3D L.A.S.A.R. Orthotics Tutorial

Overview of the adjustment options for lower limb orthoses, and their effects on the body statics and gait pattern.
Introduction/
Introduction

The 3D L.A.S.A.R. orthotics tutorial shows the basic setup and adjustment options to optimize orthosis alignment during fitting. Depending on the indication, a large number of the adjustment options can be immediately applied. In particular, the functional or structural leg length should always be considered for each patient.

For better illustration, the representations are deliberately “exaggerated,” and the implications for the musculoskeletal system have been simplified. For this reason, the view of the upper limb has been omitted. During the examination, however, the upper body inclination is also taken into account. The dimensions refer to the 2D L.A.S.A.R. posture mode (vertical, red load line) and are based on the average values that correspond to the posture of healthy individuals. In principle, the scale of these values should be reached or deliberately deviated from for therapeutic reasons.

For the static adjustment of the orthosis alignment, the distances between the load line and the reference points of the knee joint are in most cases decisive. In practice, a distance of 15 mm between the load line and reference point has proved useful for adjustments in the sagittal plane. This value is very close to the physiological comparison value. Following the static alignment, the focus during the dynamic fitting is on whether the desired knee movement is achieved in the stance phase or whether the alignment may have to be readjusted.

A compromise often has to be made due to the individual’s pathology. To do so, a detailed clinical examination focusing on joint status, muscle status, and sensitivity is required to assess and apply the results of the statics analysis.
Mean statics values of healthy persons (study of 2017)*


** Compromise knee rotation according to Nietert: approx. 2 cm above the medial tibial plateau 60 %/40 % in the a/p direction.

~ 15 mm acromion center
~ 10 mm greater trochanter
~ 20 mm knee center of rotation according to Nietert**
~ 60 mm Malleolus lateralis
~ 20 mm knee center
~ 15 mm ankle center
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Overview

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Leg length compensation/
Heel height
01 | Adjustment of leg length compensation and heel height

Initial situation

Possible main causes

Proposed design characteristics and design

Adjustment option

- Scoliotic malposition
- Leg length discrepancy (right)
- Full-sole leg length compensation in or under the shoe
- Set leg length compensation so that the spine is straight and the body centerline runs through the cervical vertebra C7

Knee joint load in the sagittal plane must be checked
01 | Adjustment of leg length compensation and heel height

Initial situation

Possible main causes

Proposed design characteristics and design

Adjustment option

Load line is behind the knee center of rotation

Leg length discrepancy (left)

Full-sole leg length compensation in or under the shoe

Set leg length compensation so that the load line in physiological terms (~ 15 mm) is in front of the knee joint

Shape of the spine and body centerline must be checked
01 | Adjustment of leg length compensation and heel height

Initial situation: Load line is too far in front of the knee center of rotation; heel does not have floor contact.

Possible main causes: Pes equinus

Proposed design characteristics and design: Heel lift added to shoe

Adjustment option: Set heel height so that the load line in physiological terms (~15 mm) is in front of the knee joint.

Shape of the spine and body centerline must be checked.
02 | Adjustment of the upper ankle joint angle in the sagittal plane

Initial situation
Load line is behind the knee center of rotation

Possible main causes
Insufficiency of the calf muscles

Proposed design characteristics and design
Ankle-foot orthosis
- Frontal support element
- Soft heel
- Forefoot with resistance

Adjustment option
Set dorsal stop so that the load line in physiological terms (~ 15 mm) is in front of the knee joint
02 | Adjustment of the upper ankle joint angle in the sagittal plane

- Leg not capable of bearing load
- Minor insufficiency of the knee extensors
- Ankle-foot orthosis
  - Ventral support element
  - Soft heel
  - Forefoot with resistance
- Set dorsal stop so that the load line is 20 to 35 mm in front of the knee center of rotation
02 | Adjustment of the upper ankle joint angle in the sagittal plane

Initial situation

Leg not capable of bearing load

Possible main causes

Insufficiency of the knee extensors

Proposed design characteristics and design

Knee-ankle-foot orthosis
- Ventral support on the thigh
- Ventral and dorsal support on the lower leg
- Free motion knee joint, set to the posterior
- Soft heel
- Possibly forefoot with resistance

Adjustment option

Set dorsal stop so that the load line is 40 to 60 mm in front of the knee center of rotation
**02 | Adjustment of the upper ankle joint angle in the sagittal plane**

**Initial situation**
- Leg not capable of bearing load

**Possible main causes**
- Insufficiency of the extensor chain

**Proposed design characteristics and design**
- Knee-ankle-foot orthosis
  - Dorsal support on the thigh
  - Ventral support on the lower leg
  - Foot with heel support
  - Locked knee joint, E-MAG Active or C-Brace

**Adjustment option**
- The knee angle has already been corrected. Set dorsal stop so that the load line in physiological terms is in front of the knee center of rotation. A physiological alignment is indicated in connection with the C-Brace. If necessary, the load line must be further advanced in order to achieve the necessary stabilization of the knee.
02 | Adjustment of the upper ankle joint angle in the sagittal plane

**Initial situation**
- Load line is far in front of the knee center of rotation

**Possible main causes**
- Insufficiency of the calf muscles

**Proposed design characteristics and design**
- Ankle-foot orthosis
  - Ventral support element
  - Stiff heel
  - Forefoot with little resistance

**Adjustment option**
- Set knee angle so that the load line in physiological terms (~ 15 mm) is in front of the knee joint
03 | Adjustment of the knee joint angle in the sagittal plane

- **Initial situation**: Leg not capable of bearing load
- **Possible main causes**: Insufficiency of the extensor chain
- **Proposed design characteristics and design**: Knee-ankle-foot orthosis
  - Dorsal support on the thigh
  - Ventral support on the lower leg
  - Foot with heel support
  - Locked knee joint, E-MAG Active, or C-Brace
- **Adjustment option**: Set knee angle so that the load line in physiological terms (~ 15 mm) is in front of the knee joint
03 | Adjustment of the knee joint angle in the sagittal plane

Initial situation

Knee joint is hyperextended, load line is far in front of the knee center of rotation

Possible main causes

Insufficiency of the knee extensors

Proposed design characteristics and design

Knee-ankle-foot orthosis
- Ventral support on the thigh
- Dorsal support on the lower leg
- Soft heel
- Free-motion knee joint (pushed back if necessary)

Adjustment option

Set knee angle so that the load line is 40 to 60 mm in front of the knee center of rotation
04 | Adjustment of the knee angle in the frontal plane

Initial situation
- Load line is medially next to the knee center

Possible main causes
- Genu varum

Proposed design characteristics and design
- Knee orthosis or knee-ankle-foot orthosis
  - Valgus 3-point principle

Adjustment option
- Correct knee axis until the load line in physiological terms (~ 20 mm) is laterally next to the knee center
04 | Adjustment of the knee angle in the frontal plane

Initial situation

Load line is far laterally next to the knee center

Possible main causes

Genu valgum

Proposed design characteristics and design

Knee orthosis or knee-ankle-foot orthosis
  • Varus 3-point principle

Adjustment option

Correct knee axis until the load line in physiological terms (~ 20 mm) is laterally next to the knee center
05 | Adjustment of the foot position in the frontal plane

Initial situation

Possible main causes

Proposed design characteristics and design

Adjustment option

AFO example

KAFO example

Load line is medially next to the knee center, knee axis cannot be corrected or has already undergone maximum correction.

Genu varum

Lateral wedge

Set lateral wedge in such a way that the load line in physiological terms (~ 20 mm) is laterally next to the knee center.
## Adjustment of the foot position in the frontal plane

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Load line is far laterally next to the knee center, knee axis cannot be corrected or has already undergone maximum correction.
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