

# **DIABETIC ULCERATION** - by John Falkner Heylings BSc, DipPodM, FPSPract, Podiatrist

The major complications of diabetes mellitus arise from the build-up of atheroma in the arteries, which narrows the blood vessels and reduces the flow of blood. This can result in heart attacks, blindness and kidney failure. Reduced circulation in the lower limbs causes intermittent claudication, increases the risk of thrombosis, and leads to neuropathy and poor healing of wounds with the attendant risk of diabetic ulcer and gangrene.

The earlier the diagnosis, the sooner control can be achieved and the tighter that control can be, the greater is the reduction of long-term effects. Good control of diabetes in pregnancy reduces the risk of abnormalities in the baby, or of miscarriage. If diabetes is diagnosed early and the patient complies with all the advice given, the diabetes will have little effect and a full and entire lifespan is to be expected. However, if balance is not maintained and the patient chooses to ignore advice on lifestyle, the diabetes will have so many effects upon so many systems of the body that life will be much reduced in quality and duration.

In addition to the polyuria, polydipsia, polyphagia and their acute effects there will be longer-term effects particularly to the heart, mechanisms responsible for infection resistance and wound healing. Sight loss may be experienced due to retinal deterioration, and the kidneys may be affected. There may be neuropathies of the legs and feet due to the effects upon the peripheral circulation, putting the foot 'at risk'. Peripheral neuropathy is of vital interest to the foot health worker. Due to the diabetes there is disruption of the blood supply to the extremities which starves the peripheral nerve endings and receptors of proper nourishment. There is a consequent loss of sensation which allows injury to be sustained, but not appreciated.

## **CONTROL OF DIABETES MELLITUS**

**In diabetes, attention to diet and lifestyle is fundamentally important. A healthy diet consisting of high fibre, low-fat, low simple sugar confections and high complex sugar (pasta, rice, potatoes) intake is advised. Sweet foods and drinks that contain lots of sugar are discouraged in favour of the slow release starchy foods that digest slowly. The fibre provides the 'bulk' in the diet. And if little fat is consumed, there is less that can be added to that which is already there.**

**In Type 1 diabetes, attention to diet and exercise, self-testing, together with insulin directly administered by syringe, pen or pump will allow close to normal lifestyle.**

**In Type 2 diabetes a reduction in weight alone may be sufficient to lower the body's energy requirements and restore blood glucose to normal levels. Glucose that can be 'burned off' by exercise will not add to the burden of that which is already stored, so physical exercise is promoted. If alteration in diet and lifestyle fails, oral antidiabetic medications can be prescribed. Insulin can still be administered if these treatments fail. Insulin may also have to be administered in pregnancy, illness or in the event of a general anaesthetic being required for surgery.**

**The closer the control that can be achieved, the lower is the risk of suffering the worst long-term effects of diabetes – retinopathy, nephropathy, neuropathy, and poor tissue viability. Practitioners need to be aware of the aetiology of neuropathy, lowered resistance to infection, slow healing wounds and the formation of diabetic ulcers.**

## ULCERATION

**‘Approximately 50 to 60% of all diabetic foot ulcers can be classified as neuropathic. Signs or symptoms of vascular compromise are observed in 40 to 50% of all patients with the vast majority having neuroischemic ulcers, and only a minority of patients have purely ischemic ulcers’**

*Apelqvist, et al 2007, cited by Mendez and Neves (2012)*

Ulceration does not occur spontaneously, but rather follows upon some form of trauma such as scalding or burning, puncture or wounding. Dermatophyte infection or vascular eczema may lead to cellulitis, as might a persistently weeping wound that leaks tissue fluid such as those that occur in lymphedema. Abrasion or constant pressure from footwear, or trauma caused by foot over-use such as standing for long periods or distance walking with resultant blistering may all initiate ulceration. Biomechanical stress or foot deformities deliver excessive local pressure and induce ulceration. Applications of caustic chemicals such as salicylic acid, or reaction to allergens as in dermatitis also compromise skin integrity.

*‘The major cause of impairment to the feet of diabetics is persistent hyperglycemia, potentially leading to peripheral neuropathy as well as to pathological changes in plantar soft tissue, which stiffen its structure and diminish its ability to effectively distribute foot-ground contact loads’*

*Gefen, (2003)*

A study by Bus, SA *et al* (2004) demonstrated that lesser toe retraction causes fat pad displacement and raised peak plantar pressure beneath the now-unprotected metatarsal heads, leading to plantar ulcerations.

Foot deformities such as Hallux abductovalgus, plantar-plate ruptures, toe retractions, and Charcot foot also present high pressure areas where the foot makes contact with the ground or footwear.

The anatomy of the foot must be considered in determining the risk of ulceration. A person with flatfoot is more likely to have disproportionate stress across the foot and may have an increased risk for tissue inflammation in high-stress regions. Biomechanically, those feet with unusual metatarsal head parabolas, notably those with long second metatarsals or short first metatarsals will present areas upon which extraordinary and excessive pressure can occur.

Diminished sensory responses lead to ulceration. Non-appreciation of pressure that might cause damage, either by its intensity or duration, and failure to move away from or relieve such pressure will result in areas from which blood is excluded for periods which may be protracted.

Autonomic nerve damage leads to non-functionality of skin glands. In the absence of the output of eccrine sweat and sebaceous glands the skin is dry, loses flexibility and the skin can no longer perform its barrier functions.

Macrovascular Disease occurs more commonly in diabetics. Atheromatous plaque is laid down more often, particularly in the arteries of the lower limbs, cerebral and coronary vessels due to hyperlipidemia for which anticholesterolemic drugs are prescribed. The amount of fat carried in the bloodstream is greater in diabetics because of the breakdown of fat in the poorly controlled state.

**85% of amputations are preceded by a foot ulcer**

## AMPUTATION

***Every week over 135 leg, foot or toe amputations are carried out on people with diabetes, but around 80 per cent of these could be prevented***

A typical course of events is that a first episode of ulceration arises and might be dealt with by diagnostic examination, regular dressing and off-loading. If there is perceived to be need, bypass grafting or the fitting of stents may be sufficient to resolve the problem and there may be no recurrence. If this is not done, the cause of the initial ulceration remains.

But a second or subsequent ulceration at the same site will cause the question to be asked 'will this continue to occur if the underlying cause is not, or cannot be addressed?' A vascular surgeon may conclude that there is no point in trying to keep alive a body segment that cannot be re-vascularised and does not have the necessary infrastructure to keep it alive – and that amputation is the best course of action. This decision will also be informed by the health status and quality of life of the individual, and the financial cost and burden of future management.

Diabetic foot complications are more common amongst the elderly, and amputation rates increase with age. For people over 75 years old, the risk does increase considerably.

- Minor amputation regards removal of *toes* or *feet*.
- Major amputation refers to the *above* or *below* the knee amputation.

*'New figures have revealed that the number of diabetes-related amputations each week in England has now reached an all-time record high of 135, according to new analysis by Diabetes UK.*

*The figures, calculated using new Public Health England data, show that the annual number of diabetes-related amputations in England is now more than 7,000, compared to the previous figure of 6,677. This equates to seven more amputations each week. Yet, with good diabetes and footcare, up to 80 per cent of these amputations can be avoided.*

### ***Diabetes-related amputations figure rising***

*The figures show that despite a big focus on preventing these amputations, the amputation rate for major and minor amputations combined in people with diabetes has stayed the same. And because of the sharp increase in the number of people with diabetes in the past 20 years, the number of diabetes-related amputations is rising.'*

*Diabetes UK website Wednesday 15 July 2015*

***up to 80 per cent of people die within five years of having an amputation  
-nearly 50% die within two years***

## **TISSUE PROTECTION STRATEGIES (Offloading and patient lifestyle modification)**

Local areas, usually over bony prominences, will need to be defended against pressure that may fall upon them, either from stance, gait or footwear. Part of our skill is in recognising the origin of the threat or the potential of a threat arising, and being able to change the relationship of the foot or its parts to mitigate against the threat. Alternatively, the patient must be helped to modify the activity that poses the threat to the tissues.

Our dressing skills should be of the highest order. Dressings need to be well-designed and made from deliberately chosen appropriate materials, thoughtfully applied. Hypoallergenic tapes and materials carefully applied and monitored with full interest at appropriate intervals are important. Dressings and tapes and hydrogel appliances should never be allowed to cause secondary irritation of the skin of the toe-clefts, and should not be worn for longer than necessary.

All practitioners need to be conversant with appropriate offloading techniques. Offloading is essential in defence of the skin of the foot against trauma and excessive pressures that may arise. Orthoses should be employed where it is appropriate to re-distribute gait forces. There must be recognition that digital and metatarsal misalignments often have their origins in the hyperpronating, uncontrolled foot.

The neuropathic patient is likely to be completely unaware of pressure that would cause discomfort in a person with normal sensation. They may also be untroubled by itching, blistering, abrasions, small wounds or ingrowing toenails. Further, they could sustain damage from the toenails of adjacent toes. This is where patient education becomes important and the diabetic patient needs to be taught the necessity of daily hygiene and foot inspection, both visual and manual. Patients also need education and support in the choice of footwear and hosiery. We must be generous in our advice and recommendations.

***'Skin disorders are present in 79.2% of patients with DM, and cutaneous disease may appear as the first sign of DM or develop at any time in the course of the disease.'***

*Diabetes Mellitus and the Skin: Recognition and Management of Cutaneous Manifestations William B. Horton, MD; Patrick L. Boler, MD, PharmD; Angela R. Subauste, MD South Med J. 2016;109(10):636-646.*

**The International Working Group on the Diabetic Foot recommends the incorporation of therapeutic shoes, custom-made insoles or orthoses whenever a foot deformity or pre-ulcerative sign is present. This same organization promotes pressure relieving footwear to decrease the risk of recurrent plantar ulcerations in the at-risk population. Concerning non-plantar diabetic foot ulcerations, researchers have found that improperly fitting shoes and other footwear are major contributing factors.**

This material is sourced from:

# **DIABETES MELLITUS**

**-a four module diploma course for lower limb practitioners**

composed by John Falkner-Heylings BSc(Podiatric Medicine), DipPodM, FPSPract, Podiatrist

and available from the College of Foot Health Practitioners



## DIABETIC ULCERATION

*These questions are based upon the preceding paper. Answers should be submitted on A4 paper and should be of sufficient length to demonstrate full understanding of the topic. Single word answers are not acceptable for CPD. Try to answer in one or two short paragraphs, not more than ¼ page per answer.*

1. Why is early diagnosis of Diabetes important?
2. Describe what is meant by a 'healthy diet' and why it is important to diabetics
3. How are Type 1 and Type 2 diabetes controlled?
4. Does ulceration occur spontaneously?
5. What is the major cause of impairment to the feet of diabetics?
6. How do foot shape and deformity contribute to ulceration?
7. Explain the course of events that might follow a first episode of ulceration?
8. Who suffers most from diabetic foot complications?
9. What is the survival rate following amputation?
10. What is the importance of observing skin disorders?

*Return this page with the administration fee (see website CPD Download page) and your answers to:*

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*A CPD certificate will be issued for 10 CPD points on successful completion.*

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