The primary function of the ankle and foot is to absorb shock and impart thrust to the body during walking.

OSTEOLGY

- The term ankle refers primarily to the talocrural joint, but also includes two related articulations: the proximal and distal tibiofibular joints.
- The term foot refers to all the structures distal to the tibia and fibula.
Osteology

- **Rearfoot** - talus, calcaneus, talocrural joint.
- **Midfoot** - tarsals, transverse tarsal joint, distal intertarsal joints.
- **Forefoot** - metatarsals, phalanges.
Torsion angle of the Tibia

In adults, the distal end of the tibia is twisted about its long axis about 20 to 30 degrees relative to its proximal end.

• Slight externally rotated position
• The twist of the leg is referred to as lateral tibial torsion, based on the orientation of the bone’s distal end relative to its proximal end.
Talus

- The talus is the most proximal tarsal bone.
- Its dorsal or trochlear surface is a rounded dome, convex anterior-posteriorly and slightly concave medial-laterally.
- In the adult, the long axis of the neck of the talus positions the head about 30 degrees medial to the sagittal plane.
- Children: 40 to 50 degrees-inverted
The major joints of the ankle and foot are the talocrural, subtalar, and transverse tarsal joints.
Terminology for Motions and Positions

A. Fundamental movement definitions

- **Abduction/Adduction**: (vertical axis)

B. Applied movement definitions

- **Pronation**: Eversion abduction dorsiflexion
- **Supination**: Inversion adduction plantar flexion

**Eversion/Inversion**: (AP axis)

**Dorsiflexion/Plantar Flexion**: (ML axis)
The **distal tibiofibular joint** is formed by the articulation between the medial surface of the distal fibula and the fibular notch of the tibia.

The **interosseous ligament** provides the strongest bond between the distal end of the tibia and fibula.
The talocrural joint is the articulation of the trochlear (dome) and sides of the talus with the rectangular cavity formed by the distal end of the tibia and both malleoli.
The confining shape of the talocrural joint provides a major source of natural stability to the ankle.
Medial collateral Ligaments

- The medial collateral ligament of the talocrural joint is called the **deltoid ligament**, based on its triangular shape.
- The deltoid ligament is strong and expansive.
- The primary function of the deltoid ligament is to **limit eversion** across the talocrural, subtalar, and talonavicular joints.
The lateral collateral ligaments of the ankle include the anterior and posterior talofibular and the calcaneofibular ligaments.
The Anterior talofibular ligament attaches to the anterior aspect of the lateral malleolus, then courses anteriorly and medially to the neck of the talus.

Anterior talofibular ligament is the most frequently injured of the lateral ligaments.

Injury is often caused by excessive inversion or (horizontal plane) adduction of the ankle.
The **Calcaneofibular ligament** courses inferiorly and posteriorly from the apex of the lateral malleolus to the lateral surface of the calcaneus.

Calcaneofibular ligament **resists inversion** across the talocrural and subtalar joints.
lateral collateral Ligaments

- The calcaneofibular and anterior talofibular ligaments together limit inversion throughout most of the range of dorsiflexion and plantar flexion.
The posterior talofibular ligament originates on the posterior medial side of the lateral malleolus and attaches to the lateral tubercle of the talus.

The primary function of the posterior talofibular ligament is to stabilize the talus within the mortise.

In particular, it limits excessive abduction of the talus, especially when the ankle is fully dorsiflexed.
The ankle 2
Osteokinematics

- The talocrural joint possesses one degree of freedom.
Arthrokinematics
Progressive Stabilization of the Talocrural Joint Throughout the Stance Phase of Gait
The subtalar joint, as its name indicates, resides under the talus.
The **subtalar joint** is the set of articulations formed by the posterior, middle, and anterior facets of the calcaneus and the talus. The prominent posterior articulation of the subtalar joint occupies about 70% of the total articular surface area.
Ligaments

- The interosseous(talocalcaneal) and cervical ligaments provide the strongest connective tissue bond between the talus and calcaneus.
- The interosseous and cervical ligaments limit the extremes of all motions-most notably inversion.
Osteokinematics and Arthrokinematics

ABDUCTION/ADDUCTION (Vertical axis)

EVERSION/INVERSION (AP axis)

DORSIFLEXION/PLANTAR FLEXION (ML axis)

EVERSION/INVERSION (AP axis)

Subtalar joint

Medial view

Superior view

Neutral

PRONATION: Main components EVersion AND ABduction

SUPINATION: Main components INversion AND ADDUCTION
The transverse tarsal joint, also known as the midtarsal joint, consists of two anatomically distinct articulations: the talonavicular joint and the calcaneocuboid joint.
Transverse tarsal joint
The talonavicular joint (the medial compartment of the transverse tarsal joint) resembles a ball-and-socket joint, providing substantial mobility to the medial (longitudinal) column of the foot.

The talonavicular joint consists of the articulation between the convex head of the talus and the continuous, deep concavity formed by the proximal side of the navicular bone and ("spring") ligament.
The spring ligament is a thick and wide band of collagenous connective tissue. Spanning the gap between the sustentaculum talus of the calcaneus and the medial-plantar surface of the navicular bone. The surface of the spring ligament that directly contacts the head of the talus is lined with smooth fibrocartilage.
The calcaneocuboid joint is the lateral component of the transverse tarsal joint, formed by the junction of the anterior (distal) surface of the calcaneus with the proximal surface of the cuboid.
By passing perpendicularly to the calcaneocuboid joint, the plantar ligaments provide excellent structural stability to the lateral side of the foot.
kinematics
Transverse tarsal joint: Longitudinal axis

ABDUCTION/ADDUCTION  
(Vertical axis)

<15°

EVERSION/INVERSION  
(AP axis)

DORSIFLEXION/PLANTAR FLEXION  
(ML axis)

EVERSION/INVERSION  
(AP axis)

A

Medial view

B

Superior view

C

Neutral

D

PRONATION: Main component  
 EVERSION

E

SUPINATION: Main component  
 INVERSION

Transverse tarsal joint: Oblique axis

ABDUCTION/ADDUCTION  
(Vertical axis)

52°

EVERSION/INVERSION  
(AP axis)

DORSIFLEXION/PLANTAR FLEXION  
(ML axis)

EVERSION/INVERSION  
(AP axis)

F

Medial view

G

Superior view

H

Neutral

I

PRONATION: Main components  
ABDUCTION AND DORSIFLEXION

J

SUPINATION: Main components  
ABDUCTION AND PLANTAR FLEXION
Medial longitudinal arch of the foot

• The characteristic concave in-step at the medial side of the foot is maintained primarily by the medial longitudinal arch.
• The keystone of this arch is located near the talonavicular joint.
• The medial longitudinal arch is the primary load-bearing and shock-absorbing structure in the foot.
• The bones that contribute to the medial arch are the calcaneus, talus, navicular, cuneiforms, and three medial metatarsals.
Pes planus

Normal arch

Dropped arch
The primary function of these joints is to provide stability across the midfoot by formation of the transverse arch.
Distal intertarsal joints

Cuneonavicular joints
- The major function of the cuneonavicular joints is to help transfer pronation and supination movements distally through the medial midfoot to the forefoot.

Cuboideonavicular joints
- Transferring pronation and supination movements across the more proximal regions of the midfoot.

Intercuneiform and cuneocuboid joint complex
- The intercuneiform and cuneocuboid joint complex forms the transverse arch of the foot.
- This arch provides transverse stability to the midfoot.
- Under the load of body weight, the transverse arch depresses slightly, allowing body weight to be shared across all five metatarsal heads.
Tarsometatarsal joints
Intermetatarsal joint

Epicondyle

Medial capsular ligament (cord portion)

Plantar plate and sesamoids
Thank You!