



## Case Report

# Platelet Rich Plasma for Treatment of Nonhealing Diabetic Foot Ulcers: A Case Report

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## ABSTRACT

Diabetic foot ulcers are one of the most important causes of lower limb amputations worldwide.

The conventional treatments of diabetic foot ulcers are costly and often require patients to be hospitalized for long periods of time, thus representing a huge burden on any health care system.

The use of autologous platelet-rich plasma (PRP), which is rich in multiple growth factors, may bear some similarities to the natural wound healing process. Nonetheless, few studies on human subjects have so far addressed the efficacy of PRP as a novel and minimally invasive treatment. Today, there is only 1 approved and available system to separate PRP from a patient's own blood in order to be used in diabetic ulcers. This system incorporates bovine thrombin for activation of PRP gel and may be applied by many healthcare providers without the need for extensive special training. In this report, a patient with extensive diabetic foot ulcers, non-responsive to other treatment modalities, was successfully treated by PRP.

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## R É S U M É

Les ulcères du pied diabétique sont l'une des causes les plus importantes d'amputations du membre inférieur à travers le monde.

Les traitements traditionnels des ulcères du pied diabétique sont coûteux et exigent souvent l'hospitalisation à long terme des patients, ce qui, par conséquent, représente un lourd fardeau pour tout système de soins.

L'utilisation de plasma riche en plaquettes (PRP) autologue, qui est aussi riche en facteurs de croissance divers, peut se rapprocher du processus naturel de cicatrisation. Néanmoins, certaines études réalisées sur des sujets humains ont déjà abordé l'efficacité du PRP comme nouveau traitement minimalement invasif. Aujourd'hui, il existe 1 seule méthode approuvée et accessible pour séparer du sang prélevé du patient le PRP, qui sera utilisé pour ses ulcères diabétiques. Cette méthode incorpore la thrombine bovine pour l'activation du gel PRP et peut être appliquée par plusieurs prestataires de soins sans le recours à une formation particulière plus poussée. Dans ce rapport, un patient ayant d'importants ulcères du pied diabétique, qui n'avait pas répondu à d'autres modalités de traitement, a été traité avec succès par le PRP.

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## Introduction

Standard treatment of chronic wounds, such as diabetic ulcers, includes debridement, minimization of weight bearing and vacuum dressing especially when vascular insufficiency is involved (1–3).

However, topical growth preparations are increasingly used as an adjuvant treatment (4,5). The idea of using platelets for enhancement of wound healing process dates back as far back as 1985.

The merits of PRP are obvious: it is much more lasting and less costly than the recombinant human growth factors, and, being of autologous source, is free from communicable pathogens (6). Platelet-rich plasma (PRP) is defined as a portion of the plasma fraction of autologous blood having a platelet concentration above baseline (7,8).

Platelets are known to start the wound healing process through release of locally active growth factors (6–9) that exert their effect

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**Figure 1.** Photograph of the patient's soles (*left and right*) at the time of admission to hospital (before PRP treatment).

by attracting undifferentiated cells into the site of injury and promoting their division. PRP may also curb inflammation by suppressing cytokine release, and further improve the regeneration process by promoting capillary angiogenesis and re-epithelialization (10). The collaboration of the macrophages in the healing process is also thought to be initiated when they are called into action by platelets' excretion of signalling proteins (11). PRP has also been demonstrated to be of some antimicrobial properties against microorganisms, such as *E Coli*, MRSA, *Candida albicans* and *Cryptococcus neoformans* (12).

In this report, a patient with extensive diabetic foot ulcers that were nonresponsive to other treatment modalities was successfully treated by PRP.

### Case Report

A 71-year-old male patient sustained severe burns on his soles by walking barefoot on a hot cobble stone surface. Diagnosed with type II diabetes 30 years ago, he was unable to perceive the surface's extreme hot temperature due to diabetic neuropathy. The patient was on a regular regimen of insulin to control his blood glucose level. Having his wounds infected, he was admitted several times at the local hospital in his town of residence to receive treatment to almost no avail (Figure 1). A verdict of amputation was finally reached and the patient was referred to the Moaieri hospital, a special orthopedic centre in Tehran, Iran in August 2011. His lab results upon admission are presented in Table.

The patient was subsequently treated with an Antibiotic regimen of IV Clindamycin (600 mg q6h) + Cefazidim (1.5 mg q8h). The following day, he was taken to the operating theatre to perform complete and partial surgical debridement for his right and left soles, respectively. The debridement process was

**Table**

Laboratory test results of patients at the time of admission

Laboratory test	Result in first admission	Result after 8 months follow up
ESR	74 mm/h	24 mm/h
CRP	3+	negative
Cr	1.2	
BUN	14	
FBS	105	
Hb	11	
Other CBC component	normal	

ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; Cr, creatinine; BUN, blood urea nitrogen; FBS, fasting blood sugar; Hb, hemoglobin; CBC, complete blood count.

completed by application of Chytototic biologic debridement jelly to his soles.

The following day, a standard protocol of PRP (Bio-Act from biojel Inc.) treatment was initiated for the patient by separating PRP from 6 units of his own blood. Each 8 mL unit of blood was centrifuged to separate the packed red blood cells from the platelet poor plasma and platelet concentrate layer, which was activated by calcium gluconate, to be re-centrifuged for 5 minutes at 2000 rpm. The resulting PRP was injected 4 mm deep inside the wound and 1 cm of its peripheral skin. The patient was subsequently put on oral ciprofloxacin 500 mg BD, and standard dressing was then applied. On the 4<sup>th</sup> day after hospitalization, the patient was discharged, to be followed up at home. The dressing was removed 10 days after the time it was applied, and the wound appeared to be clean and free from any signs of infection, such as malodorous purulence. The wound was irrigated with normal saline and re-dressed on a daily basis. Twenty days after the time of PRP treatment, small islands of regeneration tissue began to granulate with epithelialization in progress, as depicted in the enclosed photos (Figure 2). The wound was satisfactorily healed in the end of the 8-month follow-up period (Figure 3).

### Discussion

In this case, a patient with extensive diabetic foot ulcers that were non-responsive to other treatment modalities was successfully treated by PRP. This study is in line with the study by McAleer et al, which reported successful use of autologous PRP in chronic lower extremity wound in a 57-year-old man with type 2 diabetes and a wound of 6 months duration (13).

Another study reported the effectiveness of a combination of autologous adipose tissue and PRP in a case study of a non-diabetic 65-year-old male patient who had a foot ulcer of 3 years duration. More recently, Scimeca et al reported the successful treatment of a deep, non-healing plantar diabetic ulcer of 3 months duration in a 49-year-old man (14).

Another notable report is a retrospective cohort study of 26 599 patients with diabetic foot ulcers in whom wound healing had been achieved in 50% of patients undergoing PRP treatment and 41% of patients not treated with PRP (15).

PRP is a relatively cheap treatment modality that requires multiple venesections; but also minimally invasive, as only a small amount of blood is taken from the patient each time. Each PRP preparation should contain at least 1 million platelets per microliter (6).

While single platelet-derived growth factors, such as rhPDGF-BB, may be used to promote wound healing, with the application of PRP, naturally balanced amounts of growth factors are introduced to the site of injury. The process may, therefore, bear more similarity to the natural wound healing process (15–17).

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