# Evaluation of wound healing in diabetic foot ulcer using platelet-rich plasma gel- A single-arm clinical trial

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#### Abstract

The aim of the present study was to evaluate the effectiveness of using autologous platelet-rich plasma (PRP) gel for treatment of diabetic foot ulcer (DFU) during the first 4 weeks of the treatment. In this longitudinal and single-arm trial, 100 patients were randomly selected after meeting certain inclusion and exclusion criteria; of these 100 patients, 70 (70%) were enrolled in the trial. After the primary care actions such as wound debridement, the area of each wound was calculated and recorded. The PRP therapy (2 mL/cm<sup>2</sup> of ulcers) was performed weekly until the healing time for each patient. We used one sample T-test for healing wounds and Bootstrap resampling approach for reporting confidence interval with 1000 Bootstrap samples. The p-value < 0.05 were considered statistically significant. The mean (SD) of DFU duration was 19.71 weeks (4.94) for units sampling. The ratio of subjects who withdrew from the study was calculated to be 2 (2.8%). Average area of 71 ulcers in the mentioned number of cases was calculated to be 6.11 cm<sup>2</sup> (SD: 4.37). Also, the mean, median (SD) of healing time was 8.7, 8 weeks (SD: 3.93) except for 2 mentioned cases. According to one sample Ttest, wound area (cm<sup>2</sup>), on average, significantly decreased to 51.9% (CI: 46.7–57.1) through the first four weeks of therapy. Furthermore, significant correlation (0.22) was not found between area of ulcers and healing duration (p-value > 0.5). According to the results, PRP could be considered as a candidate treatment for non-healing DFUs as it may prevent future complications such as amputation or death in this pathological phenomenon.

### Introduction

Diabetic foot ulcer (DFU) is a common accompanying complication and the most important cause of hospitalization among diabetic patients. This phenomena, with an incidence of 15% in diabetic population, is an important issue for health and care services [1], [2], [3]. During the lifetime of a diabetic patient, the risk of any lower extremity involvement with DFU is estimated to be about 25%, which is affected by several risk factors including arterial disorders, peripheral neuropathy and infection. Among diabetic patients, 20% are diagnosed with inadequate blood flow and 50% with peripheral neuropathy. These incidences are highly significant in DFU population because 80% of them are suffering from both conditions [4]. Moreover, the vascular problems in these cases not only postpone the wound healing process but also hinder the reaction of the immune system to the accompanying infections. The vascular complications in diabetic patients mostly develop as 3 major disorders of thrombosis or arteritis of arterioles, peripheral neuropathy (mostly due to the ischemic situations) and atherosclerosis of arteries. Besides the mentioned risk factors, physical and mechanical traumas causing neuropathy in lower extremity may also lead to DFUs [5], [6], [7]. Chronic DFU is defined as an ulcer not decreased by 50% of the primary size during a month [4]. Proper treatments suggested for DFU mostly include local actions such as ulcer debridement, antibiotic therapy and bedside surgery [8], [9]. Although ulcer debridement is suggested as the primary step, it could only be helpful when the patient does not suffer from arterial insufficiency. So far, different surgical methods such as percutaneous transluminal angioplasty [10], luminal stenting and arterial reconstruction surgery have been practiced in order to improve blood supply in patients with ischemic DFUs [11], [12]. Moreover, new strategies such as hyperbaric oxygen therapy [13], bioengineered tissues [14], electrical stimulation, phototherapy [15] and platelet derived growth factors [16] are also recommended and applied. Platelet derived growth factors, which have been available clinically since 1985, are biologic active compounds acting in different mechanisms and pathways including activation or induction of chemotaxis, cellular proliferation and angiogenesis to induce and accelerate wound healing [17].

The aim of this longitudinal and single-arm clinical trial was to evaluate the effectiveness of using autologous PRP gel for treatment of DFU during the first 4 weeks of treatment.

## Section snippets

# Ethics

This clinical trial was approved by the Medical Ethics Committee of Research Institute for Hematology, Oncology and Stem Cell Transplantation of Shariati Hospital, Tehran University of Medical Sciences (approval code: 1394.103.3). Also all the team members considered the 1975 Declaration of Helsinki and its following revisions during the trial. The aim of this study was clearly explained to each patient. After the purpose of the study was explained (according to the patients' level of

# Results

During the mentioned time period, 100 patients were evaluated from which 30 were excluded according to the already defined exclusion criteria. Among the remaining 70 cases with 71 ulcers, 58 (83%) individuals were male and 12 (17%) were female. The average age of participants (in the range of 30–79 years old) was calculated to be 53.8 years (SD: 10.59). As already explained, a full medical history of patients was collected and according to these histories, duration of diabetes was recorded

#### Discussion

Diabetes has long been known as a serious issue in health care system due to its growing prevalence. According to the literature, patients with diabetes are estimated to be 422 million (2014) [18], which could reach to 552 million people in 2030 [19]. As any other chronic disease, diabetes is associated with various complications in different organs [20], [21]. Among these complications, DFUs, which almost always are observed in lower extremity, occur in 15% of diabetic population [22]. This

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