

# Adult onset flatfoot

## a guide to posterior tibial tendon dysfunction

**A common cause of adult onset flatfoot deformity is dysfunction of the posterior tibial tendon. Early recognition of this dysfunction is important because of its progressive nature. Nonoperative and operative treatment options depend on the severity of the symptoms and the stage of the disease.**



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### Anatomy

The posterior tibial muscle, which arises from the proximal third of the tibia, interosseous membrane and the posterior aspect of the fibula, forms part of the deep posterior compartment of the calf. The posterior tibial tendon runs in a synovial sheath in a groove behind the medial malleolus (Figure 1).

The tendon terminates in multiple insertions into the tuberosity of the navicular, plantar surfaces of the medial, middle and lateral cuneiforms and the cuboid as well as to the bases of all the metatarsals. The tendon course is posterior to the axis of rotation of the ankle joint and medial to that of the subtalar joint. The posterior tibial tendon therefore functions as a plantarflexor of the ankle and an invertor of the foot.

Dysfunction of the posterior tibial tendon leads to collapse of the medial longitudinal arch (Figure

2) and eversion of the subtalar joint with abduction of the foot at the talonavicular joint. With eversion of the subtalar joint, the heel will assume a more valgus alignment (Figure 3). This may lead to contracture of the Achilles tendon. As the deformity progresses, these changes will eventually cause the calcaneus to impinge against the fibula, creating pain in the lateral part of the foot and ankle.

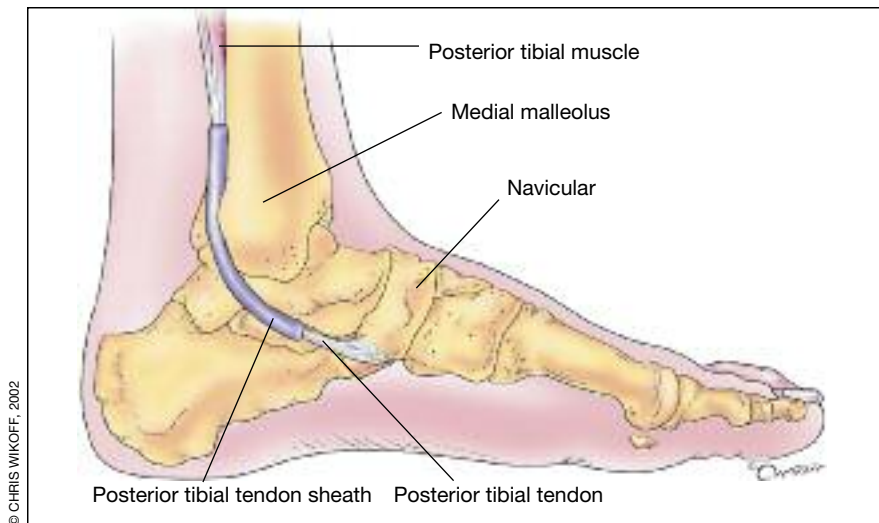
### Causes

There are a variety of disorders that can predispose to dysfunction of the posterior tibial tendon. Dysfunction of the tendon has been linked to seronegative inflammatory disease, such as ankylosing spondylitis, Reiter's syndrome and psoriasis (Figure 4). Injection of corticosteroid in the vicinity of the tendon has been implicated in tendon rupture. Dysfunction can also be caused by acute trauma with partial or complete disruption of

### IN SUMMARY

- The diagnosis of posterior tibial tendon dysfunction is based on a thorough history, examination of the foot and plain radiographs.
- In the early stages of posterior tibial tendon dysfunction, the patient will describe an insidious onset of fatigue and vague aching on the medial side of the foot and ankle, which are aggravated by activity. Swelling is common if the dysfunction is associated with tenosynovitis.
- With increasing deformity, patients or their relatives and friends may notice a change in the shape of the foot and that it becomes increasingly difficult to wear shoes.
- Both feet should be examined with the patient standing. Observe the alignment of the foot and ankle, and look for any asymmetrical swelling, flattening of the medial longitudinal arch and forefoot abduction.
- Nonoperative treatment (use of orthotics and shoe modification) should be tried first. If this fails, several surgical procedures are available depending on the stage of the disease.

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Figure 1. Anatomy of the posterior tibial tendon.

the tendon. There is an increased prevalence of posterior tibial tendon dysfunction in middle-aged obese women.

It is likely that most posterior tibial tendon ruptures are due to intrinsic abnormality of the tendon. It has an area of relative hypovascularity immediately distal to the medial malleolus that may contribute to the development of

Dysfunction of the posterior tibial tendon is three times more common in women than in men. The average age at presentation is about 40 years. Most patients are obese and have hypertension.

In the early stages of posterior tibial tendon dysfunction most of the discomfort is located medially along the tendon (Figure 6). The patient will describe an

aching on the medial side of the foot and ankle. This is aggravated by activity. Swelling is common if the dysfunction is associated with tenosynovitis.

Later in the disease process, the pain (which may be sharp, dull or vague aching) occurs laterally in the sinus tarsi because of impingement of the fibula against the calcaneus with weight bearing. With increasing deformity, patients or their relatives and friends may notice a change in the shape of the foot and that it becomes increasingly difficult to wear shoes.

Once complete rupture of the tendon occurs, the patient may no longer report medial ankle pain. Instead, the pain is located laterally.

### Physical examination

The physical examination should include inspection of the patient's shoe and any orthotics used.

Both feet should be examined with the patient standing. The entire lower extremity should be visible to allow observation of the alignment of the foot and ankle. Asymmetrical swelling, flattening of the medial longitudinal arch and forefoot abduction should be noted.

### 'Too many toes' sign

Inspection from behind the patient is useful in identifying an increased valgus alignment of the hindfoot and to look for the 'too many toes' sign (Figures 7a and b). The sign is positive when more of the lesser toes are visible lateral to the ankle on the involved side than on the uninvolved



Figure 2. Loss of the medial longitudinal arch.



Figure 3. Hindfoot valgus of the left foot.



Figure 4. Psoriatic plaques on the legs.



Figure 5. Degenerative tear of the posterior tibial tendon as seen at operation.



Figure 6. The patient complains of medial ankle tenderness and swelling.

side when viewed from behind. This indicates increased forefoot abduction.

### Single heel rise test

The single heel rise test is a good indicator of the function of the posterior tibial tendon. The patient is asked to lift the uninvolved foot in the air and to rise onto the ball of the involved foot (Figures 8a and b).

In patients with an intact posterior tibial tendon, the posterior tibial muscle is activated as the patient begins to rise onto the ball of the foot. This inverts and stabilises the hindfoot. The gastrocnemius and soleus muscles then elevate the calcaneus via the Achilles tendon. This accomplishes the heel rise.

With posterior tibial tendon dysfunction, inversion of the heel is weak and the heel will remain in valgus or the patient will have difficulty rising onto the forefoot. Patients may feel pain medially along the course of the posterior tibial tendon while attempting this test.

If the patient has early disease, the single heel rise test may be negative. This patient may be stressed further with a repetitive single heel rise test (up to five repetitions); this may result in pain along the posterior tibial tendon or fatigue. A person without the dysfunction should easily be able to perform five to 10 consecutive single heel rises.

### Palpating the tendon

The posterior tibial tendon is palpated with the patient seated. With chronic dysfunction, the tendon is thickened. There may be swelling due to tenosynovitis. Tenderness along the course of the tendon is elicited.

### Assessing passive range of motion

The passive range of motion of the subtalar and ankle joints and the presence of any contracture of the Achilles tendon are assessed. With more advanced dysfunction of the posterior tibial tendon, rigidity of the subtalar and then of the



Figures 7a and b. Positive 'too many toes' sign. When the patient is viewed from behind (b), more toes of the involved foot are seen than the uninvolved foot.



Figures 8a and b. Positive single heel rise test. The patient can raise the heel of the uninvolved left foot (a), but cannot raise the heel of the involved right foot (b).

ankle joints may be present. This is frequently associated with contracture of the Achilles tendon.

### Strength testing

The strength of the posterior tibial tendon is assessed (Figure 9). The patient is asked to invert the foot against resistance with the foot in the fully plantarflexed and inverted position. The plantarflexed position will eliminate the synergistic action of the anterior tibial tendon.



Figure 9. Testing the strength of the posterior tibial tendon.

### Imaging

Anteroposterior, oblique and lateral weight-bearing radiographs of both the foot and ankle are recommended for the evaluation of posterior tibial tendon dysfunction. The plain radiographs confirm the extent of the deformity and the presence of osteoarthritis.

Magnetic resonance imaging and ultrasound are not required to make the diagnosis and do not assist in planning

treatment.

### Classification

It must be emphasised that the diagnosis of posterior tibial tendon dysfunction is based on a thorough history, examination of the foot and plain radiographs.

Dysfunction of the posterior tibial tendon is a spectrum of disorders ranging from tenosynovitis to rupture of the tendon and fixed deformity. The staging system classifies the natural history of

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Figure 10. Lateral radiograph of a patient with stage 4 disease showing arthritic changes and valgus angulation of the ankle joint.

this disorder into four distinct stages. This helps to determine the appropriate treatment options.

### Stage 1

Stage 1 disease is characterised by pain, swelling and tenderness of the posterior tibial tendon along the medial aspect of the foot and ankle. The length of the tendon is normal and thus there is no clinical or radio-

graphic deformity. The tendinitis may be associated with mild degeneration. There may be mild weakness of the tendon.

### Stage 2

In stage 2, there is elongation or disruption of the posterior tibial tendon. Deformity is present with loss of the medial longitudinal arch, forefoot abduction and hindfoot valgus. The patient is unable to perform, or has difficulty performing, a single heel rise test. The subtalar joint remains flexible.

### Stage 3

In stage 3, the deformity is more severe and the hindfoot is not flexible. The patient will complain of lateral ankle pain. This is due to lateral impingement from the fixed hindfoot valgus deformity. This stage may be accompanied by degenerative arthritis of the hindfoot or midfoot as seen on radiographs.

### Stage 4

Stage 4 is where there is valgus deformity and arthritis of the ankle (Figure 10).

## Treatment

### Nonoperative treatment

Nonoperative treatment should be attempted for all patients with posterior tibial tendon dysfunction.

In all patients with pain from the tendon dysfunction, custom-made orthotic devices will help to support the medial longitudinal arch. This aims to unload the posterior tibial tendon. Patients will also often require a medial heel wedge and a medial column post to be added to the shoe to control the hindfoot valgus. Oral anti-inflammatory medication may be useful in helping with the pain but does not affect the natural history of the condition.

If the patient has severe pain, a short leg walking cast may be required for six

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weeks. The use of corticosteroid injection is generally not recommended.

If nonoperative treatment has failed after a three- to six-month trial, operative treatment should be considered. Routine follow up at six to 12 months is recommended after nonoperative treatment because the symptoms may recur or the condition may progress. If this occurs, surgery may be required.

### Operative treatment

The age, weight and level of activity of the patient and the degree of deformity (stage of the disease) determine the type of operation that is selected. In general, two groups of procedures can be performed.

The first is a tendon transfer procedure that aims at reconstructing a new posterior tibial tendon to replace the degenerate, poorly functioning or non-functioning tendon. This procedure is suitable in younger, nonobese patients

with a flexible deformity.

If the patient is older, obese or has a rigid deformity, then a fusion procedure is recommended to correct the deformity.

### Conclusion

Adult onset flatfoot deformity is a common clinical entity. Dysfunction of the posterior tibial tendon is now a commonly recognised cause of this. Patients with posterior tibial tendon dysfunction will initially present with pain and swelling over the medial aspect of the foot and ankle. As the condition progresses, they will notice a change in the shape of the foot and a loss of endurance with activities. The progressive flatfoot deformity will lead to pain along the lateral aspect of the ankle.

Early recognition of posterior tibial tendon dysfunction is important because of its progressive nature. The diagnosis and staging of posterior tibial tendon dysfunction is a clinical process.

Effective treatment is now available. Nonoperative treatment should be tried first. This involves the use of orthotics and shoe modification. Operative treatment is indicated after nonoperative treatment has failed. A number of surgical procedures are available depending on the stage of the disease. **MT**

### Further reading

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