

Healing a diabetic forefoot non-healing neuropathic ulcer using the new Amit Jain's offloading system



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Offloading the diabetic foot is an essential treatment modality aimed at healing an ulcer. There are many offloading methods available and one of the most commonly used offloading methods in the West is felted foam, which is based on the concept of deflective offloading. The new Amit Jain offloading system provides an alternative to felted foam that can be used for healing diabetic foot ulcers in a similar format. This article describes a case of a forefoot non-healing ulcer that was effectively healed with this new offloading modality.

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Foot ulceration is one of the most common and serious complication of diabetes and it precedes lower-extremity amputations in up to 80% of cases (Baker and Osman, 2017). Plantar ulceration is a common complication in a neuropathic diabetic foot (Armstrong et al, 2004; Deursen, 2004). This plantar ulceration often initiates a process of further ulceration and, ultimately, amputation (Deursen, 2004). Around 56% of diabetic foot ulcers get infected and 20% of the patients with infected wounds end up with some form of lower-extremity amputation (Wu, 2015).

Knowing the fact that neuropathic ulceration occurs because of a combination of focal pressure and repetitive stress at a given site (Armstrong et al, 2004), redistribution of plantar pressure away from sites of elevated pressure (offloading) results in faster healing of foot ulcers (Raspovic and Landorf, 2014). In fact, uncomplicated plantar ulcers should heal in 6 to 8 weeks with adequate offloading (Cavanagh and Bus, 2010). However, the author observed in clinical practice that it can take longer to heal as it depends upon the size of the ulcer, location of the ulcer, recurrences, previous surgeries, type of offloading modality used, compliance of patient, status of the opposite limb and systemic condition of the patient.

Various offloading methods are available in different countries. This article describes a case of forefoot ulcer that was healed using Amit Jain's offloading system (Jain 2017a; 2017b; Jain et al, 2017); a new deflective offloading system.

Case report

A 64-year-old woman with a history of diabetes mellitus of 20 years' duration presented to the author's department with a non-healing ulcer in the right forefoot region that she had had for 3 months. The patient was already experiencing peripheral neuropathy and had undergone amputation of the right big toe 3 years previously. She was treated at multiple hospitals, but she found the ulcer was increasing in size.

On examination, the patient was found to have a non-healing ulcer measuring around 2.5 x 2.2 cm² at first metatarsophalangeal joint (MTPJ) region [Figure 1]. It belonged to Amit Jain's S2A1C1 ulcer type (Jain 2017c). It had pale granulation tissue at its base with punched-out edges. There was no probing to bone and X-ray of the foot did not show osteomyelitis.

The wound was cleaned with povidone iodine and saline, and surrounding callosity was debrided [Figure 2]. A dressing was applied [Figure 3] and Amit Jain's offloading device was prepared and applied as follows:

- A square/rectangular piece of 8 to 10 cm² microcellular rubber (MCR) of 10° to 15° shore A hardness with 3 mm thickness is prepared
- An equal size piece of ethyl vinyl acetate (EVA) of 5 mm thickness with 10° to 15° shore hardness is prepared
- A synthetic rubber adhesive is applied and both are stuck together. This is an 8 mm thick Amit Jain offloader [Figure 4].
- In this case, an L-shaped aperture is made over of the corners of the offloader, removing a small

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Figure 1 (left). Shows the non-healing trophic ulcer at first MTP region of right foot.

Figure 2 (middle). Shows the wound cleaned and surrounding callosity debrided.

Figure 3 (right). Shows the wound being dressed.



Figure 4 (left). The 8mm Amit Jain's standard offloading.

Figure 5 (middle). An aperture made in offloading to accommodate the ulcer area.

Figure 6 (right). Application of strips of elastocrepe bandage.



piece as shown [Figure 5] to accommodate the area of ulcer

- The offloader is loosely secured by applying two to three strips of elastocrepe adhesive bandage on the EVA side as shown [Figure 6] and this is anchored to the plantar skin [Figure 7]
- The Amit Jain offloader is then densely secured by applying large elastocrepe adhesive as shown [Figure 8]
- This offloader and dressing were changed every 3 to 4 days. The patient was allowed to use her protective footwear with a polymer insole
- The ulcer showed significant improvement [Figure 9] and healed at end of 7 weeks and 2 days of application [Figure 10]. We continued using the offloading for 2 more weeks for scar protection.

Discussion

Offloading of diabetic foot neuropathic ulcer is recommended as one of the main modalities for prevention and management of ulcer (Raspovic and Landorf, 2014). In spite of its known importance, it is often ignored and overlooked due to lack of training, poor understanding or limited resources (Shankhdhar et al, 2016; Baker and Osman, 2017).

Today, offloading is one of the main recommended treatment modality in diabetic foot ulcers. The author believes that offloading of foot ulcers should be considered both as an art

and science, instead of just an art (Cavanagh and Bus, 2010).

Various offloading devices are available and include total contact casts (TCCs), removable casts, felt padding, Amit Jain's offloading system, half shoes, samadhan system, CROW and cast shoes (Raspovic and Landorf, 2014; Jain, 2017a; 2017b).

The TCC, which was suggested earlier to be the first line offloading and the considered to be a gold standard in the West, is infrequently used in many developing countries due to multiple reasons (Jain, 2017a), including non-acceptance by patients, due to lack of knowledge and resistance to use by the treating clinicians. TCC is strictly contraindicated in infection, ischaemia, loss of sight and poor balance (Baker and Osman, 2017). Furthermore, it requires expertise, time, cost and can cause complications, such as skin ulcers (Sambrook et al, 2015; Jain, 2017a). Even in Western countries, it was shown that only 2% of practitioners use TCC (Wu, 2015). TCC should be considered to be a last resort of offloading when other modalities fail to heal the ulcer (Jain, 2017a).

Felted foam is a commonly used offloading method in clinical practice. Various studies have found that 7 mm to 8 mm felted foam are effective (Bowker and Pfeifer, 2008; Curran et al, 2015). Its main disadvantage is bottoming and losing its pressure-relief properties (Jain, 2017a). Furthermore, it is not available in developing countries.

Amit Jain's offloading system is a better



Figure 7. The application of Amit Jain's offloading in a similar fashion as felted foam.

Figure 8. Firm securing of Amit Jain's offloading with elastocrepe adhesive bandage.

Figure 9. The ulcer reduced in size drastically at the end of 4 1/2 weeks.

Figure 10. The ulcer completely healed.

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alternative to felt in developing and also in developed countries. In the standard Amit Jain's offloading system, a combination of 3 mm microcellular rubber and a 4 mm to 5 mm of EVA is used to make a 7 mm to 8 mm thick offloader that can be used similar to felt. Microcellular rubber (MCR) of shore hardness 10–15° shore A is known to prevent pressure points (Jain, 2017a). It has good cushioning properties, stretches in all direction and, most importantly, has the ability to spring back to its shape immediately when pressure is released in walking (Paul et al, 2014; Jain, 2017a). It is available in the author's region in 3 mm and 10 mm thickness. EVA is smooth, lightweight and soft with effective cushioning properties.

The combination was used by the author after conducting multiple pilot studies and observations. Obtaining 7 mm/8 mm microcellular rubber was difficult as the authors wanted to replicate felted foam. It was discovered that 10 mm MCR was too thick and there was pain and erythema after three to four applications. The issue with isolated EVA of 7 mm or 8 mm was that in overweight and obese patient it would get completely compressed, leading to pressure on the ulcer. EVA has an undesirable property referred to as "compression set" (Jain, 2017a).

In such a situation, the author combined a 3 mm MCR and 4 mm/5 mm EVA to produce an effective combination wherein the MCR would come to the rescue of compressed EVA and avoid contact of the wound to the ground, as well as resume its shape immediately (Jain, 2017a). Other combinations can also be used, but it is governed by Amit Jain's law of offloading (Jain, 2017a; Jain, et al, 2017). This law states: "Any viscoelastic/elastic materials used in

isolation or combination in thickness of acceptable ranges like felted foam should be considered to be a variation of Amit Jain's offloading system". This law was proposed to avoid plagiarism of this technique.

Conclusion

The practice of offloading is changing especially in developing and under-developed countries. Various new deflective offloading devices are now available. Amit Jain's offloading is one such new, simple deflective offloading, which is a better and superior alternative to foam. This offloading system has a scientific rationale of usage based on the deflective offloading concept, in view of the defined characteristics and properties of the materials used, which are scientifically accepted worldwide **DFIME**

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Expert commentary: Healing a diabetic forefoot non-healing neuropathic ulcer using the new Amit Jain's offloading system

Diabetic foot ulcers, especially non-healing ones, and their complications not only put a massive strain on healthcare systems the world over, but have a major impact on the quality of life for the patient. I have always said that healing any diabetes foot ulcer is like 'pulling all the pieces of a jigsaw together' and if all the 'pieces' are not in place, it will result in non healing or, at best, delayed healing.

In my 29 years' experience of treating diabetes foot ulceration, I know that the 'piece of the jigsaw' that is usually neglected is pressure relief, especially in neuropathic patients. I feel the reason for this can be threefold:

- Patient compliance due to insensate feet
- Lack of understanding
- The varied ability to supply suitable pressure relief.

Amit quite correctly points out in his article that Total Contact Casting 'in the West' is considered to be gold standard, but even in developed countries only 2% of practitioners actually regularly use this treatment modality. The reasons for this are generally related to patient acceptance, suitable clinician training and lack of access to a 7-day per week service.

Often, even in what we like to think of as 'gold standard' multidisciplinary foot clinics in the UK, we have to make compromises, for whatever reason, to suit either patient or service circumstances.

As Amit points out, felt padding, although not ideal, is still sometimes used in Western

countries as a method of offloading, but this is not an option for Amit's patients due to the lack of availability of felt in India.

Sometimes as clinicians, we have to 'adapt our treatment plan' according to our circumstances and, in my opinion, Amit has done this very well.

Amit Jain's offloading system to my mind demonstrates very clever use of what is available locally to achieve an end goal of pressure relief, or at least significant pressure reduction, to aid ulcer healing.

Amit has also very cleverly realised that using different densities of materials in combination not only provides enhanced pressure-relieving properties, but also prevents 'bottoming out', which happens quite quickly with the use of a material such as felt.

In the UK, in my experience and in my travels to other developed countries, many removable or non-removable pressure relieving/reducing strategies are adopted and fitted to patients. These strategies are not available to Amit in his clinic in India and I feel although his offloading system does have its limitations and drawbacks, he has introduced a strategy with what is available to offload his patients to the best of his ability with the available resources.

When we look at such strategies, we should be very grateful and understand, even though we do moan sometimes, that actually the service we provide, although not perfect, is infinitely better than services that are being provided in some other countries around the world.

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