + go modularity allows adaptation to changes caused by the disease without the need for a new orthosis. Thanks to the wide range of system ankle joints available from FIOR & GENTZ, the orthosis can be optimally adjusted to the patient's requirements.

In addition to the system joints listed below, other system ankle joints are also compatible with plug + go modularity. Under specific conditions, the NEURO CLASSIC-SPRING system ankle joint and the NEURO CLASSIC-SWING system ankle joint can also be used within the context of plug + go modularity.

System Ankle Joints with plug+go MODULARITY

Acral
(from Greek *akros* = furthest end): concerning the acras. In medicine, acras refer to those parts of the body that are furthest away from the torso.

AFO
(ankle-foot orthosis): term for an orthosis encompassing the ankle joint and the foot

Amputation
Surgical or traumatic separation of a body part. A major amputation involves an amputation at the lower or upper leg. The ankle joint is then removed. With a minor amputation, the ankle joint remains intact.

Angiography
Radiological imaging of blood vessels and, in a broader sense, lymphatic vessels. The distribution and flow of a contrast agent injected into the vessels can be followed on the X-ray images.

Arterial
(from Latin *arteria* = artery): relating to ↑arteries, belonging to the artery

Arteriosclerosis
Hardening (sclerosis) of the ↑arteries in the body, also known colloquially as arterial calcification. The vessel walls thicken and lose elasticity. As a result, they become increasingly narrow and restrict the blood flow.

Artery
(from Latin *arteria* = artery; from Greek *Artēría* = trachea, artery): Blood vessel that carries blood away from the heart. The coronary arteries are excluded from this.

Asymptomatic
without noticeable ↑symptoms, free of symptoms

Atherothrombosis
Development of blood clots (thrombi) in ↑arterial vessels due to inflammatory-degenerative changes in the vessel walls. Atherothrombosis often leads to heart attacks or strokes.

Atrophic
(from Greek *atrophia* = emaciation, lack of nutrition): concerning atrophy, wasting away, dwindling

Balloon Catheter
Plastic catheter with a balloon at its tip that can be inflated with pressurised air or liquid. In the case of PAD, it is used to widen a narrowed blood vessel (angioplasty).

Colour-Coded Duplex Sonography
(abbreviation CCD): a form of ultrasound-guided vascular examination that also enables the visualisation of small blood vessels

Computed Tomography
(from Greek *tomé* = cut; *gráphein* = write): abbreviation CT, imaging procedure. The human body can be visualised in cross-sectional images using tomographic X-rays. Unlike conventional X-ray procedures, CT images also show soft tissue in detail with slight differences in contrast.

Diabetic Foot Orthotic
A foot orthotic custom-made for the patient suffering with diabetes. It consists of several layers of soft foam with different shore hardnesses. This so-called sandwich construction supports the ideal distribution of foot pressure.

Digital Subtraction Angiography
(abbreviation DSA): a diagnostic procedure for visualising vessels in which, in contrast to conventional procedures, interfering image elements are removed (subtracted)

Distal
(from Latin *distare* = to be distant): denoting a position away from the centre of the body. The opposite of distal is ↑proximal.

Doppler Equipment
Pin probe that can be used to assess the quality of blood flow in the leg arteries. This ultrasound probe utilises the so-called Doppler effect.

Dorsiflexion
Lifting of the foot or reduction of the angle between lower leg and foot. It is called dorsiflexion because of this movement (↑flexion). Functionally, however, it is a stretching movement in the sense of an ↑extension. Countermovement of ↑plantar flexion.

Dorsiflexors
Colloquially known as shin muscles. Muscles causing the lifting of the foot.

Drop Foot
Malfunction that prevents the foot from being actively extended or lifted and therefore the foot passively hangs down during swing phase. This malfunction is caused by peroneal palsy or a weakness of the ↑dorsiflexors.

Dynamic
(from Greek *dynamikos* = active, strong): displaying movement, characterised by momentum and energy. Thus, a dynamic ↑AFO enables movement in the anatomical ankle joint.

Extension
(from Latin *extendere* = to extend): active or passive straightening of a joint. Straightening is the countermovement of bending (↑flexion) and characteristically increases the joint angle.

Fibromuscular Dysplasia
non-inflammatory thickening of an arterial wall

Flexion
(from Latin *flectere* = to bend): active or passive bending of a joint. Bending is the countermovement of straightening (↑extension) and characteristically reduces the joint angle.

Forefoot Lever
anatomical lever arm running from the upper ankle joint to the metatarsophalangeal joints of the toes

Functional Element
Component of a system ankle joint that is responsible for the movement performed with the orthosis. For example, the orthosis allows, blocks or ↑dynamically controls a movement.

Gangrene
(from Greek *gangraina* = ulcer): death of body parts caused by ↑necrosis or prolonged ↑ischaemia

Hydraulics
(from Greek *hýdor* = water; *aulós* = pipe): technology in which liquids are used to transmit, for example, forces

Intermittent Claudication
(from Latin *claudicare* = to limp): temporary limping in PAD, caused by pain due to ↑ischaemia in the calf muscles

Interventional
(from Latin *intervenire* = intervene): interventional therapy involves targeted interventions on diseased tissue or structures.

Intraarterial
introduction of medication or other substances into an ↑artery (e.g. infusion or injection)

Ischaemia
(from Greek *ischein* = to hold back; *haima* = blood): lack of ↑arterial blood supply, which reduces or completely stops the blood flow to a tissue

Lesion
(from Latin *laesio* = injury): damage or injury

Necrosis
(from Greek *nekros* = corpse, dead body): death of cells caused by ↑pathological processes; cell destruction

Neuro Orthotics
(from Greek *neuron* = nerve): neuro orthotics is generally concerned with the device-supported improvement of movements that are influenced by neurological disorders.

Palpation
examination of the patient's body structures with one or more fingers or hands; basic technique of clinical examination

Pathological
(from Greek *pathos* = pain; disease): abnormally (changed)

Percutaneous Transluminal Angioplasty
(abbreviation PTA): dilation of a constricted blood vessel using a ↑balloon catheter. Percutaneous (= through the skin) refers to a minimally invasive procedure that is performed transluminal (= through the cavity of the ↑artery).

Peripheral
(from Greek *peripherēs* = turning round): located in the outer zones of the body. The peripheral nervous system is the part of the nervous system that is not part of the brain and spinal cord.

Polyneuropathy
(from Greek *poly* = multiple): damage to several sensory and/or motor nerves due to certain diseases of the ↑peripheral nervous system. The ↑symptoms are diverse and depend on the fibre type of the nerves and the affected body region.

Physiological
(from Greek *physis* = nature; *logos* = doctrine): concerning the natural life processes

Plantar Flexion
Lowering of the foot or increase in the angle between lower leg and foot. Countermovement of ↑dorsiflexion.

Plantar Flexors
Colloquially known as calf muscles. Muscles causing the lowering of the foot.

Proximal
(from Latin *proximus* = the nearest): positioned towards the centre of the body. The opposite of proximal is ↑distal.

Spring Constant
value that indicates the ratio of the force acting on a spring to the resulting deflection

Spring Unit
precompressed coil springs or specifically layered disc springs intended for use in system ankle joints

Statins
group of medications that reduce cholesterol production in the body by inhibiting a specific enzyme reaction

Static
(from Greek *statikos* = standing; causing to stand): the equilibrium of forces, concerning statics, in equilibrium, at rest, standing still. A static ↑AFO does not allow any movement in the anatomical ankle joint.

Stenosis
(from Greek *sténosis* = constriction): narrowing or constriction of the cross-section of blood vessels, for example

Symptoms
total of all signs detected by the patient or physician that occur in connection with a disease

Trophic
(from Greek *trophe* = nutrition): nutritional, growth or metabolic state of an organism or tissue

Trophic Disorder
functional and structural tissue changes resulting from a lack of nutrition or denervation of a body part, which manifests itself in a reduction in mass (atrophy)

Tuning
Measures to change the shank-to-floor angle on an already produced orthosis. Tuning aims to adjust the lever ratios of an orthosis to the patient and thus influence the biomechanics of standing and walking. In the case of solid orthoses without an adjustable ankle joint, tuning is done by attaching wedges under the foot piece, which automatically changes the foot-to-floor angle.

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Orthosis Configurator

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