

## Study of Some Effective Treatments for Accelerating Diabetic Foot Ulcer Healing: A Systematic Review

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### ABSTRACT

**Introduction:** Diabetes is a chronic, metabolic disease characterized by an increase in blood glucose levels. Foot ulcer is a major complication of diabetes mellitus with high morbidity, mortality, and associated costs. Foot ulcers are commonly infected with diabetic patients and have potential for cellulite progression. And if not treated quickly and properly, it leads to blood and gangrene infections, and sometimes leads to amputation. Considering that planning to increase the health of patients with diabetic foot ulcer needs to know the existing treatments and the problems with these treatments. Therefore, this systematic review was conducted with the goal of determining some effective treatments for accelerating diabetic foot ulcer healing.

**Materials and Methods:** The present study is a systematic review study it was conducted in English and Persian by searching articles in search engines, reputable scientific sites and databases Magiran, Google Scholar, Embase, Science direct, Google Scholar, Pub Med, and Springer. In order to achieve the goal of the study and to improve the accuracy of its study and its comprehension, this integrated overview study was conducted based on the Broome method. This study, using the papers published over the past 20 years, has been associated with effective treatments for accelerating diabetic foot ulcer healing. In the first stage, 38 articles were found. Of these, 12 articles related to the topic that were published in the last 20 years were reviewed.

**Results:** In this study, several methods for the treatment of diabetic foot ulcers have been investigated. One of these studies was performed with the goal of determining the effect of compressive-suction treatment (VCT) on the repair of foot ulcer in diabetic patients, the decrease in the area of the foot ulcer surface after treatment in the experimental group was higher than the control group. As a result, when compressive suction treatment is combined with proper care of the foot ulcer, it increases the healing of diabetic foot ulcers.

**Conclusion:** In the studies that studied, several treatments have been made on diabetic foot ulcers that have been effective, therefore, it is necessary to follow up on timely treatment to prevent the recurrence of wound infection and limb amputation. It is also imperative that diabetic patients with their blood glucose and BMI control, doing aerobic exercise, healthy eating and regular referral to the physician, prevented the development of foot ulcers and other complications.

**Keywords:** diabetic foot ulcer, diabetes, foot ulcer treatment, diabetic patients

### INTRODUCTION

Diabetes is a chronic, metabolic and genetically heterogeneous disease which is characterized by an increase in blood glucose levels and has become a major public health problem in the world, especially in Asia, due to an increase in the number of people suffering from the disease

(1-6). Inappropriate combination (low physical activity and unhealthy foods) has led to an uncontrollable increase in the prevalence of diabetes in the world. In 2014, the global prevalence of diabetes among adults older than 18 years of age was estimated at 9% (7-11). The disease is associated with multiple short-term and long-term complications, which in many

cases is not reversible (12-14). In diabetic patients, depression is one of the most common psychiatric disorders (15). Depression is one of the most common and debilitating problems for youth and adolescents. (16,17). Depression and occupational stress daily can cause some disorders in people's mental and physical health (18). High occupational stress is known as a known psychosocial factor in cardiovascular disease (19). According to previous studies, the study can reduce their anxiety and depression (20). Diabetes is also one of the most common endocrine complications in thalassemic patients (21). Thalassemia is a hereditary blood disease. The annual incidence of symptomatic cases is estimated to be around one in every 100,000 people worldwide (22-27).

Foot ulcer is a major complication of diabetes mellitus with high morbidity, mortality, and associated costs (28). Foot ulcers are commonly infected with diabetic patients and have potential for cellulite progression. And if not treated quickly and appropriately, it leads to blood and gangrene infections, and sometimes leads to amputation (29). Therefore, it is necessary to take precautionary measures against diabetic foot. that includes identifying people with foot ulcer risk factors, educating the patient and his fellows in the field of foot care and appropriate and comprehensive treatment of foot ulcer (30). Also Considering that planning to increase the health of patients with diabetic foot ulcer needs to know the existing treatments and the problems with these treatments. Therefore, this systematic review was conducted with the goal of determining some effective treatments for accelerating diabetic foot ulcer healing.

## **MATERIALS AND METHODS**

The present study is a systematic review study It was conducted in English and Persian by searching articles in search engines, reputable scientific sites and databases Magiran, Google Scholar, Embase, Science Direct, Google Scholar, PubMed, Springer. Using the articles published over the past 20 years, he has been discussing effective treatments for accelerating healing of diabetic foot ulcers. In the first stage, 38 articles were found. were reviewed of these, 12 articles related to the topic that were published in the last 20 years.

In order to achieve the goal of the study and to improve the accuracy of its study and its comprehension, this integrated overview study was conducted based on the Broome method.

The purpose of this method was to achieve the purpose of the study and to enhance the study's thoroughness and comprehension. The method is based on three steps in the search of texts, data evaluation and data analysis. In the search phase of the texts, the studies after the retrieval were examined in terms of the criteria for entering the study in four stages. After obtaining the terms of entry into the study, the content of the study is evaluated and at the end the analysis of the data was done.

The studies studied were written in English or Persian, access to their full text was possible and they entered the study and unnamed studies were deleted without history and non-academic. To achieve relevant studies, a wide range of keywords including diabetic foot ulcer, diabetes mellitus, foot ulcer treatment, and diabetic patients was used as a one-to-one search, combined with the method "And" and "OR".

## **RESULTS**

In this clinical trial study by Kargar et al. With the aim of determining the effect of platelet gel in the treatment of diabetic foot ulcers, 70 patients with diabetic foot ulcer were selected randomly based on vascular and neuropathic ulcer grading. 35 patients were treated with platelet gel and 35 subjects received routine treatment. Both groups received intravenous antibiotics (metronidazole and ceftriaxone) during the admission. Patients were evaluated for three weeks. The basis for the response to treatment was the formation of visible and visible granulation of graft, or epithelization. There was no indication of amputation in the platelet gel treatment group. In the control group, foot ulcers in 6 patients resulted in limb amputation. (31).

In a study aimed at determining the role of laser therapy in the treatment of diabetic foot ulcers and a randomized clinical trial on diabetic patients who had been diabetic foot ulcers for more than three months. Patients were randomly divided into two groups: light laser and silent laser (placebo). Laser therapy was performed for 12 sessions during 4 weeks with low-power laser gallium, aluminum. Low-power laser beam can be contacted on the surface of the lesion. Changes in the area of lesions were evaluated as the main post-treatment outcome and up to the fourth month follow-up (32).

In a study that aimed to determine the effect of compressive-suction treatment (VCT) on foot ulcer healing in diabetic patients, the decrease in

the area of the foot ulcer surface after treatment in the experimental group was higher than the control group. And as a result, when compressive suction treatment is combined with proper care of the foot ulcer, it increases the healing of diabetic foot ulcers (33).

In a study that aimed to determine the effect of low-frequency ultrasound waves on diabetic foot ulcers with osteomyelitis in a randomized clinical trial, in the treatment of chronic ulcerative grade 3 diabetic wounds, based on Wagner's classification, low-frequency ultrasound waves along with standard wound care compared with standard care from wound healing alone initially accelerate the healing of chronic diabetic foot ulcers, especially in the second and third months. However, after 6 months of follow up, no significant difference was observed in the rate of wound healing (34).

In a study to report a case of diabetic foot ulcer treatment with topical administration of honey and olive oil, to the patient was advised to wash the wound completely with the serum first then place the mixture on a sterile gas and place it on the scar and dressing every 24 hours. After 5 days of treatment, granulation tissue was developed in the wound and the wound was completely improved within a month. The result was that the patient was followed up for two weeks after treatment discontinuation and no recurrence was observed (35).

In a study that was performed with aimed to report a case of diabetic foot ulcer treatment using heat-treated propolis in olive oil, the patient had a wound in the area of the toe at a depth of 1 cm. After referring, the use of penicillin powder and rinse with betadine was stopped and treated as daily dressing with topical mixture of heated lambs in olive oil and animal oils. The patient was advised to wash her wounds before dressing with her serum and then place the topical mixture on a sterile gas Place the wound on the wound and change the bandage every 12 hours. After one week of starting treatment, new tissue was seen in the wound and the ulcer was completely closed within 2 weeks. The result is that the heat treated wax in olive oil and animal oil is suitable for the treatment of diabetic foot ulcers (36).

In a study of 7 diabetic patients with chronic Wagner 2 and 3 wound healing, it was seen that the red light of 660 nm radiation to the wound base and infrared 980 nm around the wound and red intravenous light with infrared laser to some acupuncture points for 5 to 10 days a day and

then 2 times a week until complete wound healing repairs these wounds. that have not recurred after 6 months (37).

In another study, retrospective study was done on 48 patients before and after treatment, using immersion ultrasound of necrotic tissues derided and the surface of the wound decreased and the granulation tissue increased and the rate of wound healing without scar and slough was also higher (38).

Another way to treat foot ulcers is to use an air cast diabetic walker boot the air bag inflates inside the boot to reduce stress on the skin. It has a hard outer sheath and a deep heel that lowers the pressure (39).

Another method that replaces the two-layer human skin that is used to treat intra venous ulcers and diabetic foot ulcers is Apligraf (40).

In a clinical trial, Tretinoin 0.5% solution for 10 minutes daily followed by iodine gel for 4 weeks in wound healing than control group (41).

The findings of this study aimed to determine the effect of endurance training and cold plasma on wound healing in diabetic rats. Showed that the effect of a cold plasma radiation and endurance training did not significantly improve the wound healing in diabetic rats. However, a period of endurance training and cold plasma also has a significant effect on wound healing in diabetic rats. The result is that it is the first time that endurance and cold plasma therapy is used to improve diabetes mellitus. And these two together significantly accelerated wound healing in diabetic rats (42).

## DISCUSSION AND CONCLUSION

Diabetes is a chronic, metabolic disease which is associated with multiple short-term and long-term complications which in many cases is not reversible. Foot ulcers are commonly infected with diabetic patients and have potential for cellulite progression. And if not treated quickly and appropriately, leads to blood and gangrene infections and sometimes leads to amputation. Considering that planning to increase the health of patients with diabetic foot ulcer needs to know the existing treatments and the problems with these treatments. Therefore, this systematic review was conducted with the goal of determining some effective treatments for accelerating diabetic foot ulcer healing.

In a study to determine the effect of platelet gel in the treatment of diabetic foot ulcers in general, it can be said that this study showed

that platelet gel dressing was effective in the treatment of diabetic foot ulcer (31). Platelet growth factors are biologically active substances which accelerates the tissue repair mechanism such as chemo-toxicance, cell proliferation, angiogenesis, and extracellular matrix sedimentation. At the site of tissue damage, platelets release mitogen and inflammatory substances which embrace all aspects of tissue repair. The recombinant human platelet growth factor has been successfully used in the treatment of squamous and diabetic foot ulcers, but its production is not easy and costly (43). Accordingly, the released platelets in the form of activated platelets have been widely studied for the local treatment of various clinical conditions, including wounds and soft tissue lesions (44).

In a study that was done in order to determine the role of laser therapy in the treatment of diabetic foot ulcer in diabetic patients, showed that laser therapy can be effective in accelerating the healing of diabetic ulcers (32). The laser works with several mechanisms in these cases. In the first stage, vasodilatation increases the blood flow in the area. In infectious wounds, strengthening the immune system helps eliminate microorganisms. Finally, by enhancing the tissue repair process, wound healing is accelerated.

In another study that was done the aimed to determine the effect of compressive-suction treatment (VCT) on foot ulcer healing in diabetic patients, showed that compressive suction treatment was accompanied by proper care of foot ulcer, it increases the healing of diabetic foot ulcers. Therefore, it is recommended that patients with diabetic foot ulcers and chronic wound without recovery should use vascular-compression therapy for wound healing and maintenance of organs (33).

In a study conducted with the purpose of reporting a case of diabetic foot ulcer treatment with topical administration of honey and olive oil, after 5 days of treatment, granulation tissue was developed in the wound and the wound was completely improved within a month. The result was that the patient was followed up for two weeks after treatment discontinuation and no recurrence was observed (35).

In the studies that studied, several treatments have been made on diabetic foot ulcers that have been effective; therefore, it is necessary to follow up on timely treatment to prevent the recurrence of wound infection and limb

amputation. It is also imperative that diabetic patients with their blood glucose and BMI control, doing aerobic exercise, healthy eating and regular referral to the physician, prevented the development of foot ulcers and other complications.

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