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**Review Article**

# Effective Management Strategies for Treatment of Diabetic Foot Ulcer

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## ABSTRACT:

**Background:** Diabetes mellitus is a rapidly rising disease worldwide. It has many complications affecting the overall health status of diabetic individuals as well as their life quality. Peripheral vascular and neuropathy are among the devastating complications of diabetes. They result in diabetic foot ulcer development. This should be prevented initially by preventative strategies which include annual screening of diabetic-foot and patient's education of self-care. When ulcers happen, different approaches could be taken to manage patients. **Aim:** the aim of this review article is to spots light on different management methods to treat diabetic foot ulcers. **Material & Methods:** PRISMA method is used to collect the articles from different data bases such as web of science, Scopus. Total 608 articles found relevant after applying inclusion exclusion criteria and duplication criteria total 27 articles were included in the analysis. **Findings:** From the literature review eight factors are found which are discussed in detail in the paper. **Conclusions:** Diabetes mellitus is a long-term condition that can lead to serious complications. In their lifetime, around one-third of diabetic people may develop foot ulcers.

## KEYWORDS:

Diabetes mellitus, Wound management, Diabetic foot ulcer, wound dressing, wound debridement, growth factor, team multidisciplinary (MDT), glycemic control, medication-based treatment, negative wound pressure

## 1 | INTRODUCTION

In recent decades, diabetes mellitus (DM), a chronic metabolic disease, has emerged as a major global health concern.[1] Numerous problems associated with diabetes mellitus impact both life expectancy and quality of life. One of the most difficult side effects of diabetes mellitus is diabetic foot ulcers (DFU). DFUs may occur in up to one-third of diabetic people at some point in their lives.[2] According to reports, the frequency of DFUs is 6.3% worldwide, and they are more common in type 2 DM than type 1 DM and in men than women.[3] DFUs have a high recurrence rate as well. The management of diabetic foot ulcers requires offloading the wound, negative wound pressure, one of the widely used methods for treating diabetic foot ulcers, is necessary for the extraction of tissue fluid using a sealed vacuum. In order to preserve the barrier function against outside forces and contaminants, wound dressing is essential. Additionally, it promotes the best possible absorption of the oozing around the ulcer site. Since surgery helps prevent and repair ulcers, it is an essential part of DFU therapy for diabetic patients. Callus forms as a result of debridement's decreased pressure on the DFU. Selective sharp debridement or debridement of superficial lesions are two techniques for eliminating necrotic and hyperkeratotic tissue. This enhances the tissue's ability to heal injuries. One therapeutic strategy for DFU patients who have shown a satisfactory response to growth factors, such as platelet-derived growth factor, is the use of growth factors. Treatment based on medication Patient education and awareness initiatives enhance patients' knowledge of diabetes and their capacity to manage it

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independently. Patients with diabetic foot ulcers who have numerous comorbidities and require the engagement of multiple specialists in their treatment must be treated by a team multidisciplinary (MTD).

## 2 | LITERATURE REVIEW

### 2.1 | Team Multidisciplinary

MTD is required for the Patients who are having diabetic foot ulcer, experience many complications, necessitating the involvement of multiple specialists in the patient's care. Research indicated that diabetes patients receiving solitary specialist care have a higher rate of amputations in contrast to those under MDT care. A diabetologist, podiatrist, ophthalmologist, general surgeon, vascular surgeon, microbiology, specialized nurse, and an orthopedic make up the specialist team. This is important because glycemic and blood pressure control, renal function and retinopathy have all been highlighted as aspects need to be followed up thoroughly as all affect the prognosis of the patient.[4]

### 2.2 | Glycemic Control

Glycemic control postpones the progression of diabetic complications and slows down development of DFU among diabetic patients. Nevertheless, glycemic control must be accompanied with continuous monitoring of glycemic state to prevent hypoglycemia.4 A meta-analysis conducted to assess the effect of intensive glycemic control demonstrated significant reduction of neuropathy development among diabetic patients. In other research evidence, it was suggested that tight glycemic control is the most important tool in prevention and delay of neuropathy development among diabetic patients. This is a useful tool also to measure distal sensorimotor neuropathy objectively.[5]

### 2.3 | Medication

Medication based treatment Patients' understanding of diabetes and ability to manage it on their own are improved by patient education and awareness campaigns. Additionally, this forces patients to follow their doctors' advice and take their prescription more precisely. Treating neuropathic pain presents difficulties for both patients and doctors.[6] DFU is brought on by persistent sensorimotor distal symmetrical polyneuropathy, which is the source of it. For the treatment of pain, pregabalin and duloxetine as first-line medications. It is recommended to quit smoking and take statins regardless of cholesterol levels to minimize this.[7] Moreover, antiplatelet drugs are advised. Treatment for superinfections beyond DFU is also necessary. Effective antibiotic therapy is one that is well-targeted and dependent on the outcomes of the wound culture. The length of treatment varies according on the severity of the underlying infection, from two weeks to two months.[8]

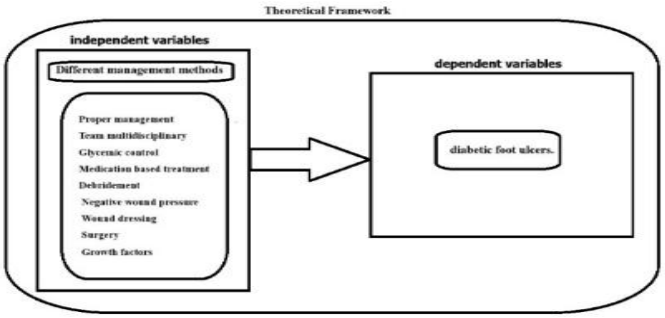


**Figure 1:** Theoretical framework

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### 2.4 | Debridement

Debridement reduced pressure on the DFU causes callus to develop. One of the two methods for removing necrotic and hyperkeratotic tissue is debridement of superficial lesions or selective sharp debridement. This improves the tissue's capacity to mend wounds. On the other hand, extensive debridement and maybe surgery are necessary for profound ulcerations involving soft tissue and bone. A decrease in the number of amputations among diabetes patients is the outcome of timely debridement.[9]

### 2.5 | Negative wound pressure

Negative wound pressure is one of the popular techniques for managing DFUs which involves extracting tissue fluid using a sealed vacuum. This enhances the creation of granulation tissue and tissue perfusion. Compared to a standard gauze dressing, the course of treatment is shortened. According to a Canadian evidence-based study, there is no statistically significant difference in the amount of time required for wound closure between negative wound pressure and normal wound care.[10]

### 2.6 | Wound dressing

Wound dressing plays a crucial role in maintaining barrier function against external forces and contaminations. Moreover, it facilitates optimal absorption of ooze surrounding the ulcer site. Different dressing kinds and cutting-edge techniques for encouraging wound healing are available.[11] While there is evidence that moist dressings are more effective than dry ones or vice versa, developments in wound dressing technology remain. Randomized controlled trials could provide a solution to the question of whether wet or dry dressings work better.[12]

### 2.7 | Surgery

Surgery is a crucial component of DFU care for diabetic patients, since it helps prevent and treat ulcers. Over the previous 20 years, its utilization has increased. Surgery procedures have significant risks since those patients are diabetic.[13] Therefore, the improvement in results must be attributed to the specific technique used for foot ulcers. Amputations and both vascular and non-vascular foot procedures are among the surgeries performed.[14]

### 2.8 | Growth factors

Growth factor is also one of the management strategies for controlling patients with DFU who have demonstrated good response from growth factors such as platelet derived growth factor (PDGF), fibroblast growth factor, vascular endothelial growth factor, insulin-like growth factor and many others. Nonetheless, in RCTs, one kind demonstrated higher healing rates in comparison to controls.[15] This growth factor is called rhPDGF, or recombinant human PDGF. than those receiving the best clinical care plus placebo (vehicle gel) alone," the study stated.[16]

## 3 | MATERIAL AND METHODS

Establishing a research question, carrying out a comprehensive database search to obtain pertinent research materials for possible inclusion, using preset inclusion and exclusion criteria to choose which studies to evaluate, evaluating the quality of the selected studies and extracting relevant information, conducting the analysis, and presenting the results are the five main steps that typically make up a systematic review process.[17]

3.1 | Formulation of the Question (a) Which management approaches have been studied in relation to DFU?
(a) In what ways do various management techniques aid in DFU control?

Inquiry into Research To assess the scope and accessibility of research on the connection between management strategies and DFU, a preliminary evaluation of the body of current literature was carried out at the outset. The results of this inquiry showed that no systematic literature evaluation had been done on the topic before. Assessing a variety of search strings prior to starting the full search can help determine the efficacy and suitability of the search query. The following search query was created to examine articles inside the chosen databases after a sufficient number of tests with various strings. In August 2024, a search was conducted in two popular databases: Web of Science and Scopus.

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### 3.2 | Inclusion and Exclusion

Standards Both quantitative and qualitative research that provided important insights into the management strategies for controlling DFU were included in the systematic literature review (SLR). We concentrated on articles released in the twenty-first century to guarantee thorough coverage. English-language research articles, books, book chapters, dissertations, and erratum were all included in our selection criteria. Before carefully assessing the whole texts to ascertain article relevancy, we first performed searches using titles, abstracts, and keywords. The following exclusion criteria were used to further evaluate the original sample. First, only full-text, peer-reviewed publications were taken into consideration for inclusion, in accordance with earlier systematic literature reviews.[14-16] Research papers, book reviews, editorials, extended abstracts, letters, notes, brief surveys, bibliographical items, meeting abstracts, news items, and retractions were not included. Second, the original search did not include research that were not published in English. Thirdly, our research seeks to examine conceptual and literature review studies that demonstrate both methodological and theoretical rigor, as well as empirical investigations (including mixed-methods, qualitative, and quantitative studies).

### 3.3 | Study Selection and Data Extraction

608 studies were included in this review as a result of the two screening phases, which were title/abstract and full text. A data extraction form was completed for each qualifying study in order to collect details like the name of the first author and the year of publication. Finally, redundant articles were eliminated. As a result, the research papers that made up this systematic literature review came from reliable sources, specifically Web of Science and Scopus, added to the systematic literature review's strength and dependability and provided a thorough and reliable basis for understanding the relationship between management strategies and DFU.

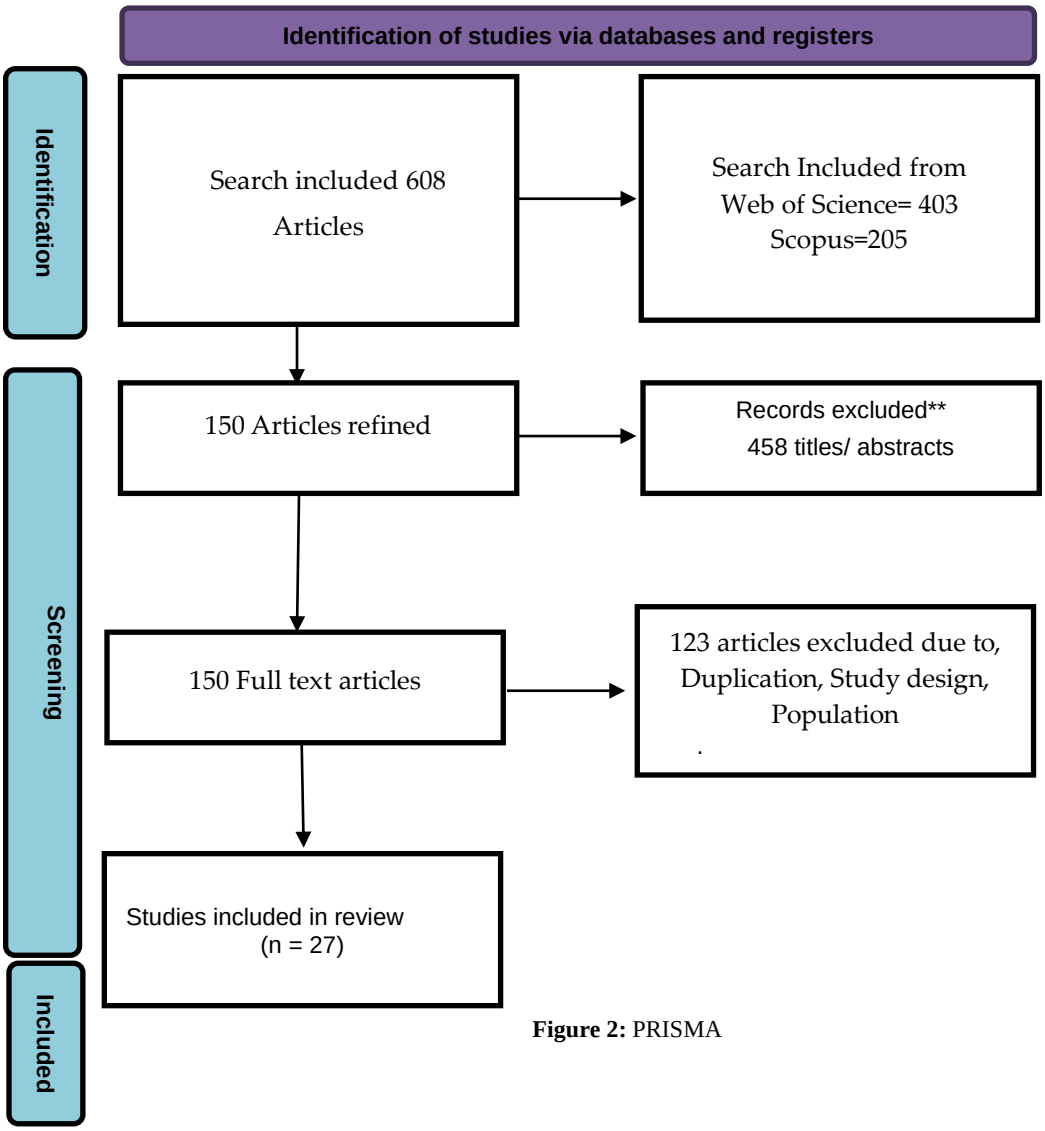


**Figure 2:** PRISMA

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## 4 | RESULTS AND DISCUSSION

This Systematic Literature Review was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[19] The studies included in the systematic literature review encompass management strategies viz, Wound management, Diabetic foot ulcer, wound dressing, wound debridement, growth factor, team multidisciplinary (MDT), glycemic control, medication-based treatment, negative wound pressure. A diabetologist, podiatrist, ophthalmologist, general surgeon, vascular surgeon, microbiologist, specialized nurse, and an orthopedic specialist are all part of the multidisciplinary team's management.[20] Patients with diabetes who get strict glycemic management show a marked decrease in the development of neuropathy. This method is particularly helpful for reliably measuring distal sensorimotor neuropathy. The underlying cause of DFU is persistent sensorimotor distal symmetrical polyneuropathy. Duloxetine and pregabalin are the first-line drugs used to alleviate pain. To reduce this, statins and quitting smoking are advised regardless of cholesterol levels.[7] Antiplatelet medications are recommended in Debridement. Deep soft tissue and bone ulcerations may require significant debridement and possibly surgery. According to Hsu, Chang, Chen, Lin, and Chen[9] prompt debridement results in fewer amputations among diabetic patients. Another well-liked method for treating DFUs is negative wound pressure, which entails drawing tissue fluid out with a sealed vacuum. This promotes tissue perfusion and granulation tissue formation. In order to preserve barrier function against outside forces and contaminants, wound dressing is essential. Additionally, it promotes the best possible absorption of the oozing around the ulcer site. There are various types of dressings and innovative methods for promoting wound healing.[11] An essential part of DFU treatment for diabetic individuals is surgery. The surgeries include vascular and non-vascular foot procedures as well as amputations.[14] Patients with DFU who have shown a satisfactory response to growth factors, such as insulin-like growth factor, fibroblast growth factor, vascular endothelial growth factor, platelet derived growth factor (PDGF), and many others, can also be managed with growth factors.[21]

## 5 | CONCLUSION

Diabetes mellitus is a long-term condition that can lead to serious complications. In their lifetime, around one-third of diabetic people may develop foot ulcers. Dramatic outcomes are typically the outcome of an occurrence that could have been avoided. Diabetic foot ulcers (DFUs) require a multidisciplinary approach to care and prevention. Preventing the production of DFU is the most crucial strategy. Adequate treatment interventions should be carried out as soon as they are developed, and prevention actions should be put into action as soon as possible. Patients with diabetes are more likely to develop DFUs, which frequently result in the amputation of a lower leg. Numerous interventions might very easily prevent this. The patients' awareness and education are the most crucial factors. For these conditions to be managed, MDT must be present. When practical and appropriate, the methods outlined in the review ought to be employed. They lower diabetic patients' morbidity and death.

## 6 | IMPLICATIONS

The current study has implications for health practitioners as well as diabetic patients. There is need to conduct empirical study on this topic and framework, the findings of such study would offer some practical implications for health workers, physicians, consultants, specialists as well as patients, healthcare organizations and Ministry of Health Pakistan could also take benefits form the findings of the study. Moreover, the factors identified in this study are also helpful for diabetic patients and health practitioners.

## 7 | LIMITATIONS AND FUTURE DIRECTIONS

This study has offered several contributions but it is important to mention limitations and future research directions. First of all, this study has collected data from WOS and Scopus, it is recommended for future studies to add data and articles form EBSCO, PubMed, Ulrich and J-Gate.

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