Frank's flat feet

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This series on the foot care of patients with diabetes focuses on the importance and assessment of foot structure. An altered, 'misshapen' foot is an important risk factor for diabetic foot ulceration, like vascular and neurological deficits.

The first article in this series addresses one of the basic foot structure types, the flat foot, and its associated pressure patterns and footwear needs. An appreciation of foot structure and the pressure areas in stance and gait is important. A simple check of foot structure and pressure areas can be included in the regular six-month foot check of your patients with diabetes (Table).

Case history

Frank is 23 years old with an eight-year history of type 1 diabetes that is well managed. His height is 1.84 m and weight 81 kg; thus his BMI is 23.92 kg/m^2 (i.e. he is in the healthy weight range). His Hb_{A1c} is 6.5%, and he has had no hypoglycaemic episodes requiring external help.

Frank has normal foot pulses, healthy skin and no clinical evidence of peripheral neuropathy. He is a good footballer, plays tennis and likes to swim. His last football season was dogged by 'shin splints' (medial tibial stress syndrome), and he also had problems with callus build up (Figure 1) and sometimes blistering of the skin adjacent to the first metatarsophalangeal joint and the big toe. The weight-bearing areas of the feet show callus build up and his feet look quite flat when he stands and walks.

Figure 1. The callus on Frank's big toe.

Questions to consider

- How might Frank's foot structure be contributing to his problems?
- How would you assess this?
- What can be done to help Frank?

Frank's foot structure

The distribution of Frank's callus and blisters is characteristic of a flat foot responding to a high load.

- A foot with a normal arch distributes pressure evenly over the foot during the foot strike cycle (Figure 2, left).
- A flat foot concentrates the load on the inner medial side (Figure 2, right), with particularly high loads over the first metatarsophalangeal head and toe, which is Frank's problem.
- A foot with a high arch loads the metatarsophalangeal heads and the terminal phalanges and may also put pressure on the dorsal phalangeal joints once toes become clawed.

For Frank the problem is a nuisance, but in the future if, or when, he develops neuropathy and/or vascular disease his foot structure would be very likely to precipitate a foot ulcer. The current problem is an early warning and should be responded to.

Assessing Frank's foot

Look at Frank's soles for areas of callus (the skin's response to pressure). Check the typical pressure areas (as indicated above). Pick up Frank's shoes and see if they look like the shape of his feet. Check the shoe condition: shoes that have 'bumps' in the uppers are rubbing on the feet, and shoes that are worn out or have worn to form a slope to the side will not help Frank's gait or standing position.

Ask Frank to stand, and look at his foot position under his legs. Do they look straight, everted (flat arch) or inverted (high arch). What happens when Frank walks? Do his feet stay straight or roll to one side or the other?

Finally, while Frank is wearing his shoes, check how he stands and walks again. Do the feet look straighter with his shoes on, or do they appear to roll in or out more than when he was barefooted (Table)? In other words, do the shoes help to correct a problem or make it worse?

Helping Frank

If you see pressure areas on the feet (corns or calluses) or if the footwear and feet don't work well together, a podiatrist assessment might be helpful. Removal of the callus reduces the load by 20% (by stopping the concentration of force over a small area),[1] and appropriate footwear, socks and insoles can each further reduce loads by 20% (total reduction 50% for these three measures). Orthotics can be designed to deflect loads away from high pressure

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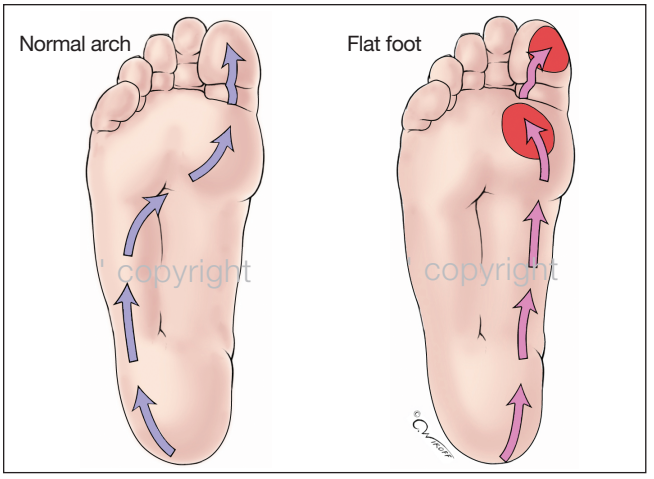

Figure 2. Left. The gait of a foot with a normal arch. Pressure is distributed evenly over the foot during the foot strike cycle. Right. Frank's gait. A flat foot concentrates the load on the inner medial side with particularly high loads over first metatarsophalangeal head and toe.

Figure 3. Features to look for when choosing a sports shoe.

areas.[2-5] Compensating for dysfunctional foot structure spreads the load and restores the mechanics of the foot and leg.

The most important point is to prevent problems like Frank's calluses, blisters and shin splints developing so that he can continue his active sporting interests. If you were unsure about Frank's foot structure, a podiatrist might help by providing advice on footwear.

A stable shoe will support the foot as it loads, yet allow for adaptation to different surfaces and while moving and turning (Figure 3). Flexibility across the forefoot is important so the foot can push forward, and lacing can keep the foot in place, reducing the friction that might otherwise cause blistering. If an orthotic is needed the shoe should be deep enough to incorporate this without compromising foot protection and foot function. The upper should allow for cooling by airflow evaporation. Football or soccer boots should be selected with particular care because of their limited depth.

There is no substitute for fit; the sports shoe should be fitted while the person is wearing the socks that will be worn to play the sport involved. Advise your patients to seek out specialist sporting footwear shops where the staff are trained to measure and fit footwear effectively.

Although not relevant in Frank's case, foot problems may be precipitated and/or aggravated by being overweight. MT

Table. What to look for at the foot structure check up

Factors	Feet	Footwear	Gait
Nonweight-bearing factors	• Plantar calluses • Dorsal pressure areas • Arch shape	• Shape • Sole	Not applicable
Weight-bearing factors	• Normal • Flat: rolled in • High arch: rolled out	• Do the feet lean in or out of shoes? • Are there pressure areas over toe regions of the shoes?	• When barefooted, do the feet roll in or out, or stay straight? • Do shoes change the barefoot gait pattern? Is this better or worse?

References

1. Redmond A, Allen N, Vernon W. Effect of scalpel debridement on the pain associated with plantar hyperkeratosis. J Am Podiatr Med Assoc 1999; 89: 515-519.
2. Murray HJ, Young MJ, Hollis S, Boulton AJM. The association between callus formation, high pressure and neuropathy in diabetic foot ulceration. Diabet Med 1996; 13: 979-982.
3. Curryer M, Lemaire ED. Effectiveness of various materials in reducing plantar shear forces. J Am Pediatr Med Assoc 2000; 90: 346-353.
4. Veves A, Masson EA, Fernando DJ, Boulton AJ. Studies of experimental hosiery in diabetic neuropathic patients with high foot pressures. Diabet Med 1990; 7: 324-326.
5. Warren G. Controlling callus. Medicine Today 2003; (4): 95-97.

DECLARATION OF INTEREST. Ms Evans: None. Dr Phillips has received grants and acted as consultant for a number of pharmaceutical companies; none of these interests are relevant to this article.