

REVIEW ARTICLE

Medicine Science 2021;10(4):1562-5

Looking at offloading in diabetic foot from a different angle- the triangle

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Received 28 April 2021; Accepted 14 June 2021

Available online 04.10.2021 with doi: 10.5455/medscience.2021.04.145

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Abstract

Plantar ulcerations are quite common in foot of diabetic patient and majority of them are neuropathic. In view of these ulcers being located at weight bearing areas, it becomes essential to reduce pressure on wounds to facilitate optimal healing. In spite of knowing the benefits of offloading and also availability of various methods and devices, the practice of offloading has been suboptimal in many regions. This article aims to discuss some of the available offloading methods through a new teaching model, the triangle of offloading.

Keywords: Diabetes, foot, ulcer, triangle, offloading

Introduction

Diabetes mellitus is a chronic non communicable disease which is a major public health problem of 21st century [1]. It is predicted that there will be 552 million people with diabetes globally by the year 2030 [2]. India is also showing a drastic increase in diabetes and it is estimated that by 2030, there will be 79.4 million people suffering from diabetes [1, 3]. Even the burden of diabetes related complications is very high in India [4].

A common distressing complication of diabetes is the diabetic foot. It is estimated that globally, there are around 20 million people who have diabetic foot and around 2 million of them require amputation every year [5].

Diabetic foot ulcers, which is characterized by triad of neuropathy, infection and ischemia, continues to be a major health care burden [6, 7]. The lifetime risk of developing a diabetic foot ulcer range from 15-25% [8, 6, 9]. It is stated that every year 5 % of diabetes patient develop foot ulcers and 1% will require some amputations [10]. Foot ulcers may affect both feet and bilateral involvement ranges from 7.4% to 11.1% [8].

Many factors are involved in causation of diabetic foot ulcers apart from neuropathy and peripheral vascular disease. Some of the notable factors include trauma, previous ulcers, deformities, improper footwear, etc [11].

Most of the diabetic foot ulcers are located commonly over weight bearing area of the foot [12]. Most diabetic foot ulcers are located in forefoot region. In Smith et al study, the ulcers occurred in forefoot is 79% of cases whereas in Jain et al series, 88.8% of diabetic foot ulcers occurred in forefoot [8, 13].

Now with diabetic foot ulcers being on weight bearing areas commonly, they are subjected to frequent trauma that will not allow the ulcer to heal [12, 14]. Hence, in management of plantar ulcers, the pressure has to be redistributed away from the ulcer and this is known as offloading [14, 15].

It is stated that an ideal properties of pressure relieving methods consist of provision of effective pressure reduction throughout, cost effective in nature, should be easily applied with no side effects and patient should be compliant [16]. There are numerous offloading methods for healing diabetic foot ulcers and we shall address them through the new triangle of offloading [17].

Triangle of offloading

The Amit Jain's triangle of offloading (Figure 1) is a new teaching model that was proposed, in lines similar to triangle of wound

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assessment that provided a framework in wound management [18].

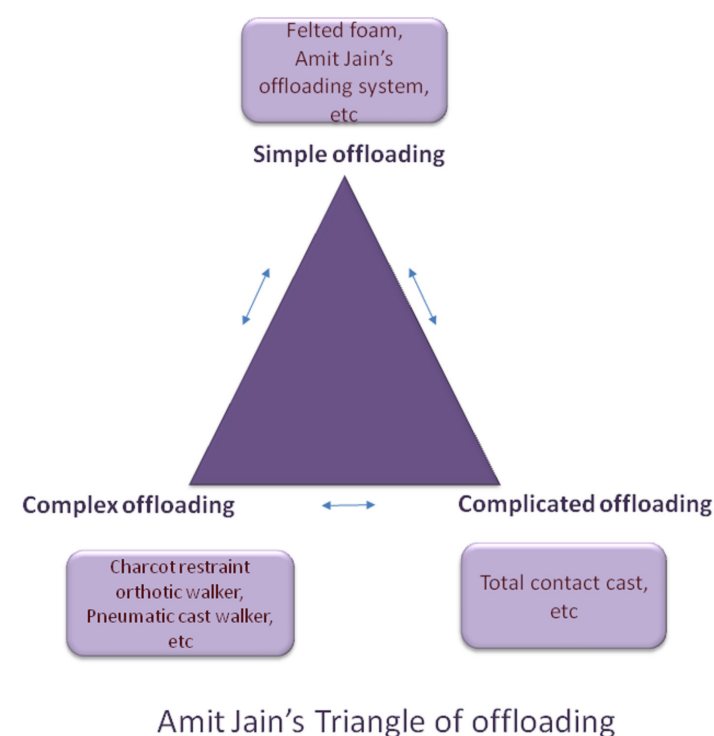


Figure 1. Amit Jain's triangle of offloading for diabetic foot

This triangle of offloading was obtained from Amit Jain's 'SCC' classification for offloading that categorized the offloading into 3 types namely type 1 offloading (simple), type 2 offloading (complex) and type 3 offloading (complicated) [19].

The 3 corner areas of the triangle of offloading represents the various offloading options available that can be used for diabetic foot ulcer [18].

Type 1 offloading - simple offloadings

Simple offloading is easiest to use and apply in diabetic foot ulcers [19]. Some of the offloading in this category includes the felted foam, wedged footwear's, Amit Jain's offloading system, etc. [19]. The felted foam has been used successfully by many clinicians who are trained in this technique [20]. A study by Raspovic et al showed that felted padding was the most commonly chosen modality for offloading the plantar ulcers and was used by 94% of the clinicians [14]. A study showed that 93% of ulcers healed within 12 weeks when they were treated by felted foam compared to 92% in people treated with total contact cast [20]. There are many advantage of felted foam like it can be used in presence of infection, wounds can be observed frequently, patient's can walk and go to work and further it is not as expensive as TCC [21].

However, the recent IWGDF guidelines state that it should not be used unless other options are not available as it is considered by the guidelines to be the least effective offloading device [21]. However many clinicians consider it to be first choice in their practice and have noticed good healing in their patients [20, 21, 14].

The another simple offloading that works on deflective offloading concept is the Amit Jain's offloading system, which is considered to be a better alternative to felted foam and can be used in places

where felted foam is not available and TCC is not preferred [23]. In this offloading system, two distinct types are available. In standard offloading system, a combination of microcellular rubber and ethyl vinyl acetate is used, whereas in variant type, only ethyl vinyl acetate or other visco-elastic material is used similar in pattern of felted foams [24]. A recent study found that 94% of the ulcers healed at the end of 8 weeks with Amit Jain's offloading system with no difference between standard and variant type of offloading [25].

Another simple type of offloading is the Samadhan system [26]. In this offloading method, a foam is rolled in cylindrical shape after applying adhesive to it and this is placed proximal to the forefoot ulcer and a retainer bandage is applied [26]. Patient can use this in footwear and do his work [27]. There are few case reports [26, 27] published on this technique by its innovator. Various other materials have been used by others like roller gauge, rolled up pads, gloves, etc instead of rolled foam though none have demonstrated any benefit over it [23].

Wedge shoes, half shoes, peg insoles, etc are other type of simple offloading used in clinical practice [19]. In peg insole footwear, plugs of materials are removed at area to be offloaded [12]. A study on ortho-wedge shoes showed 64-66% reduction in pressure [28]. The practical issue with anterior or posterior ortho- wedge footwear is instability during walking and risk of fall especially in elderly. In the wedged footwear, there is a thick wedged shaped section in the sole that has a thin platform part at the area to be offloaded [29]. The purpose of wedged footwear is to reduce the mechanical pressure on the wound so that there is healing. It was recommended as an alternative in ulcer management where other devices like TCC or RCW cannot be used [30]. However, the wedge footwear cannot or should not be used if patient has ankle equinus or bilateral ulcers [31].

Type 2 offloading- complex offloadings

Removable walker like pneumatic walker or Charcot restraint orthotic walker (CROW) are commonly used offloading devices that were designed to be alternatives to the total contact cast [12, 28]. These removable cast walkers are complex offloading device [18, 19] and they can be considered superior to many other offloading devices [20]. A study by Wu et al showed that only 15.2% used removal cast walkers [32]. The pneumatic walker, also known as aircast, offloads the foot by achieving complete contact with plantar aspect of foot [12]. These devices are equally efficacious like TCC and have a distinct advantage of removing, inspecting the wound and dressing it [15]. They can be used in presence of ischemia unlike TCC [15].

Another complex offloading device is Charcot restraint orthotic walker, which can be used in second and third stages of Charcot foot to maintain joint stability [28]. This bivalve ankle foot orthosis lasts for longer period [12].

Type 3 offloading- complicated offloadings

These offloading require time to apply and also expertise [19]. The examples of complicated offloadings are total contact cast (Figure 2) and Bohler Iron plantar cast [18, 19]. Total contact cast is considered to be the most effective offloading method for

diabetic foot wounds as it redistributes the pressure across the foot efficiently [16]. Although considered gold standard by many, a study by Wu et al showed that majority (58%) do not consider TCC as gold standard and less than 2% used TCC [12, 32]. TCC heals wound in short period of time and many studies showed healing rates to be as high as 90% by end of 12 weeks [20, 33]. In spite of TCC being an excellent offloading method, there are numerous disadvantages associated with it like time consuming, requires expertise, costly, cannot be used in infected wounds and ischemia, etc [12, 20, 23]. Further, TCC is not frequently used at many places due to lack of training and resources [29]. The complications with TCC are also high and have been under-reported.



Figure 2. Total contact cast being applied. This is type 3 offloading

Bohler Iron plantar cast is another complicated offloading device that is effective in healing [34]. It is also time consuming and is not easily available at many places and requires training. A study by Saikia et al found Bohler iron cast to have a good healing of ulcers without affecting the lower extremity function [34].

Conclusion

Distinct methods of offloading are available in different parts of the world and a clinician can choose which ever is best suitable for his patient provided it is effective. The offloading modalities range from simple off loadings like felted foam to complicated offloading like total contact cast, which is expensive and requires expertise. Each offloading method has its own advantage and disadvantage and it requires a good decision making as to which is appropriate to his patient based on clinical evaluation. Cost evaluation and patient's job profile are also essential key factors in deciding the choice of offloading in clinical practice apart from other local wound factors.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

All authors declare no financial support.

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