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The ABCS of foot care in diabetes: S is for structure

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This article on risk factors for foot problems in people with diabetes reviews the more intensive foot care and special footwear that is often necessary in patients who have odd-shaped feet because they have worn ill-fitting shoes, have complications of their diabetes, or have flat feet or high arches.

Sensation and blood flow are rightly focused on when examining the feet of a patient with diabetes because peripheral neuropathy and ischaemia can both (especially in combination) threaten the person's limb and life.^{1,2} Foot care is well recognised as an important preventive aspect of diabetes complications involving the foot and lower limbs.^{3,4} Foot structure, however, is often overlooked or poorly understood, although it is a major risk factor for foot problems, both in people with diabetes and those without the condition.

A person with diabetes who has normal foot sensation, circulation and structure needs the same foot care and footwear as a person without diabetes. But a person with 'odd shaped' or 'misshaped' feet may need more intensive foot care and monitoring and special footwear. The foot factor 'traffic lights', which address the podiatric ABCS of anaesthesia, blood supply, foot care and foot structure, provide a practical framework to assess foot risk: the more amber and red 'lights', the higher the risk (Table 1).^{5,6}

This article, the fifth in a series on foot care in people with diabetes, outlines a simple assessment of foot structure, footwear and gait, the effects of common foot structures and the likely signs of problems, with steps to address them. A patient handout summarising the podiatric ABCS, 'Your foot report', accompanies the article. Previous articles in the series have discussed the assessment of the ABCS in people with diabetes and the various aspects of peripheral neuropathy, peripheral vascular disease and routine foot care.¹⁻⁵

Don't go soft on callus!

'It doesn't matter what shoes I wear, I get this thick skin that hurts like hell. I have learnt to cut it off with scissors. I reckon I would have been a good surgeon!'

Jack, describing his calluses.

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S - Structure

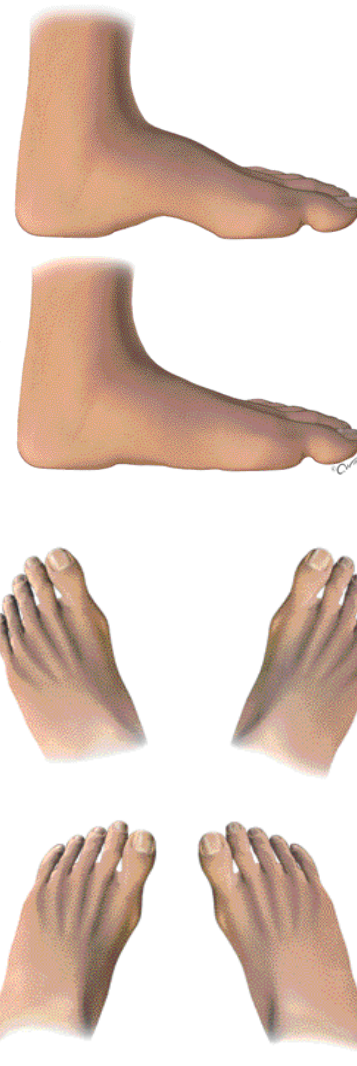


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Calluses and corns are signs of increased pressure and need to be regarded as potential ulcer sites in people with diabetes. Additional signs of increased pressure may include skin redness, thickened nails and skin breakdown. It is a good sign if these areas of increased pressure hurt because then there is a protective pain feedback that gets people to alter their gait, change their shoes and off-load the forces. The risk of ulcers escalates when calluses do not hurt.

When a person has recurrent calluses or corns, GPs should consider the possible

continued

Table 1. Foot factor traffic lights and patient risk assessment

Foot factor traffic lights			
ABCS assessment	Red lights – ‘Danger’	Amber lights – ‘Caution’	Green lights – ‘Healthy’
Anaesthesia – Pinprick, light touch – Reflexes	No stimuli felt No reflexes	Reduced stimuli Reduced reflexes	All stimuli felt Normal reflexes
Blood – Pulse palpation	No pulses	Reduced pulses	Normal pulses
Care – Questioning* – Observation	– Skin breakdown	Foot care, footwear could be better Threatened skin breakdown	Appropriate foot care, footwear Normal skin
Structure – Observation	Weight-bearing ulcer	Callus or corn	No skin lesions
Patient risk assessment			
Traffic lights	Risk assessment	Recommended action	
One or more ‘red lights’	High risk	Refer promptly to a podiatrist	
One or more ‘amber lights’	Moderate risk	Regular podiatry care and assessment	
All ‘green lights’	Low risk	General foot care advice	

* Inadequate foot care in the absence of any other red or amber traffic lights is not a major risk factor for severe foot problems. Adequate foot care in the presence of one or more red or amber traffic lights is essential and can prevent severe foot problems.

causes of the increased pressure. These include:

- footwear – some shoes are not meant for usual feet
- foot structure – some feet are not meant for usual shoes
- neuropathy – some feet do not feel any shoes.

Of these possible causes, inappropriate and/or ill-fitting footwear are usually

obvious (Figure 1), and neuropathy will be apparent on clinical examination.¹ The contribution of foot structure to excess local pressure will need to be assessed, but this is easily done, as indicated below and summarised in Table 2.

- Look at the feet. When standing barefoot, do the feet roll in (flat) or out (high arch)? A normal foot distributes the load evenly across the foot, a flat foot concentrates the load on the medial side and a high-arched foot concentrates the load to the lateral heel and metatarsophalangeal area.
- Look at the shoes. Are the soles worn unevenly or the uppers distorted? Uneven wear of the soles indicates high load; distortion of the uppers indicates pressure from enclosed feet.
- Look at the gait. When walking barefoot, do the feet roll in (flat) or out (high arch)? Do shoes improve or worsen the barefoot gait pattern?

Some shoes are not meant for usual feet

‘My feet are killing me. At the end of the day I’m hobbling. I can get comfortable shoes but they are so ugly!’

Sally is 63 years old, smartly dressed and was diagnosed with type 2 diabetes at age 48 years when she was (as she says) ‘fair, fat and forty’. She hopes to continue working until she is 65 years old to maximise her superannuation benefits, but she is having trouble with her feet. Although she has minimal sensory neuropathy, she unfortunately has bad hammer toes and thick painful calluses beneath her metatarsal heads from years of high heels. She is hobbling by the time she gets home from work, and her feet are so sore she is reluctant to go for the walks that have previously so assisted her health, including keeping her weight down.

Her GP looks at her feet, notices the many calluses and the fashionable shoes, and suggests she see a podiatrist.



Figure 1. High-heeled, narrow shallow-toed shoes can cause excessive pressure in many areas of the foot.

Table 2. Foot structure checklist

Factors	Feet	Footwear	Gait
Nonweight-bearing factors (i.e. when sitting)	Are there: <ul style="list-style-type: none"> • plantar calluses and/or • dorsal pressure areas? What is the arch shape?	Uppers: Is the shape distorted? Soles: Is there uneven wear?	–
Weight-bearing factors (i.e. when standing)	Is the arch shape: <ul style="list-style-type: none"> • normal • flat • high? 	Barefoot: Are there pressure areas over the toes? Shoes on: Does the foot lean in or out?	Barefoot: Do the feet roll in or out, or stay straight? Shoes on: Do the shoes change the barefoot gait pattern? If so, do they make it better or worse?

Table 3. Sally’s foot care and footwear options

Factor	Option		
	Stay as is	Compromise and survive	The ideal
Shoe heel height	8 to 10 cm heel height	4 to 5 cm heel height	1 to 2 cm heel height
Shoe type	High-fashion court shoe	Less stylish lower heeled shoe with extra depth in toe area	Laced duty shoes
Calluses	Thick calluses	Calluses treated each 4 to 6 weeks	Calluses treated each 6 to 12 weeks
Exercise	Reduced ability to exercise	Runners worn for exercise	Runners/walking shoes worn all the time
Pain	Painful	Manageable pain	Minimal pain
Ulcers	Risk of ulceration	Reduced ulcer risk	Minimised ulcer risk

‘I’m not wearing clodhoppers’ is Sally’s opening statement to the podiatrist. Ideally, Sally would get out of her high-heeled fashionable shoes and into low-heeled, cushioned, well-fitting, laced shoes. Any reduction in heel height and any increase in shoe fit are worthwhile – the forces at the metatarsal heads will be reduced with every centimetre of heel height reduction, and the extra depth shoes will reduce pressure over the toes (Figure 2).

Sally’s footwear and foot care options and the foot problems associated with each are summarised in Table 3. The podiatrist suggests a compromise to see Sally through her last two years of work. Sally accepts this middle option.

The podiatrist debrides the calluses

adjacent to the metatarsal heads, and shows Sally how to use digital shields and metatarsal padding to reduce pressure from shoes. Sally starts wearing shoes with a lower heel and more depth in the toe

area. Soon her feet are more comfortable and she is able to walk regularly again, and also is less at risk of a future ulcer. Over the next three months, she loses the 3 kg she had put on recently.

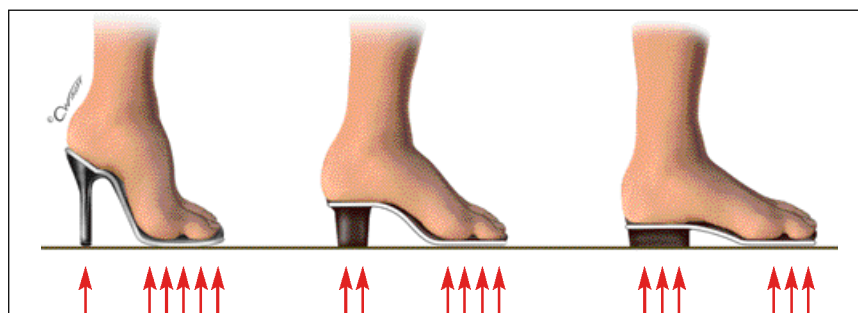


Figure 2. High fashion to high comfort. The pressure forces at the metatarsal heads are reduced with every centimetre of heel height reduction, and the forces over the toes are reduced by the extra depth and width of better fitted shoes.

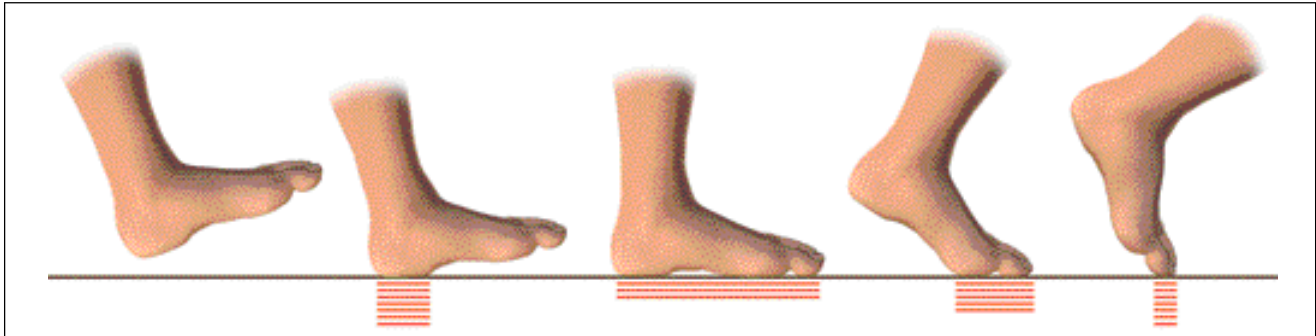


Figure 3. The gait cycle of a normal foot.

Some feet are not meant for usual shoes

'I have had flat feet all my life. It has always been hard to find comfortable shoes. Now my toes are curling up and it's getting harder still. I have calluses from my flat feet and now I have got problems with the tops and bottoms of my toes.'

Ron, who is 66 years old and has had diabetes for 14 years.

The foot skeleton is a complex array of bones, ligaments, muscles and tendons encased in soft tissues and skin. It is weight-bearing and subject to large forces associated with gait, ground reaction and footwear. The foot skeleton varies in its architecture and some irregular types are particularly vulnerable to focal pressures – which in diabetes, and especially if there is neuropathy, equals an ulceration site. Add in ischaemia, infection and neglect and it is not difficult to see why some 2500 Australians lose a leg each year.

With a normal foot and normal gait, the central–lateral heel strikes the ground and cushions the load, which is distributed to the lateral mid foot until the heel lifts. Then the load is transferred medially to the first metatarsal head and great toe, which push forward into the next step (Figure 3). A normal foot transfers forces smoothly across the foot in an S-shaped arc (Figure 4a).

With odd-shaped feet, the force lines are abnormal and pressure peaks in certain areas, causing the skin to thicken in those areas (Figures 4b and c). Calluses and

corns are signs that foot structure and gait need to be reviewed. The areas of excess pressure need to be cushioned and the loads distributed to reduce peak forces and avoid corns, calluses and ulcers. Footwear and weight-bearing loads are the two main sources of excess local pressure; other causes are bunions and clawed toes, complaints which often arise in people with diabetes and motor neuropathy.^{5,6} Orthotics and specially fitted or 'extra depth' shoes may be needed to off-load high-pressure areas.

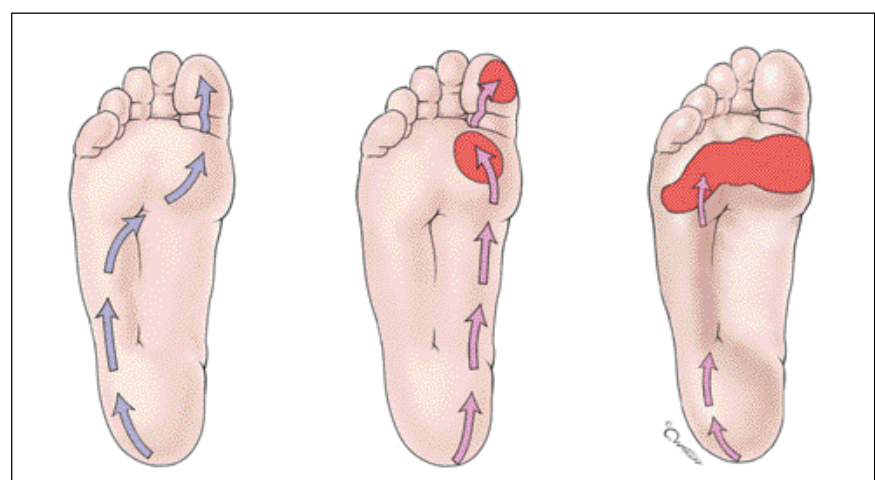
The 5 A's for foot structure

The odd-shaped foot is an important traffic light for foot risk. Remember that the abnormally shaped foot will often have calluses from weight-bearing and/or

footwear. If these calluses are painless or if the circulation is compromised, three of the four traffic lights are signalling high risk – that is, weight-bearing callus, no stimuli felt and no pulses (Table 1). Such patients need meticulous self-care and self-monitoring, appropriate footwear, close professional monitoring and clear action plans (Table 4).⁷

The 5 A's – Ask, Assess, Advise, Assist and Arrange – provide a practical framework for foot care that can be applied in the six-monthly foot check part of the diabetes annual cycle of care supported by Medicare. The 5 A's as applied to the S part of the podiatric ABCS are (Table 4):

- Ask about sore feet and shoe fit
- Assess foot shape and look for calluses



Figures 4a to c. Force distributions during walking in a normal foot (a, left), a flat foot (b, centre) and a high-arched foot (c, right).

continued

Table 4. The ABCS and the 5A's – a framework for foot care

ABCS	The five A's				
	Ask about symptoms	Assess signs	Advise about foot care and/or footwear	Assist by involving other carers	Arrange reviews and/or referrals
Anaesthesia	Any tingling, numbness?	Sensation Painless/undetected injuries	Care for feet daily Wear appropriate footwear	Possibly a relative or other carer, a visiting nurse or a podiatrist	Podiatry assessment and review, action plan
Blood supply	Any claudication? Are feet cold?	Pulses	Care for feet daily Wear appropriate footwear	Possibly a relative or other carer, a visiting nurse or a podiatrist	Podiatry assessment and review, action plan
Care	What foot care routines are followed? Do shoes fit well?	Nails and skin (thickening, drying, cracking)	Care for feet daily Wear appropriate footwear	Possibly a relative or other carer, a visiting nurse or a podiatrist	Education, ongoing review
Structure	Any foot soreness? Are shoes comfortable?	Foot arches, angles and abnormalities – when standing Weight-bearing calluses (pre-ulcers)	Debride calluses (podiatrist) Use digital shields and metatarsal padding Reduce shoe heel height Wear laced shoes Special footwear	Possibly a relative or other carer, a visiting nurse or a podiatrist	Podiatry review, for foot care and insoles/orthotics Consider orthotic and/or physiotherapy review

- Advise regarding shoes and good shoe-fitters, and also callus treatment
- Assist by involving family, carers, home nurse and podiatrist
- Arrange for podiatry review and follow up at the next visit.

Conclusion

People with diabetes may have odd-shaped feet as a result of wearing ill-fitting shoes or complications of their diabetes (clawed toes and loss of foot arches) or because they have flat feet or high arches. Patients with abnormal foot structure should watch for signs of increased pressure (skin redness and thickened skin or nails) and seek advice on ways to remove the excess pressure, especially when no pain is felt or the circulation is compromised. MT

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