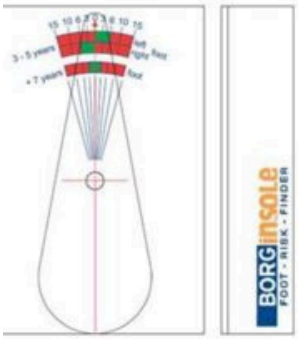
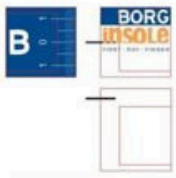
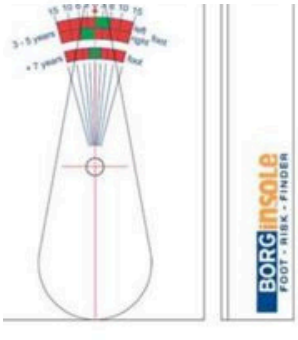
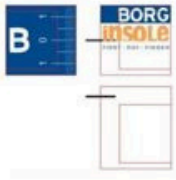
BORGinsole measurement devices









Protocol Biomechanical Measurements

Measurements in spine position

1. Hip flexion with extended Knee

- Patient on examination table in spine position
- Podiatrist is positioned at the leg in question
- Podiatrist places the digital 'Hip-Angle-Finder' on tibia of patient
- Starting from the spine position, the podiatrist lifts the stretched leg as high as possible and measures the angle between tibia and examination table

⚠ Maximum strain M. Hamstrings = when compensation starts to happen = when the other leg starts to rise off the table

✓ 80° -90° flexion

2. Internal and external rotation of the Hip: Hip in extension

- Patient on examination table in spine position
- Podiatrist seated on stool near the patient's feet
- Podiatrist positions 1 hand on distal 1/3 of lower leg and turns the patient's leg towards maximal internal and external rotation

⚠ Allow the leg to rotate just above the table, do not lift

⚠ Make sure the pelvis remains on the table and doesn't rotate along with the leg

- With the other hand, the podiatrist positions the 'Hip-Angle-Finder' parallel to and with the patella (= reference point) and measures the hip's mobility during internal and external rotation

✓ 35° internal rotation and 35° external rotation

3. Internal and external rotation of the Hip: Hip in flexion

- Patient on examination table sitting upward
- Podiatrist seated on stool near the patient's feet
- Podiatrist positions 1 hand on distal 1/3 of lower leg and turns the patient's leg towards maximal internal and external rotation

⚠ Allow the leg to rotate just above the table, do not lift

⚠ Make sure the pelvis remains on the table and doesn't rotate along with the leg

- With the other hand, the podiatrist positions the 'Hip-Angle-Finder' parallel to and with the patella (= reference point) and measures the hip's mobility during internal and external rotation

✓ 35° internal rotation and 35° external rotation

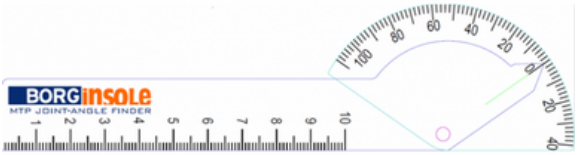
Measured with: digital Hip-Angle-Finder

4. Dorsal flexion Metatarsal-Phalangeal Joint 1

- Patient on examination table sitting upward
- Podiatrist seated on stool near the patient's feet
- Podiatrist positions 1 leg of the BORGinsole 'MTP Joint-Angle-Finder' parallel with metatarsal 1 and positions the other leg parallel with the hallux so the centre of rotation is located at Metatarsal-phalangeal joint 1 height
- Podiatrist exercises maximal dorsal flexion on the Metatarsal-phalangeal joint 1 and determines the degree of mobility

minimum of 65° dorsal flexion

Measured with: MTP Joint-Angle-Finder



Can be used for different things

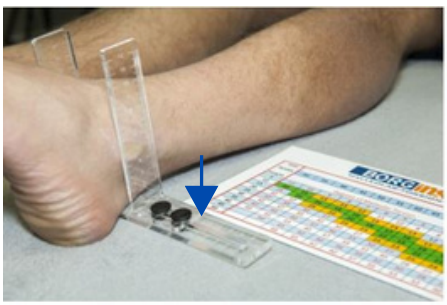
(e.g. measuring heel height)

5. Malleolar torsion

- Patient on examination table in spine position, with hip in neutral position
- Podiatrist seated near the patient's feet on stool
- Podiatrist positions the patella parallel with the examination table
- Podiatrist positions the BORGinsole 'Malleolar-Torsion-Finder' underneath the ankle at medial and lateral malleolar height
- Podiatrist indicates centre of the medial and lateral malleolar
- Podiatrist calculates the difference in height (medial is usually higher) (Height)
- Podiatrist determines the width of the ankle (Width)

The degree of malleolar torsion is determined by the chart based on the degrees of Height and Width

Reference range = 18° exorotation



Measurements in prone position

6. Subtalar joint (STG): supination (inversion) and pronation (eversion)

- Patient in prone position, feet hanging off of the examination table
- Podiatrist seated on stool near the patient's feet
- Podiatrist positions the calcaneum in the frontal plane of the patient
- Podiatrist draws the bisector from the centre of the calcaneum and the centre of the distal 1/3 of the lower leg

⚠ Always double-check your bisectors

- Podiatrist encloses the calcaneum with thumb and index finger, brings it to maximal inversion and eversion and determines the degrees in question off the BORGinsole 'Angle-Finder'

⚠ Do not allow the skin to move/stretch

- Podiatrist uses the other hand to position 1 leg of the BORGinsole Angle-Finder right above the bisector of the calcaneum and 1 leg right above the bisector of the lower leg so the centre of rotation lies at STG height, podiatrist then determines the degree of mobility

✓ Minimum of 20° supination and 10° pronation (always a 2 to 1 ratio)

Measured with: BORGinsole Angle-Finder

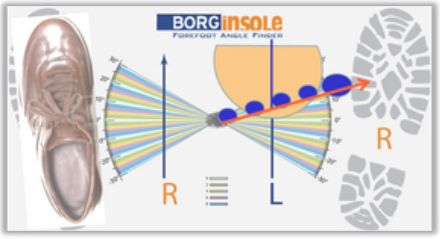
7. Midtarsal joint (MTG)

- Patient in prone position, feet hanging off of the examination table
- Podiatrist seated on stool near the patient's feet
- Podiatrist positions the calcaneum in the frontal plane of the patient (transversal plane of the podiatrist) and the STG in its neutral position
- Podiatrist positions the bisector of the calcaneum in the extension of the BORGinsole 'Forefoot-Angle-Finder's bisector and determines the degree of forefoot-rearfoot ratio at forefoot platform height.

- Positive (+) = forefoot varus = when the forefoot is inverted in relation to the rearfoot
- Negative (-) = forefoot valgus = when the forefoot is everted in relation to the rearfoot

✓ Reference range = 0°

⚠
- Palpate whether the supinator muscles aren't active during the examination and lead to a false or exaggerated Varus degree
- Additionally, you can bring the foot in a forced rearfoot supination and a forced forefoot pronation in order to eliminate the forefoot supinatus & to minimize influence of soft tissue



8. First ray (= Metatarsal 1 and os cuneiform 1): dorsal and plantar flexion mobility

- Patient in prone position, feet hanging off of examination table
- Podiatrist seated on stool near the patient's feet and brings the foot in neutral position
- Podiatrist grabs 1 cube and holds metatarsal 2 to 5 between index finger and thumb with one hand
- Podiatrist grabs the other cube and holds metatarsal 1 between index finger and thumb with the other hand and aligns them towards the other metatarsals as starting point for this measurement
- Podiatrist positions the BORGinsole 'First-Ray -Finder' on the aligned forefoot platform

⚠ Do not position the cubes too closely to each other. Otherwise the skin will be too tight and allow less movement.

- Podiatrist exercises a maximal dorsal flexion and plantar flexion with metatarsal 1 and then determines the mobility

⚠ Structural plantar = if dorsal flexion is not possible from alignment level in relation to other metatarsals

✓ Reference range = 5 mm dorsal and 6 mm plantar flexion mobility

Measured with: First-Ray-Finder

9. Talocrural joint (TCG): dorsal flexion with extended knee

- Patient in prone position, feet hanging off of examination table
- Podiatrist seated on stool near the patient's feet
- Podiatrist positions one arm of the BORGinsole 'Angle-Finder' centrally of the lower distal 1/3 of the lower leg and one arm parallel with the lateral side of the foot (metatarsal 5). Visually, the 90° angle between the foot and lower leg will now be used as starting point.
- Podiatrist exercises a maximal dorsal flexion of the TCG and determines the degree of mobility

- Objective= to measure the dorsal flexion mobility of the TCG and the muscle length of the M. Gastrocnemius

⚠ Do not push the forefoot in valgus in relation to the rearfoot. Preferably preserve a margin of moderate varus

✓ Reference range = a minimum of 10° dorsal flexion

10. Talocrural joint (TCG): dorsal flexion with knee in flexion

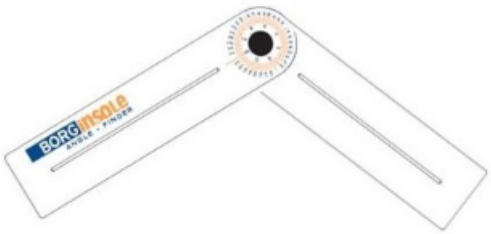
- Patient in prone position, knee in 90° flexion
- Podiatrist is standing at the patient's feet
- Podiatrist positions one arm of the BORGinsole 'Angle-Finder' centrally of the lower distal 1/3 of the lower leg and one arm parallel with the lateral side of the foot (metatarsal 5). Visually, the 90° angle between the foot and lower leg will now be used as starting point.
- Podiatrist exercises a maximal dorsal flexion of the TCG and determines the degree of mobility

⚠ Do not push the forefoot in valgus in relation to the rearfoot. Preferably preserve a margin of moderate varus

- Objective= to measure the dorsal flexion mobility of the TCG and the muscle length of the M. Soleus

✓ Reference range = 20° dorsal flexion

Measured with: Angle-Finder



Static measurements

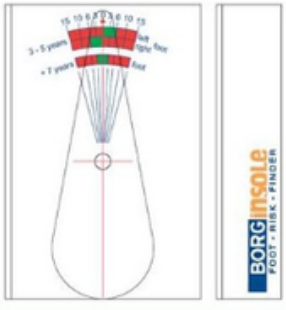
11. OCS (= Resting Calcaneal Stance)

- Patient is standing up in relaxed position: feet in normal gait angle and gait width (advice = 8 cm between both bisectors of the calcaneum)
- Podiatrist measures the angle between the bisector of the calcaneum and the horizontal plane with the BORGinsole 'Foot-Risk-Finder' and determines the angle

✓ Reference range = -2°/+2°

- Positive (+) = rearfoot varus = calcaneum is in inverted position in relation to the horizontal plane
- Negative (-) = rearfoot valgus = calcaneum is in everted position in relation to the horizontal plane

Measured with: Foot-Risk-Finder



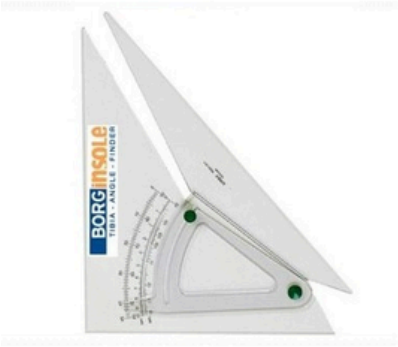
12. Tibia Position in OCS

- Patient is standing up in relaxed position: feet in normal gait angle and gait width (advice = 8 cm between both bisectors of the calcaneum)
- Podiatrist measures the angle between the bisector of the calcaneum and the horizontal plane with the BORGinsole 'Tibia-Angle-Finder' and determines the angle

Reference range = +7° Tibia Varum

In order to calculate the rearfoot angle in the database, this measurement is done in OCS

Measured with: Tibia-Angle-Finder



13. Knee Frontal in OCS

- Patient is standing up in relaxed position: feet in normal gait angle and gait width (advice = 8 cm between both bisectors of the calcaneum)
- Podiatrist positions one leg of the BORGinsole 'Angle-Finder' on the centre of the thigh and one leg on the centre of the lower leg so the centre of rotation is at knee height and the podiatrist can measure the angle in between
- Reference rage = 0°
  - Positive (+) = bow legs = genu varum
  - Negative (-) = knock knees = genu valgum

We use a formula in order to determine the acceptable OCS for children up to 7 years old

(Age x2) - 14

E.g. 4 years old: 4x2=8 -14= -6 acceptable OCS

14. Shoe and foot size finder

- You measure the inner size of the shoe
- Align the black part of the measuring device with the shoe's heelcup
- Push the ruler on top into the 'nose' of the shoe as far as possible without making it bend
- Read the number of millimetres
- You can determine the shoe size from the '3D Digitizer' or the 'BorgiMobi'

BORGinsole®
INTELLIGENT FOOT

Name: _____ First name: _____

Anamnese:

Limb Length: ☐ L ☐ R _____ mm shorter

Foot Length in mm: _____ **Recommended Shoe Size:** _____ **BORGinsole Last Size:** _____

BIOMECHANICAL ASSESSMENT

SPINE POSITION			Right	Normal	Left
Hip Flexion	Knee Extension			90°	
Hip Rotation	in Extension	Internal		35°	
		External		35°	
	in Flexion	Internal		35°	
		External		35°	
1st MTP	Dorsal Flexion			65°	
Mal Torsion				18°	

PRONE POSITION		Left	Normal	Right
STJ	Supination		20°	
	Pronation		10°	
MTJ	Forefoot - Rearfoot		0°	
1st Ray	Dorsal Flexion		5 mm	
	Plantar Flexion		6 mm	
	Struct Plant Flexion	☐		☐
Ankle Dorsal Flexion	Knee Extension		10°	
	Knee Flexion		20°	

STANCE POSITION	Left	Normal	Right
OCS		0°	
NCS		0°	
Tibia OCS		7°	
Knee Frontal Plane		0°	

DYNAMIC ANALYSIS	Speed:	Left	Normal	Right
Pre Heelcontact		In / Ev	In	In / Ev
Heelcontact		Sup/Pro	Pro	Sup/Pro
Midstance		Sup/Pro	Pro	Sup/Pro
Init Propulsion		Sup/Pro	Sup	Sup/Pro
Late Propulsion		Sup/Pro	Sup	Sup/Pro