

Assessment of foot posture

Outline

1. Lecture

Rationale for assessment of foot posture
Concepts of reliability and validity
Common clinical techniques
Foot Posture Index

2. Practical session

Foot Posture Index

References

Menz H (1998). Alternative techniques for the clinical assessment of foot posture. JAPMA; 88(3):119-129
Evans A et al (2003). Reliability of the foot posture index and traditional measures of foot position. JAPMA; 93(3): 203-213

Why do we quantify foot posture

As part of biomechanical assessment
determine the severity of a structural malalignment
As a risk factor for injury
Predictor and need to intervene
Cause and subsequent treatment
To guide prescription of foot orthoses

What makes an ideal measure

Easy and fast to use
Reliable
Consistency of a measurement
Between the same observer
Between different observers

Valid

Measures what it is intending to be measuring
Reflective of the position of the foot
Predicts dynamic function
Normal values clearly known

Common clinical techniques

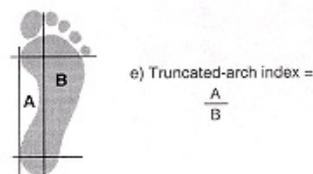
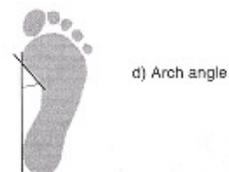
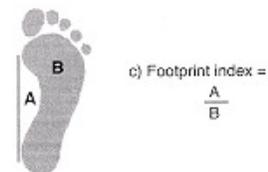
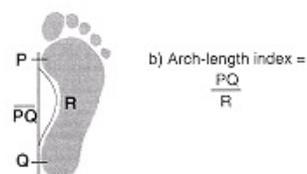
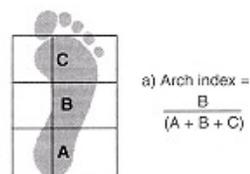
Arch height
Footprint indices
Navicular drop and drift
Rearfoot frontal plane motion
Foot Posture Index

Arch height

Low (planus), normal or high (cavus)
High arch associated with knee and back pain
Low arch associated with numerous pathologies such as fasciitis, Morton's neuroma and hallux-abducto valgus
Lack of normative 'values'
Reliability poor (Cowan et al., 1994)
Validity poor
Skin markings different to X-ray findings (Benink, 1985)
Doesn't predict dynamic function (Kernozek & Ricard, 1990; Nigg et al., 1993)

Footprint Indices

Structure and/or function of foot reflected in morphology of footprint
Numerous parameters measured
Reliable



Validity questionable

does not reflect

static foot posture (Hawes et al., 1992; Rose, 1991; McCrory et al., 1997)

dynamic rearfoot function (Atkinson-Smith & Betts, 1992; Knutzen & Price, 1994; Hamill et al., 1989)

Navicular drop

Plantar excursion of navicular in sagittal plane as foot moves from subtalar joint neutral position to resting position
10 mm or less considered normal (Brody, 1982)

Different foot sizes?

Reliable amongst experienced clinicians (Mueller et al., 1993; Sell et al., 1994)

Good validity

Majority of supination/pronation occurs at T-N joint (Lundberg et al., 1989; Winson et al., 1994)

Navicular drift

Medial excursion of navicular in sagittal plane as foot moves from subtalar joint neutral position to resting position
normal values unknown

Reliability – average (Vinicombe et al., 2001)

Validity

Majority of supination/pronation occurs at T-N joint (Lundberg et al., 1989; Winson et al., 1994)

Rearfoot frontal plane motion

Motion of the calcaneus/rearfoot in the frontal plane is a reflection of subtalar joint motion

Static weightbearing parameters

resting calcaneal stance position

neutral calcaneal stance position

rearfoot/leg orientation

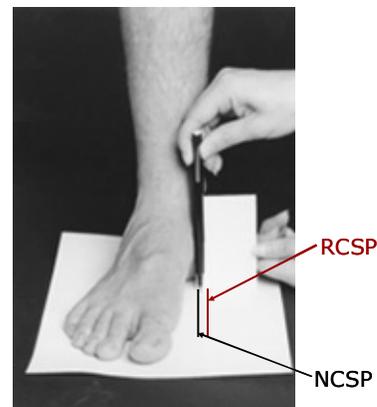
Resting and neutral calcaneal stance positions (RCSP/NCSP)

Bisect posterior aspect of calcaneus

Patient stands in base and angle of gait

The angle formed between the calcaneal bisection and the vertical with patient standing in a relaxed position (RCSP)

foot positioned in STJ neutral position (NCSP)



The alignment of calcaneus to the vertical is suggestive of STJ function

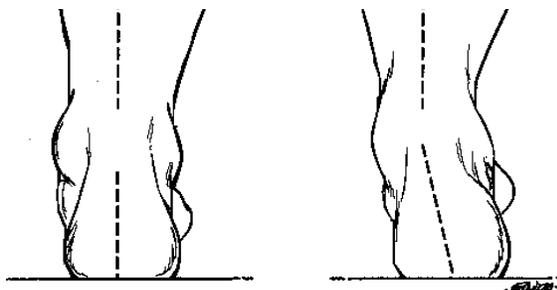
Theoretical normal values

NCSP = vertical (0-2°)

RCSP = 4-6° everted (Root et al., 1977)

larger differences between NCSP and RCSP suggest a more pronated foot

NCSP = 0° (vertical) RCSP = 10° (valgus)



Rearfoot/leg orientation

Bisections: Distal 1/3 of posterior aspect of leg and posterior aspect of calcaneus

Angle between these bisections as patient stands in NCSP and then on one leg (stimulate single support of gait)

RCSP

Increased valgus angulation of the rearfoot relative to the leg is associated with increased pronation at the STJ

Theoretical normal values: <14° (Michaud, 1993)

"Hyperpronation exists when the difference between NCSP and RCSP exceeds 14°" (Michaud, 1997)

To use or not use rearfoot bisections?

Reliability poor (Elveru et al., 1988; Freeman, 1990; Smith-Oricchio & Harris, 1990; Picciano et al., 1993)

Soft tissue displacement

Thickness of line

Goniometer placement

Validity questionable

Not reflective of dynamic function (Hamill et al., 1989)

Frontal plane rearfoot motion isn't STJ triplanar motion

Majority of population lack theoretical normal values

17% exhibit normal alignment (McPoil & Hunt, 1995)

Foot posture index (FPI) (Redmond, 2001)

A new technique to quantify foot posture in the transverse, sagittal and frontal planes

Eight criterion rated from -2 to +2 (highly supinated to highly pronated)

1. Talar head palpation
2. Symmetry of supra- & infra- malleolar curvature
3. Bowing of the Achilles tendon
4. Calcaneal frontal plane position
5. Prominence in the region of the talonavicular joint
6. Congruence of the medial longitudinal arch
7. Congruence of the lateral border of the foot
8. Abduction/adduction of the forefoot on the rearfoot

Cumulative score obtained ranging between -16 to +16

-16 to -7 highly supinated

-6 to -2 supinated

-1 to +4 normal

+5 to +9 pronated

+10 to +16 highly pronated

Reliability good (Evans et al., 2003)

Validity questionable (Scharfbillig et al., 2004)

Conclusion

Measures of foot posture (and biomechanical parameters in general) need to be;

Easy and fast to use

Reliable (intra-rater and inter-rater)

Valid

Normal values clearly known

Parameters to be familiar with

Arch height

Footprint indices

Navicular drop and drift

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