

TOPIC OUTLINE 4 – LOWER LEG, ANKLE AND FOOT.

Introduction.

The foot and ankle are the focal point to which the total body weight is transmitted in ambulation, and they are well tailored to that function. The thickening of fat/muscle found at the heel and toes act as shock absorbers, and the joints in the foot are capable of the adjustments necessary for fine balance on a variety of terrain.

Due to the concentrated stress these joints are under, static deformities that don't often affect other body parts occur in the foot and ankle. Moreover, the foot is subject to a high incidence of general systemic conditions, ranging from vascular to degenerative processes.

Since the foot brings the human into immediate and direct physical contact with their environment, its constant exposure and susceptibility to injury necessitates an artificial protection – the shoe. Therefore a complete physical examination of the foot and ankle should involve an observation of the patient's footwear as they can contribute to injuries of the feet.

Initial Regional Inspection.

Factors to consider during your observation of the foot and ankle include;

- Stance, Pes Cavus/Planus
- Gait, Antalgic, Foot drop
- Scars, Surgical/traumatic
- Deformities, Hallux Valgus, Tailor's bunion, Hammer toe, Claw toe, Mallet toe.
- Skin lesions, blisters, ulcers, warts, fungus
- Atrophy, especially gastrocnemius
- Swelling, difference between local/general swelling, bilateral/unilateral swelling.

Ref: (Passor Musculoskeletal Physical Examination Competencies Lists 2000 – 2001).

Palpable Structures – Bony Structures.

MEDIAL ASPECT.

- 1st Interphalangeal Joint
- 1st Metatarsophalangeal Joint
- Metatarsocuneiform Joint
- Cuneiform
- Navicular Tubercle
- Head of the Talus
- Medial Malleolus
- Sustentaculum Tali

- Medial Tubercle of the Talus

LATERAL ASPECT

- 5TH Interphalangeal Joint
- 5th Metatarsophalangeal Joint
- Styloid Process of the 5th Metatarsal
- Cuboid
- Peroneal Tubercle
- Lateral Malleolus
- Sinus Tarsi
- Trochlear part of the Talus
- Inferior Tibio-Fibular Joint.

The bony palpation commences with the patient seated with the foot being examined resting on a cushion on the practitioners lap. If the patient is not comfortable the palpation can be carried out in a supine position.

1st Interphalangeal joint

The palpation begins at the tip of the great toe. Palpate proximally along the phalange and interphalangeal joint, through the soft tissue assessing for deformities, swelling and pain.

1st Metatarsophalangeal Joint

The palpation is continued proximally, until the 1st metatarsophalangeal joint is palpated. The margins of the joint is assessed as it can often be tender.

Assessments are made for deformities such as, hallux valgus and bunion formation, as well as possible pathologies, specifically gout and arthritis.

The palpation should also include an assessment of the 1st metatarsal, for bony irregularities.

Metatarsocuneiform Joint

The metatarsocuneiform joint is palpated as a depression at the proximal aspect of the 1st metatarsal.

The joint is a common site of discomfort, especially as it helps to maintain the medial longitudinal arch – the cuneiform acting as a “keystone”.

Medial Cuneiform

The proximal articulation of the metatarsocuneiform joint is the medial cuneiform. This bone is not commonly fractured other than a specific trauma. It is often tender on palpation due to inflamed tendons which over lie this bone. The bone is therefore assessed for tenderness as well as its relative position with its other articulations.

Navicular Tubercle

Proximal to the cuneiform is the bony landmark of the navicular tubercle. The tubercle is the attachment point of the spring ligament.

The navicular bone is also assessed for position, as it is commonly subluxed due to a dropped medial longitudinal arch.

Head of the Talus

Proximal to the navicular tubercle the talonavicular joint is palpated. The proximal aspect of the joint is comprised of the head of the talus. The head of the talus is assessed for positional dysfunction.

Medial Malleolus

Posterior and superior to the head of the talus is the prominent medial malleolus, which is the distal landmark of the tibia.

The margins are assessed for tenderness, swelling and pain as the medial collateral ligament attaches on the malleolus.

Sustentaculum Tali

A difficult landmark to palpate - which may be easier, with the foot everted. Approximately 3cm inferior to the medial malleolus the sustentaculum tali is palpable.

The sustentaculum tali is a landmark of the calcaneus and is the posterior attachment of the spring ligament.

Medial Tubercle of the Talus

Palpate anterior and slightly superior from the sustentaculum tali to the medial tubercle of the talus. The tubercle is the attachment point of the medial collateral ligament.

5th Interphalangeal Joint

On the lateral aspect of the foot, the palpation is begun with the phalanges and the interphalangeal joint of the 5th digit. Assessments are made for alignment and tenderness.

5th Metatarsophalangeal Joint

Taylor's bunion is a common condition located at the 5th metatarsophalangeal joint. Irritation and inflammation of the bursa over the joint is the predisposing factor to Taylor's bunion. Poor foot wear is a common aggravating factor.

Styloid Process of the 5th Metatarsal

Palpate proximally from the 5th MTP joint, assess the 5th metatarsal for bony irregularities and tenderness.

The proximal end of the metatarsal bone is an enlargement for muscular insertion. This enlargement is known as the styloid process.

Cuboid

Immediately proximal to the styloid process is a depression, the floor of which is the cuboid.

The cuboid can often drop anteriorly or inferiorly because of its weight bearing importance as it supports the lateral longitudinal arch of the foot.

Peroneal Tubercle

Proximal to the cuboid, on the lateral aspect of calcaneus, a tubercle inferior and posterior to the lateral malleolus is palpated. The tubercle separates the peroneal muscles. Peroneus brevis passes superior to the tubercle, whereas the longus passes inferior.

Lateral Malleolus

Superior to the tubercle, the lateral malleolus is palpated.

The margins are palpated for tenderness and pain, as the collateral ligaments attach here.

Sinus Tarsi Region

Anterior to the lateral malleolus a depression should be palpated. This depression is the sinus tarsi.

The sinus tarsi is a depression in which the belly of extensor digitorum brevis lies. The anterior talofibular ligament and a fat pad is also found in this region.

Trochlear part of the Talus

On the anterior aspect of the ankle, approximately half way along an imaginary line between the two malleoli the trochlear aspect of the talus is palpated.

The ankle is dorsi and plantar flexed to assess range and quality of movement.

Inferior Tibio – Fibular Joint

Superior to the trochlear aspect of the talus, approximately 1cm above the imaginary line described above is the inferior tibio-fibular joint.

The region of the ankle is palpated by alternately dorsiflexing, plantarflexing, inverting and everting the foot. Freedom and quality of movement should be preserved, whilst crepitation is common, it is not necessarily a sign of dysfunction but the joint can suffer from osteoarthritis.

Interphalangeal Joints of the Middle Three Digits.

The middle three digits are contacted, and assessed as described for the 1st and 5th digit.

Metatarsal Bones of the Middle Three Joints

Palpate proximally to the MTP joints and assess the integrity of the 2nd to 4th metatarsal bones. These bones and specifically the second can be involved in stress fractures where prolonged, unsupported or violent walking/marching can lead to a spontaneous fracture of the shaft of the metatarsal.

Dome of the Calcaneus

On the hind foot the rounded part of the posterior calcaneus is palpated.

The posterior calcaneus is the point of the attachment of the Achilles tendon. The calcaneus can suffer injury, most commonly due to compressive trauma.

The dome is palpated for tenderness and special care is to assess the Achilles attachment.

Posterior Tubercle of the Calcaneus

The posterior tubercle is the attachment point of the Achilles.

Medial Tubercle of the Calcaneus

The medial tubercle of the calcaneus is located deep in the plantar fascia, and is found anterior and medial to the inferio-anterior projection of the calcaneus.

A common injury is a “heal spur”. This is a tractional force on the tubercle secondary to plantar fasciitis.

Sesamoid Bones.

On the plantar aspect, palpation to the inferior aspect of the 1st metatarsophalangeal joint is conducted. At this point a number of sesimoid bones may be palpated within the flexor tendons of the digits.

These bones are not commonly injured but may be inflamed resulting in sesamoiditis.

Palpable Structures – Soft Tissue Structures

The soft tissue palpable structures in this section are:

1. Gout and Bunions
2. Spring ligament
3. Medial Collateral ligament
4. Structures around the Medial Malleolus,
 - Tibialis Posterior
 - Flexor Digitorum
 - Posterior Tibial Artery
 - Tibial Nerve
 - Flexor Hallucis Longus
5. Tendons of the Dorsum of the Foot.
 - Tibialis Anterior
 - Extensor Hallucis Longus
 - Dorsalis Pedis Pulse
 - Extensor Digitorum Longus
6. Lateral Collateral Ligament
 - Anterior Talofibular Ligament
 - Calcaneofibular Ligament
 - Posterior Talofibular Ligament
7. Peroneal Tendons
8. Sinus Tarsi
9. Tailor's Bunion
10. Achilles Tendon
11. Calcaneal Bursa
12. Plantar Surface
13. Toes.

The soft tissue palpation commences as with the bony palpation. The patient is seated, with the foot being examined placed on a cushion resting on the practitioners lap.

Gout and Bunions.

As with the bony palpation, the examination begins by assessing the 1st metatarsophalangeal region. Assessments are made for deformities (possible bunion formation) and signs for local inflammation (extreme tenderness on palpation, swelling and redness) which may indicate the presence of gout.

Spring Ligament

The navicular tubercle is contacted. The region between the navicular tubercle and the sustentaculum tali is palpated. These are the attachment point of the spring ligament – also known as the Plantar Calcaneonavicular ligament. Assessments are made for tenderness and signs of inflammation.

Medial Collateral Ligament

The MCL is also known as the Deltoid ligament. The ligament originates from the medial malleolus and has 4 main parts:

- Posterior Tibiotalar Ligament
- Tibiocalcaneal Ligament
- Tibionavicular Ligament
- Anterior Tibiotalar Ligament

The margins of the medial malleolus are palpated to assess the ligament as a whole, examining for signs of inflammation.

Structures around the Medial Malleolus

There are 3 tendons, a nerve and an artery that pass posteriorly around the medial malleolus. They are situated from anterior to posterior in such a way so the phrase “ Tom, Dick an Harry “ can be used to remember them.

The structures are :

- Tibialis Posterior Tendon (Tom)
- Flexor Digitorum Tendon (Dick)
- Posterior Tibial Artery (a)
- Tibial Nerve (n)
- Flexor Hallucis Longus (Harry)

To palpate these structures individually, palpate posteriorly from the medial malleolus whilst applying resisted plantarflexion and inversion to find Tibialis posterior, then apply resisted toe flexion to find flexor digitorum.

Immediately posterior to this tendon the pulse of the posterior tibial artery should be palpable, with the un-palpable tibial nerve posterior to the artery.

To identify the tendon of flexor hallucis longus, resist flexion of the big toe whilst palpating posterior to the posterior tibial pulse.

Tendons of the Dorsum of the Foot

Crossing the dorsum of the foot are three tendons and an artery. From medial to lateral they are;

- Tibialis Anterior Tendon
- Extensor Hallucis Longus Tendon

- Dorsalis Pedis Artery
- Extensor Digitorum Longus Tendon

To palpate these structures individually, apply resisted dorsiflexion and inversion at the ankle and the prominent Tibialis Anterior tendon is palpable.

To palpate the Extensor Hallucis Longus tendon, the patient is asked to extend their big toe. This movement exposes the tendon.

Lateral to the tendon of EHL the dorsalis pedis pulse should be assessed (between the 2nd and 3rd metatarsals).

To palpate the extensor digitorum longus tendons, the patient is asked to extend and splay their toes. This movement exposes these tendons.

- the tendons in the previous two sections should be palpated as far towards the belly of the muscle and to the point of insertion as possible. The pulses should be assessed for rate, rhythm and amplitude- comparing with proximal and distal pulses to rule out an occlusion.

Lateral Collateral Ligament

The lateral collateral ligament is made up of three parts:

- Anterior Talofibular Ligament
- Calcaneofibular Ligament
- Posterior Talofibular Ligament

Palpate the margins of the anterior aspect of the lateral malleolus. The anterior talofibular ligament originates here and attaches to the talus, crossing the sinus tarsi. The path of the ligament is palpated assessing for tenderness and swelling. The anterior talofibular ligament is the most common ligament in the lower extremity to be injured, a sprain usually results in an “egg” shaped swelling over the sinus tarsi.

The calcaneofibular ligament is palpated from the inferior margin of the lateral malleolus to the lateral aspect of the calcaneus.

The posterior talofibular ligament is palpated from the posterior margin of the malleolus to the posterior aspect of the talus.

Peroneal Tendons

The peroneal tubercle is contacted, and the patient is asked to plantarflex and evert their foot against resistance. It is not possible to differentiate between the superior tendon of peroneus brevis and the inferior of peroneus longus, therefore they are palpated together.

Sinus Tarsi

The depression of the sinus tarsi is contacted. The belly of extensor digitorum brevis, a fat pad and the anterior talofibular ligament are found in this region. Assessments are made for a possible inflammatory process as the three above structures are pain sensitive.

Tailor's Bunion

Tailor's bunion is found on the 5th MTP joint, and is assessed as described above.

Achilles' Tendon

The posterior aspect of the calcaneus and the area where the Gastrocnemius and Soleus common tendon inserts is palpated. Assessments are made for swelling, tenderness and other signs of low grade inflammation often due to over training or incorrect footwear. The palpation is extended up and beyond the musculotendinous junction which is where most tendon ruptures occur.

Calcaneal Bursae

The retrocalcaneal and the calcaneal bursae are found at the attachment point of the Achilles tendon to the calcaneus.

The bursae are assessed for signs for inflammation.

Plantar Surface

The plantar surface of the foot is a common site of reported pain. Some causes include:

- Plantar fasciitis
- Heel Spurs
- Morton's Neuroma
- Verrucae
- Corns

Plantar Facitis

This is when the plantar fascia becomes inflamed possibly as a result of poor foot wear or altered foot biomechanics.

The plantar aspect of the foot is palpated assessing for signs of inflammation. The medial tubercle of the calcaneus is a common site for plantar fasciitis.

Heel Spurs

These are also known as calcaneal spurs. Heel spurs occur where the medial tubercle of the calcaneus becomes enlarged due to excessive traction of the plantar fascia.

Morton's Neuroma

This is a benign tumour of the digital nerve, often found between the 3rd and 4th digits. Morton's neuroma may result in pain on walking and altered sensation in the digits. Palpation reveals a mass between the metatarsal heads and a possible audible click on articulation.

Verrucae

These are extremely common and it is advisable to assess the feet before palpating. If the patient suffers with verrucae, use gloves.

Verrucae are caused by a virus which creates a plantar wart, which because of weight bearing grows inwards and is extremely painful. They are palpated as firm granular lesions which invade the surrounding skin grooves. Verrucae are extremely painful on palpation and if squeezed.

Corns

Corns are similar in appearance to verrucae, but are non viral and do not invade the skin grooves. Corns are not usually painful on palpation.

Toes

The soft tissue around the toes are palpated as described in the bony palpation, for tenderness and deformities.

Once the bony and soft tissue structures have been palpated, the active and passive range of movements are assessed.

Orthopaedic Assessment.

As with the examination of both the hip and knee, patients with ankle pain may not be able to carry out the required movements for a full assessment. Therefore the Osteopath must be able to adapt their examination to accommodate the patient. The asymptomatic ankle will be assessed first for ease, quality and range of movement as well as a comparison with the symptomatic ankle.

Normal Range of Movement.*

Dorsiflexion – 20°
Plantarflexion – 30°-50°
Inversion – 5°
Eversion – 5°
Adduction – 20°
Abduction – 10°

Ref (The Physiology of the Joints I.A.Kapandji – Vol. 2 Lower Limb)

* Normal range of movement is a rough guide, factors including age, occupation and foot biomechanics will alter these estimations.

Active Movements.

Weight bearing movements.

- Plantarflexion – Stand on toes
- Dorsiflexion – stand on heels
- Supination- Stand on the outside of the feet (this movement is a combination of inversion, adduction and planterflexion)
- Pronation – Stand on the inside of the feet (this movement is a combination of eversion, abduction and dorsiflexion)
- Flexion/Extension of the toes (assessing general mobility of the phalanges).

N.B. this examination can be carried out in a non-weight bearing posture with the patient supine/ sitting if they are unable to support their body weight.

Passive Movements.

This aspect of the examination is carried out with the patient in a supine position and their feet “ hanging” of the edge of the couch, allowing for full range of movements for the ankle.

- Plantarflexion- fixing the tib/fib articulation for pure movement
- Dorsiflexion- fixing the tib/fib articulation for pure movement
- Inversion/eversion- assessing sub- talar joint
- Abduction/ Adduction
- Flexion/ Extension of the phalanges.

Special Tests.

The special tests for the ankle would include tests to assess joint stability, in the form of ligamentous provocation tests.

Inversion or eversion sprains can stretch or tear the joints supporting ligaments and produce instability. Excessive inversion stress is the most common cause of ankle injury for 2 anatomical reasons.

1. The medial malleolus is shorter than the lateral, allowing the talus, when under stress to invert farther than it can evert.
2. The ligamentous thickening on the lateral side of the joint are separate, and are therefore not as strong as the deltoid ligament on the medial side.

The Anterior Talofibular Ligament.

This is the most common injured ligament in “ankle sprains”. To test the ligament, the patient is in a supine position and their ankle is plantar flexed and inverted. If this movement increases pain there is a possibility that the ligament is sprained or torn.

The Anterior Draw Test.

The combined plantar flexion and inversion movement may indicate the state of the ligament but not ankle joint stability. If the anterior talofibular ligament is torn the talus would be allowed to slide forward on the tibia, since the anterior talofibular ligament is the only structure preventing forward subluxation of the talus.

The anterior draw test assesses for instability of the talus on the tibia. The patient is seated with their legs dangling from the examination couch. The patient's foot is slightly plantar flexed. The practitioner places one hand on the anterior aspect of the lower tibia and grips the calcaneus in the palm of their other hand. The calcaneus (and talus) is drawn anteriorly while the tibia is pushed posteriorly. Excessive movement or an audible click may indicate joint instability due to an anterior talofibular ligament tear.

The Anterior Talofibular & Calcaneofibular Ligaments.

To produce gross instability of the lateral aspect of the ankle both these ligaments must be involved. To assess these ligaments, the patient is seated with their legs dangling from the examination couch. The practitioner then applies an inversion stress on the calcaneus. Localised pain and joint instability would be suggestive of ligamentous instability.

The Posterior Talofibular Ligament.

This ligament can be torn/sprained only in conjunction with the other lateral ligaments. For the posterior talofibular ligament to be involved a massive trauma such as a dislocation must be sustained. It is therefore not practical to assess this ligament as referral would be your course of action.

The Deltoid Ligament.

The stability of the deltoid ligament is assessed with the patient seated and their leg dangling from the examination couch. The practitioner stabilizes the patient's leg by contacting the tibia and calcaneus applying an eversion stress. Localised pain and gross gapping would be indicative of ligamentous instability.

Morton's Neuroma.

Along with callosities & warts a Morton's neuroma is a common finding in the feet. It can be described as a "fibrous thickening of the nerve due to friction, compression or mechanical strain."

A Morton's neuroma is found between the 3rd and 4th metatarsal heads. To test for this condition a direct compression is applied between the metatarsal heads. Localised pain and tenderness may indicate the presence of a Morton's neuroma.

All the above described special tests are recorded to what the patient reports, as well as the clinical finding from the practitioner.

N.B.

With most ankle injuries the practitioner would be unable to assess the joint in the acute phase as local pain, swelling and decreased range of motion would make an examination impossible. Advice can be given to the patient on management of their ankle (dependent on severity) and reassessed once the inflammation has subsided.