5th Ray - normal and abnormal function

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Articulations

Medial cuboid articulates with the lateral surfaces of the lateral cuneiform and the navicular

Medial surface of the base of the 5th articulates with the base of the 4th

4th and 5th metatarsal bases articulate with the anterior cuboid

Posterior cuboid articulates with the anterior calcaneus

Angle of Declination

5th ray

Declination angle allows dorsiflexion of 5th metatarsal head (Valmassey 1996)

Perry (1992) – 5th metatarsal head receives between 5 - 45% of pressure received by the heel, half that received by the 3rd metatarsal head during forefoot loading.

Why?
Why?

Carravaggi et al (2010) – dorsiflexion of tarso-metatarsal joints absorbs vertical forces arising at early stance/forefoot loading (esp. during higher walking speeds)

Structure of 5\textsuperscript{th} met/cuboid and 3\textsuperscript{rd} met/cuneiform joints

- Bounded laterally by 2\textsuperscript{nd} and medially 4\textsuperscript{th} metatarsals and posteriorly by lateral cuneiform.
- Bounded by cuboid posteriorly and 4\textsuperscript{th} metatarsal medially.
Range of motion

- Clinically $5^{\text{th}}$ met/cuboid joint has larger ROM than $4^{\text{th}}$ met/cuboid joint
- $4^{\text{th}}$ met/cuboid joint has a larger ROM than $3^{\text{rd}}$ met/cuneiform joint
- $3^{\text{rd}}$ met/cuneiform joint has a larger ROM than the $2^{\text{nd}}$ met/cuneiform joint
- $1^{\text{st}}$ met/cuneiform joint has a larger ROM than the $2^{\text{nd}}$ met/cuneiform joint
Dorsiflexion of 5th Metatarsal

• Bojsen Moller (2000) – tightening lateral division of plantar fascia

• Clinically, extending digits in a sequential/adaptive order to the supporting surface

Range of motion

Acts as series of adjustable levers that facilitate a controlled transfer of body weight from the lateral aspect of the foot to the medial.
Abnormal Function

• If the condition of a plantar flexed 5\textsuperscript{th} metatarsal exists then the ground reaction force of lateral forefoot strike will not be transmitted in an initial dorsal direction but the 5\textsuperscript{th} metatarsal head will become a fulcrum for medial weight transfer and possibly not the 3\textsuperscript{rd} metatarsal which has greater dorsiflexion stiffness.
Plantarflexed 5th ray

- Clinically in this case pronation speed and direction (velocity) at the subtalar joint and the mid tarsal joints will be increased as the 5th ray reaches the end range of motion early during lateral forefoot contact post heel strike.
Intervention

• Insole – 5th metatarsal head cut out to allow for position
• Orthoses – incorporating 5th metatarsal head cut out to allow for position and chronic tissue changes e.g. deltoid ligament and ‘spring’ ligament attenuation
• Strengthening exercises for lower limb muscle groups resisting internal rotation/pronation motion
• Mobilisation intervention for 5th metatarso-cuboid/calcaneo-cuboid joint to return ROM if possible