

## Clinical examination of the lower leg, ankle and foot

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### Referred pain

#### Pain referred to the foot

Pain referred from other structures (hip, sacroiliac joint, lumbar spine) is hardly ever experienced in the foot *alone*. Most commonly, it involves the foot and the ankle, with or without other parts of the lower limb. The question of referred pain only arises when the clinical examination of the foot is completely negative and the patient states that the foot pain is unaltered by walking.

#### Pain referred from the foot

Because the foot is a distally located part of the body, there is very little referred pain from lesions of the foot (following the

principles of referred pain). Therefore pain in foot or ankle usually points fairly accurately to the site of the lesion.

### History

Although the main question is the current problem – where the pain is now – it is best to try to obtain a chronological account, as summarized in [Box 55.1](#). In order to work out the problem systematically, the questions asked should follow the order given below.

- *When did the pain start?* Is the problem acute, subacute or chronic?
- *How did it start?* Was there an injury or not?

If there was an injury:

- What was the mechanism?
- What were the symptoms at that time? Pain? Swelling? Disability?
- What was their evolution over the following days?

If there was no injury:

- Did the pain come on suddenly or gradually?
- What brought the pain on? Nothing special? Overuse?

Sometimes there will be some evolution in degree and localization of pain, swelling and functional disability during the weeks or months after the onset.

The examiner should also find out what sort of treatment the patient has already had, and what the results were.

- *What has been the evolution since the onset?* No change? Gradually worse or gradually better? Ups and downs, with complete or no recovery between attacks? Do changes depend on exertion?
- *What sort of treatments did you have?*
- *What were the results?*
- *What are the problems now?*

## Box 55.1

## Summary of history taking

## What is the present complaint?

- Onset
- Trauma
- No trauma

## Evolution

- Better
- Worse
- Ups and downs

## Present complaints

- Site of pain
- Influence of movements
- Nocturnal pain
- Twinges
- Instability
- Swelling

The present complaints should be investigated further:

- *Where do you feel the pain now?* Posterior, middle or anterior segment? Medial, lateral or all over the joint(s)?
- *Is there pain at rest or during the night?* Pain at night indicates a high degree of inflammation.
- *Is there long-standing morning stiffness?* This also suggests a serious inflammatory disorder.
- *What brings the pain on?* Is there any pain during normal walking or normal running? Can you participate in your usual sports?

Because foot disorders cause pain while the foot is performing its function, walking or running will always be the provoking activities:

- *Is there equal pain on walking and standing?*
- *Can you walk on uneven surfaces?* Because walking upstairs and downstairs demands normal mobility of the ankle joint, it is worth asking if the patient can do so without problems.
- *Is the pain provoked by particular movements?*
- *Is the pain felt at the beginning of, during or after exertion?*
- *Does the pain depend on the sort of shoes you wear?* Sometimes an in-built wedge relieves or aggravates the pain. In Achilles tendinitis or plantar fasciitis, a raised heel with a horizontal surface relieves the stress on these affected tissues and therefore relieves the pain.

Further questioning should establish whether there are 'twinges' or instability:

- *Do you have twinges, and when?* A twinge in the foot is a very important symptom. It is a sudden, sharp pain, mostly occurring during walking. It should always be differentiated from 'giving way'. In a twinge, there is only momentary pain and not a feeling of instability. By the

time the patient realizes it, the pain has disappeared. A twinge is very often an indication of a momentary impaction of a loose body in the ankle or subtalar joint. If localized in the forefoot, it can be a symptom of Morton's metatarsalgia or sesamoiditis.

- *Do you have a feeling of instability? If so, describe it.* Real instability of the ankle or foot is only important in sports. Normal walking or even running on a flat surface hardly ever causes a feeling of giving way. In the occasional case where this does happen, it is the result of neurological weakness of the peronei muscles, rather than of a ligamentous lesion.

## Inspection

Inspection is first made in a standing position. The shape of the legs is evaluated: valgus or varus deformity is checked. The normal intermalleolar distance should not exceed 5 cm. A slight outward rotation of the tibiae is normal, with an outward pointing of the toes of about 15°. Exaggeration of this outward rotation can be caused by short calf muscles and results in a restricted step during walking and running.

The shape of the feet in a standing position is studied next. At the calcaneus there can be a valgus or varus deformity.

The longitudinal arch of the foot is then estimated: a cavus deformity or a flat foot may be identified. At the mid-tarsal region the shape and regularity of the bones is inspected and, at the forefoot, special attention is paid to the existence of an insufficient anterior arch, hallux valgus, claw toes, hammer toes or metatarsus inversus.

After inspection in the standing position, it is sometimes advisable to check the patient's gait and how the shoes have worn down.

Inspection in the supine-lying position gives information about contours, shape, atrophy, colour of the skin, swelling, oedema, haematoma, the condition of the skin and nails, and the existence of callosities.

Sometimes a second inspection in a standing position may follow the routine functional examination, when special attention should be paid to:

- Change of the shape of the foot during weight bearing, in relation to the shape when lying down
- Which part of the foot comes under abnormal strain
- Changes in the colour of the skin (redness on suspension and pallor on elevation point to arterial insufficiency).

## Functional examination



The foot is the most difficult moving part of the body to examine because a great number of strong structures, with little individual mobility, are condensed into a small volume. Testing each structure in turn without the help of a lever is a very difficult task and demands great technical and manual ability.

In the foot, the clinical tests consist of 18 movements (Box 55.2). Other than rising on tiptoe, the clinical examination is

## Box 55.2

**Summary of movements of the foot**

- Rising on tiptoe
- Two tests for the ankle joint
  - Plantiflexion
  - Dorsiflexion
- Three ligamentous tests
  - Mortice test
  - Inversion
  - Eversion
- Two tests for the subtalar joint
  - Varus
  - Valgus
- Six tests for the midtarsal joints
  - Plantiflexion
  - Dorsiflexion
  - Adduction
  - Abduction
  - Pronation
  - Supination
- Four resisted movements
  - Plantiflexion
  - Dorsiflexion
  - Inversion
  - Eversion

performed in the supine-lying position. Consecutively, the ankle joint, the subtalar joint, the midtarsal joints, the ligaments and the muscles are tested.

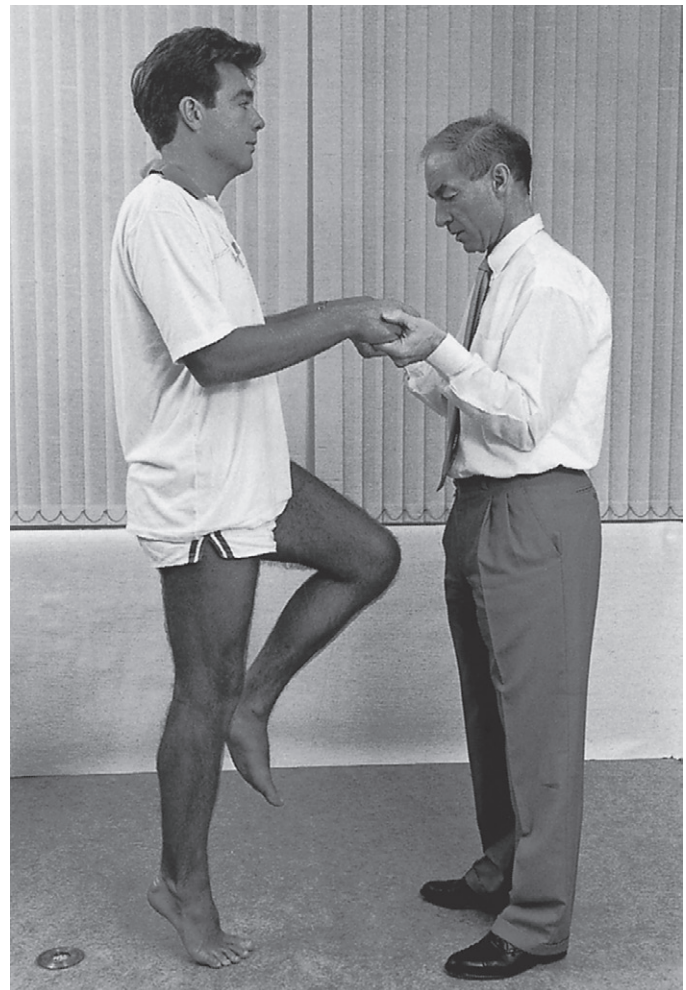
**Rising on tiptoe**

This movement (Fig. 55.1) is used to test the plantiflexor mechanism of the foot. If rising on tiptoe hurts and resisted eversion and inversion remain painless, the triceps surae muscles must be at fault. Because plantiflexion is almost entirely performed by the contraction of the triceps, rising on tiptoe will, in particular, test the integrity of triceps, the Achilles tendon and its insertion on the calcaneus. Note is taken of whether the movement is strong or weak, painless or painful.

If rising on tiptoe is painful, the following test distinguishes between the soleus and the gastrocnemius muscles. The patient lies prone and plantiflexion of the foot is resisted, first with the knee fully extended, then with the knee bent at a right angle. Flexing the knee relaxes both the gastrocnemii muscles but does not alter the pull at the soleus muscle. Hence abolition of pain when the muscle is tested during knee flexion incriminates the gastrocnemius muscle.

If rising on tiptoe is weak, a neurological lesion can be the cause. Apart from upper motor neurone lesions, peroneal atrophy and direct injury to the sciatic nerve, the common cause of painless weakness is a first and second sacral root palsy.

Rising on tiptoe is also very important in the diagnosis of Achilles tendon rupture. If the plantiflexor muscles are



**Fig 55.1** • Rising on tiptoe.

examined in the supine-lying position only, active plantiflexion is not found to be lost because the flexor hallucis longus, the flexor digitorum longus, the tibialis posterior and the peronei remain intact.

**Tests for the ankle joint**

The ankle joint is a simple joint, allowing, in normal circumstances, plantiflexion and dorsiflexion only. The range of movement is measured by estimating the angle joined by the longitudinal axis of the tibia and the dorsum of the foot.

**Plantiflexion**

Normally, an ankle can be plantiflexed until the dorsal aspect of the foot falls into line with the leg (Fig. 55.2). Plantiflexion is limited by the engagement of the heel via the Achilles tendon against the back of the tibia. Therefore the normal end-feel is soft.

**Dorsiflexion**

Normally, the ankle can be moved to reduce the angle between the dorsum of the foot and the tibia to less than 90°.



(a)



(b)

**Fig 55.2** • Passive plantiflexion (a) and dorsiflexion (b).

Occasionally, the range of dorsiflexion is limited by the length of the calf muscles. Therefore dorsiflexion is performed with the knee slightly bent so as to relax the gastrocnemii. In this position, the movement is brought to a stop by stretching of the posterior capsule of the joint and by bony engagement between the neck of the talus and the anterior margin of the tibial surface. The end-feel of normal dorsiflexion at the ankle is soft.

## Ligamentous tests at ankle and foot

### Lateral ligaments

To test the outer structures of the ankle and foot, the examiner performs a strong inversion movement during full plantiflexion. Inversion produces a combination of varus at the subtalar joint and adduction/supination at the forefoot. This test stretches all the structures at the outer and anterior side: the lateral ligaments of the ankle, the subtalar joint and the mid-tarsal joints, together with the tendons of the peroneal and the extensor digitorum longus muscles.

#### Technique

The ipsilateral hand of the examiner fixes the leg at the distal and medial side (i.e. the left hand of the examiner on the right leg of the patient). The contralateral hand is placed on the midfoot, so that the heel of the hand rests at the fifth metacarpal bone and the fingers encircle the medial border. The heel of the hand now presses the foot downwards and inwards. Meanwhile, supination is performed by an upward pulling of the fingers at the medial border (Fig. 55.3).

As there are considerable differences within individuals in the range of this movement, both sides should be compared. A note is made of the range of movement, the pain and the end-feel. The normal end-feel is soft.

### Medial ligaments

A combined test is used: full plantiflexion at the ankle joint, together with valgus at the subtalar joint and abduction-pronation at the midtarsal joint. These movements stretch the



**Fig 55.3** • Testing the lateral ligaments.

anterior and middle portion of the deltoid ligament, the anterior tibiotalar ligament and the calcaneonavicular ligament. At the outer side, however, the posterior talofibular ligament can become painfully squeezed.

#### Technique

With the contralateral hand, the examiner fixes the patient's lower leg at the distal and lateral side. The ipsilateral hand encircles the midfoot. The hand lies on the first metatarsal and the fingers encircle the lateral border. The hand forces the foot into plantiflexion and valgus. Meanwhile, the fingers provide a pronation movement (Fig. 55.4).

The thick deltoid ligament and the architecture of the midfoot make the foot very firm in this direction. Therefore, not much movement is achieved during this combined test. The normal end-feel is soft.

### Tibiofibular ligaments

A strong varus movement applied to the talus held in a neutral position forces this bone as a wedge between the two malleoli,

so testing the integrity of the distal tibiofibular ligaments. In a normal 'mortice', the strong tibiofibular and lateral collateral ligaments prevent separation of the tibia and fibula. When there is ligamentous rupture or laxity, the fibula can be pressed outwards, a circumstance that is detected by a palpable click when the tibia and the fibula engage after their momentary separation. In total rupture of the anterior talofibular or the calcaneofibular ligaments, this test will also be positive. Differentiation should then be made using the anterior drawer test (see p. 784).

#### Technique

The ipsilateral hand fixes the patient's leg at its inner side, just above the ankle. This position of the hand is important, both to give counterpressure and to detect the click when pressure is released. The contralateral hand grasps the foot at the heel and forces it into varus with a strong, quick thrust (Fig. 55.5).



Fig 55.4 • Testing the medial ligaments.



Fig 55.5 • Testing the tibiofibular ligaments (the 'mortice' test).

## Mobility of the subtalar joint

### Varus and valgus

In order to move the calcaneus on the talus, the examiner must try to avoid any movement at the ankle joint. Because the width of the trochlear surface of the talus is smaller posteriorly than anteriorly, the medial and lateral surfaces of the body of the talus are gripped tightly during dorsiflexion of the ankle. Therefore the ankle must be forced into and kept in full dorsiflexion during varus–valgus movements.

#### Technique

The heel is firmly grasped between the two hands, the fingers clasped behind the heel. Dorsiflexion is performed by traction on the heel (Fig. 55.6). Because the test involves a very strong joint, with little mobility, and because it is hardly possible to obtain any leverage, the examiner must keep the heel as steady as possible. By swinging the upper half of the body, it is possible to gain a good idea of the range of motion.

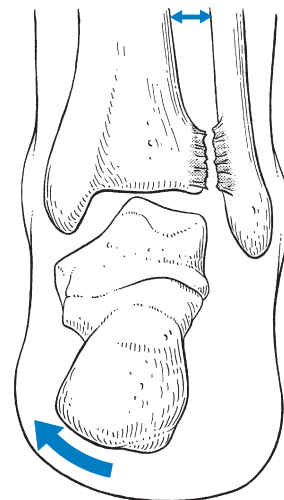
A normal varus–valgus range is between 20° and 45°. Mobility should always be compared with the other side and the normal end-feel is soft. The varus movement also tests the integrity of the calcaneofibular ligament.

## Passive tests for the midtarsal joints

### Flexion–extension, pronation–supination, abduction–adduction

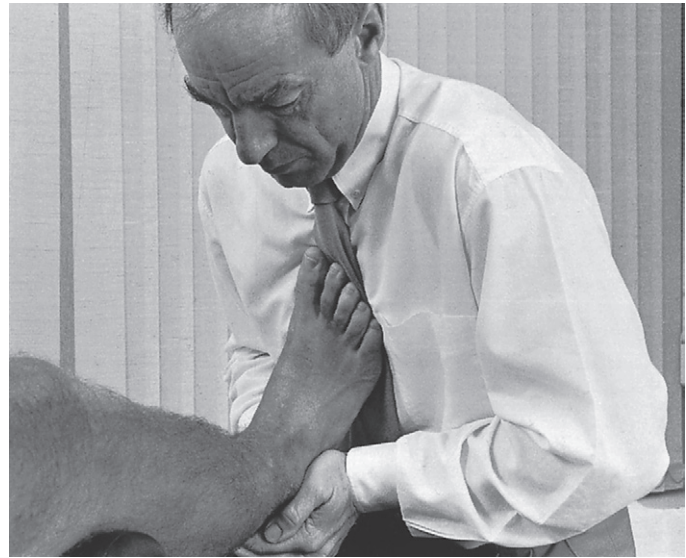
As the middle segment of the foot consists of several bones and joints, it is very difficult to assess isolated movement at the various joints. Therefore Cyriax considered the whole middle segment as one integrated structure – the midtarsal joint.

Because of anatomical characteristics, plantiflexion is often accompanied by some adduction and dorsiflexion by some abduction (see online chapter *Applied anatomy of the lower leg, ankle and foot*).



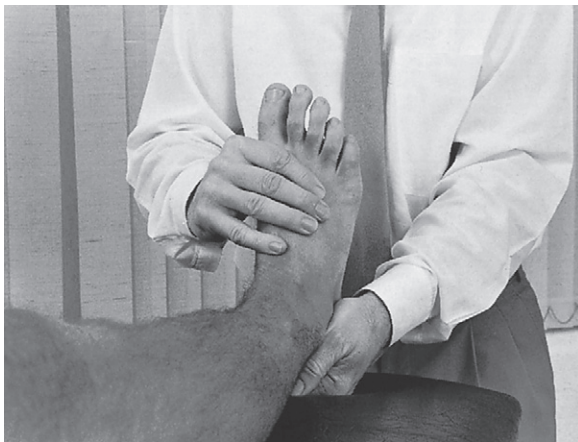


(a)

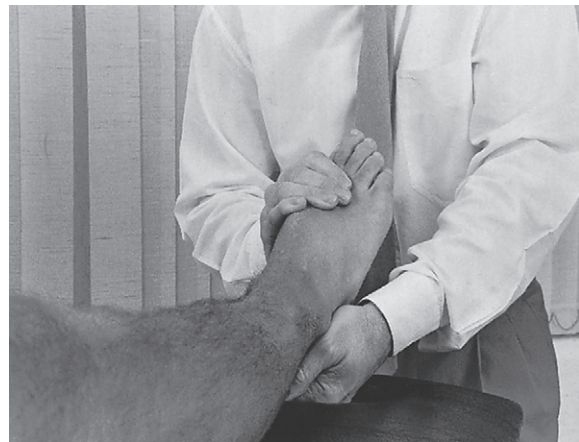


(b)

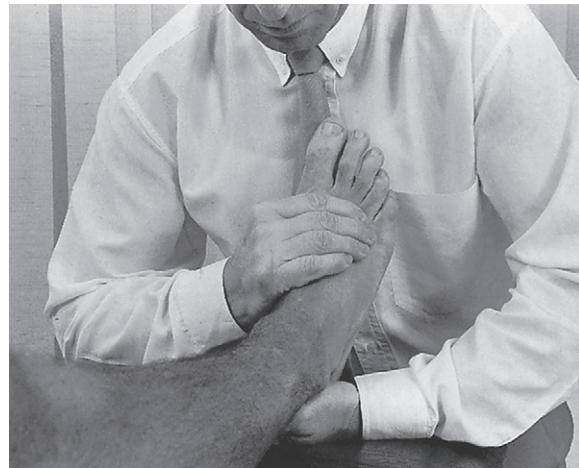
**Fig 55.6** • Varus (a) and valgus (b).



(a)

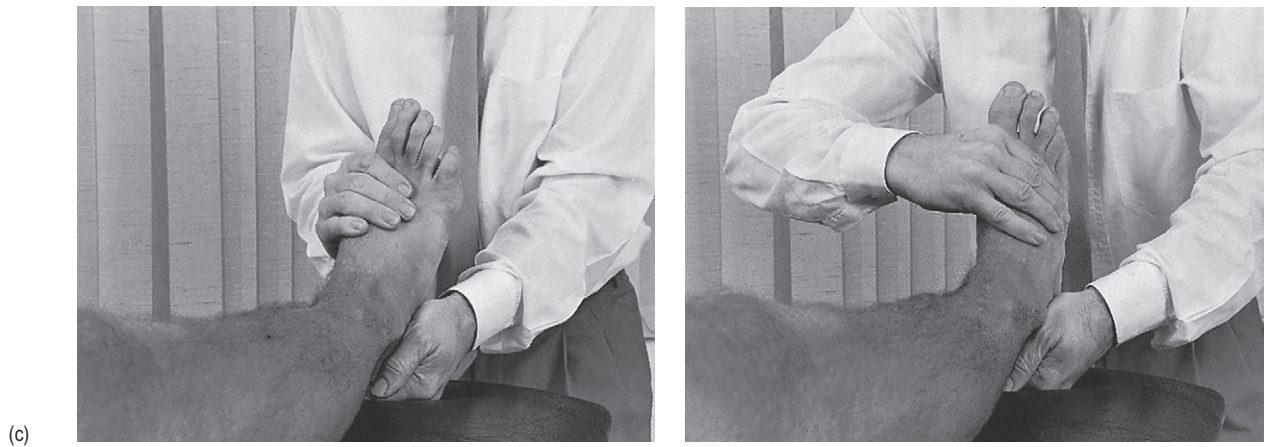


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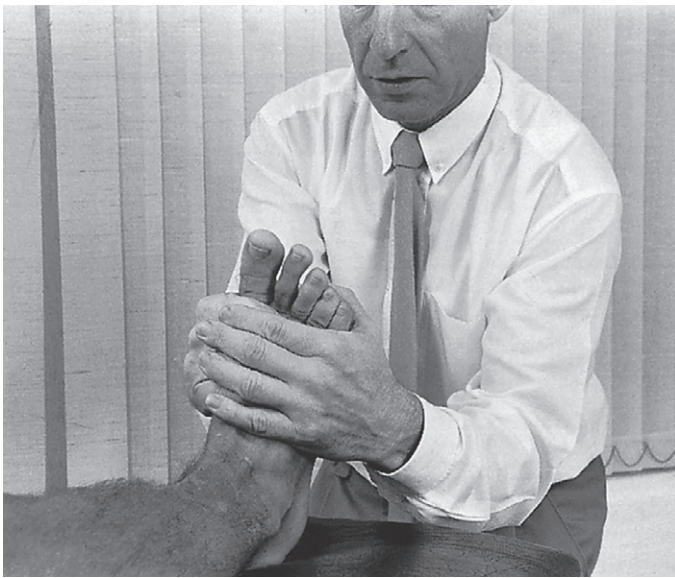


**Fig 55.7** • Extension and flexion (a), abduction and adduction (b).

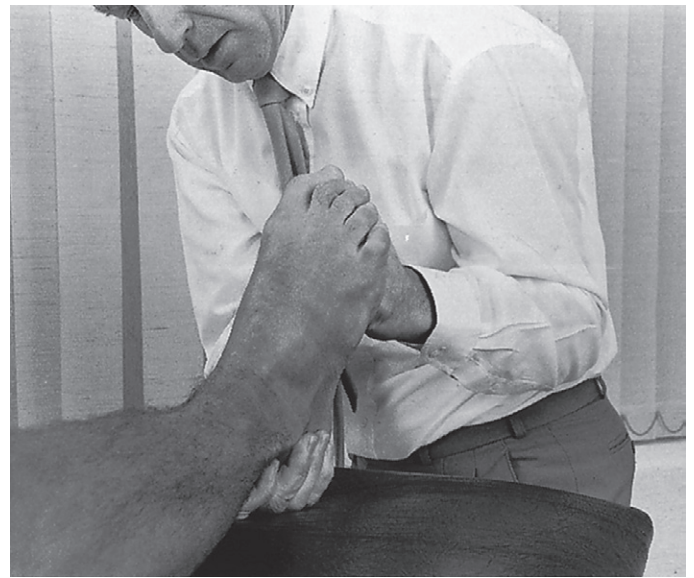
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**Fig 55.7** • Cont'd. Pronation and supination (c).



(a)



(b)



**Fig 55.8** • Resisted dorsiflexion and plantiflexion (a), and eversion and inversion (b).

## Box 55.3

**Summary of the clinical examination****History****Inspection****Functional examination**

- Rising on tiptoe
- Ankle joint
  - Plantiflexion
  - Dorsiflexion
- Ligamentous tests
  - Mortice
  - Lateral ligaments
  - Medial ligaments
- Subtalar joint
  - Varus
  - Valgus
- Midtarsal joints
  - Plantiflexion
  - Dorsiflexion

- Abduction
- Adduction
- Supination
- Pronation
- Resisted movements
  - Plantiflexion
  - Dorsiflexion
  - Inversion
  - Eversion

**Accessory tests**

- Combined movements
- Examination of the toes
- Instability tests

Pronation and supination also examine the inner and outer ligaments of the midfoot. Pronation tests the plantar calcaneonavicular ligament, whereas supination and adduction bring the calcaneocuboid ligament and the ligaments between cuboid and fifth metatarsal under stress.

*Technique*

First, the posterior segment (ankle and subtalar joints) must be stabilized. Therefore, the examiner uses the contralateral hand to pull strongly on the heel and force it into valgus. The traction forces the talus into the dorsiflexed position between both the malleoli, thus immobilizing the ankle joint, and the valgus position fixes the subtalar joint.

The ipsilateral hand encircles the forefoot, so that the thumb comes to lie under the metatarsal heads and the fingers at the dorsum of the metatarsal shafts. In this position, the examiner can easily perform plantiflexion–dorsiflexion in the foot by a simple pronation–supination movement of the arm. An adduction–abduction movement is achieved by an adduction–abduction movement of the wrist, and pronation–supination by a flexion–extension movement (Fig. 55.7). Although the range of movement varies considerably between individuals, it is surprising how much movement the normal midtarsal joints allow.

The end-feel in flexion–extension and in abduction–adduction is rather hard, whereas the end-feel in both rotations is soft.

**Resisted movements**

Resisted tests are always performed in a neutral position. No active movement of the joint is allowed. The examiner tries to evoke pure isometric contractions of the tested muscles. In order to avoid a false result, it is absolutely

essential to keep the joint immobile during the contraction. Therefore a good immobilization technique is of great importance, especially when inversion and eversion are to be tested against resistance.

*Technique*

To stabilize the foot during resisted eversion, the patient's leg is immobilized by the examiner's ipsilateral hand, placed at the medial and distal end of the leg. The examiner uses the contralateral hand to apply counterpressure at the lateral border of the foot (Fig. 55.8).

During resisted inversion, the reverse is done: the contralateral hand fixes the leg at the distal lateral side and the ipsilateral hand, placed at the inner border, applies counterpressure.

Resisted dorsiflexion tests the tibialis anterior, extensor hallucis longus, extensor digitorum longus and the peroneus tertius.

The plantiflexor muscles tested are the triceps surae, tibialis posterior, flexor hallucis longus, flexor digitorum longus and peronei brevis and longus.

Resisted eversion tests the integrity of the peronei muscles but also the peroneus tertius and extensor digitorum longus.

Inversion against resistance tests the tibialis posterior and anterior, together with the flexor and extensor hallucis longus, and slightly tests the triceps surae.

**Accessory tests****Valgus under dorsiflexion**

Forcing the heel into valgus and in dorsiflexion is the only way to reproduce pain in cases of a traumatic periostitis at the anteroinferior surface of the fibula.



### Examination of the toes

Passive, resisted examination of the big toe and the outer four metatarsophalangeal joints is performed when a lesion at the forefoot or at the toes is suspected.

### Anterior drawer test

This tests the integrity of the anterior talofibular ligament (see p. 785).

### Cases with pain but a normal examination

It is possible for a foot to hurt and yet appear normal on clinical examination, probably because the momentary stress of the

manual testing is insufficient to evoke pain. This happens particularly in athletes and ballet dancers who feel pain after exertion, i.e. after a strain far greater than any examiner can impose on the foot by mere clinical testing. In such cases, patients should stand up to demonstrate which particular movements hurt. If the pain only appears during or after training or exertion, the patient is asked to return when the pain has been provoked.

Clinical examination of the lower leg, ankle and foot is summarized in [Box 55.3](#).