

## ORIGINAL ARTICLE

# Management of Diabetic Foot Ulcer using Platelet Rich Plasma Dressings- A Clinical Study

Vinod Kumar

Assistant Professor, Department of Orthopedics, NIMS Jaipur, Rajasthan, India

### ABSTRACT:

**Background:** In diabetic foot, ulceration occurs as a result of trauma in the presence of neuropathy and/or peripheral vascular disease with infection as a secondary phenomenon following disruption of the protective epidermis. The present study was conducted to evaluate the efficacy of PRP dressings in DFU. **Materials & Methods:** The present study was conducted on 82 patients of both genders (males- 46, females- 36). Wound size as per maximum length and breadth and area were recorded and three PRP dressings were given on day 0, 1<sup>st</sup> week and at 3<sup>rd</sup> week. On 2<sup>nd</sup> week, and 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> weeks only saline dressings were applied at weekly intervals. On every dressing patient's wound was measured in maximum length and maximum breadth by using a scale and area was calculated.

**Results:** Age group 20-30 years had 1 male and 2 females, 30-40 years had 12 males and 10 females, 40-50 years had 13 males and 10 females and >50 years had 20 males and 14 females. The difference was significant ( $P < 0.05$ ). The occurrence of ulcer was fore foot (males- 12, females- 8), mid foot (males- 26, females- 18) and hind foot (males- 8, females- 10). The difference was significant ( $P < 0.05$ ). The size of ulcer decreased significantly which was 4.2 cm<sup>2</sup> in males and 3.8cm<sup>2</sup> in females on 0 day, 3.6 cm<sup>2</sup> and 3.2 cm<sup>2</sup> in females at 1<sup>st</sup> week, 2.4 cm<sup>2</sup> and 2.6 cm<sup>2</sup> in males and females at 3<sup>rd</sup> week and 1.2 cm<sup>2</sup> and 0.8 cm<sup>2</sup> in males and females respectively at 8<sup>th</sup> week. **Conclusion:** PRP is an effective dressing which shows better result in the management of diabetic foot ulcers. There is significant reduction in size of the ulcer with use.

**Key words:** Diabetic, foot, PRP, Wound.

Corresponding author: Dr. Vinod Kumar, Assistant Professor, Department of Orthopedics, NIMS Jaipur, Rajasthan, India

This article may be cited as: Kumar V. Management of Diabetic Foot Ulcer using Platelet Rich Plasma Dressings- A Clinical Study. J Adv Med Dent Sci Res 2015;3(2):191-193.

### INTRODUCTION

Diabetes mellitus (DM) is one of the most deceitful diseases that affect more than 371 million people all over the world in 2012. Diabetes mellitus is a clinical syndrome characterized by hyperglycemia caused by absolute or relative deficiency of insulin. Diabetes mellitus is of two types. Type 1 DM was previously known as insulin dependent diabetes mellitus (IDDM). Type 2 DM was previously termed as non insulin dependent diabetes mellitus (NIIDM).<sup>1</sup>

There are several complications of DM. Among all, diabetic foot ulcer, diabetic neuropathy, diabetic nephropathy, diabetic retinopathy and diabetic foot ulcer are common. In diabetic foot, ulceration occurs as a result of trauma in the presence of neuropathy and/or peripheral vascular disease with infection as a secondary phenomenon following disruption of the protective epidermis. The disease often leads to the development of serious health threatening complications.<sup>2</sup>

WHO stated that DFS is an infection, ulceration, and/or destruction of deep tissues that comes along with neurologic abnormalities and/or different stages of arterial closure disease in the lower limbs. Diabetic foot ulceration (DFU) develops in 15–25% of DM patients. Approximately 15–25% of those cases require amputation.<sup>3</sup> Some estimates have stated that the likelihood of amputation is 25–30 times higher among patients with diabetes than in

the general population. At least 40% of amputations in diabetic patients can be prevented with a team approach to wound care.<sup>4</sup>

Use of autologous platelet-rich plasma (PRP) in the form of local application obtained by centrifugation of whole blood and addition of an activator, clotting agent is designed for the creation of local conditions favourable to healing processes.<sup>5</sup> The present study was conducted to evaluate the efficacy of PRP dressings in DFU.

### MATERIALS & METHODS

The present study was conducted in the department of Orthopaedics. It consisted of 82 patients of both genders (males- 46, females- 36). All were informed regarding the study and written consent was obtained. Ethical clearance was obtained from institutional ethical committee. Patients with ulcer  $\geq 4$  weeks duration were selected.

General information such as name, age, gender etc. was recorded. Wound size as per maximum length and breadth and area were recorded and three PRP dressings were given on day 0, 1<sup>st</sup> week and at 3<sup>rd</sup> week. On 2<sup>nd</sup> week, and 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> weeks only saline dressings were applied at weekly intervals. On every dressing patient's wound was measured in maximum length and maximum breadth by using a scale and area was calculated. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

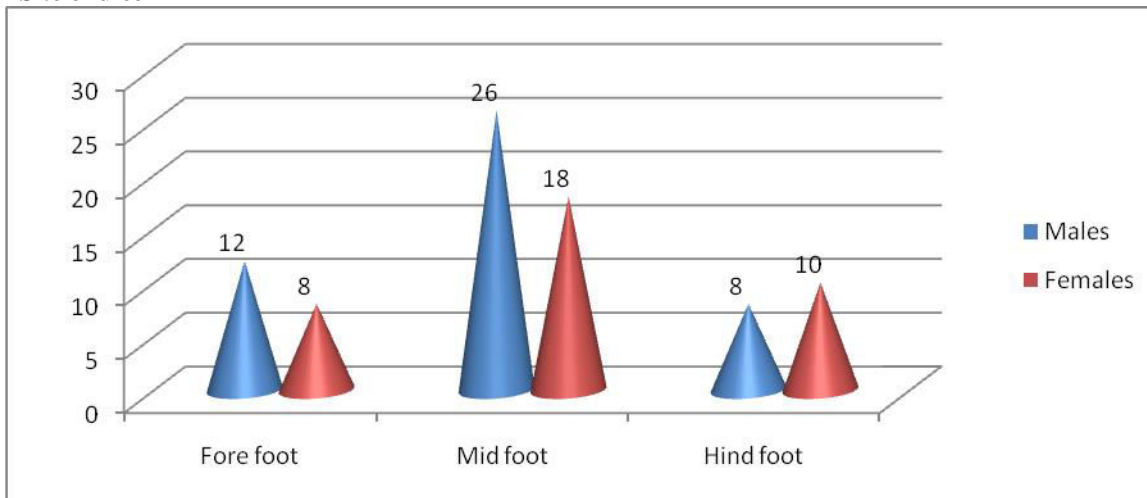
**RESULTS**

**Table I Age wise distribution of patients**

Age groups	Males	Females	P value
20-30 years	1	2	0.05
30-40 years	12	10	
40-50 years	13	10	
50> years	20	14	

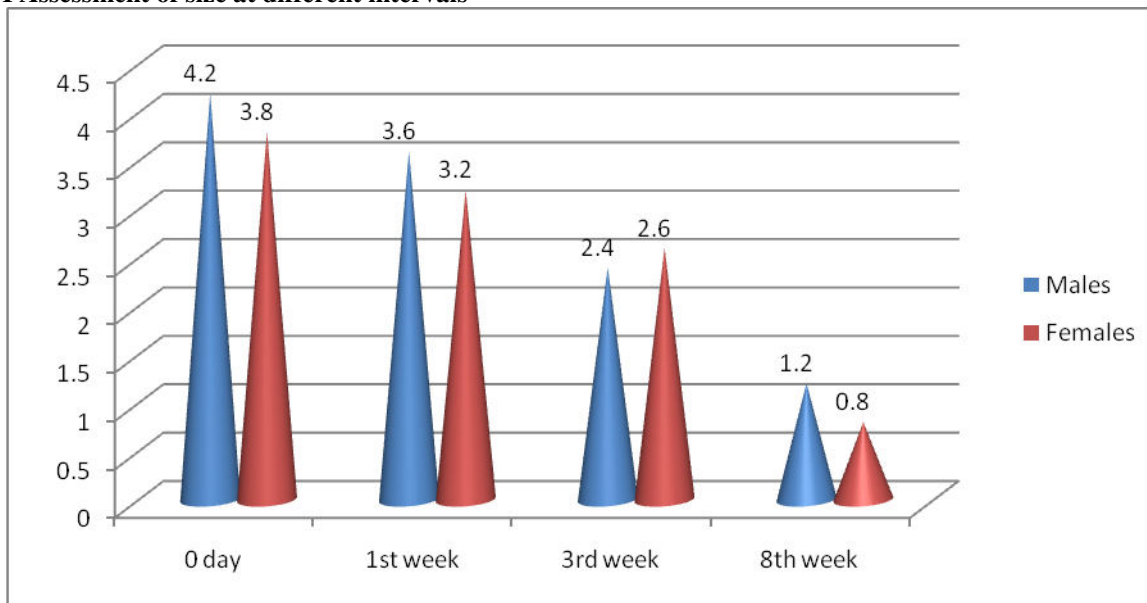
Table I shows that age group 20-30 years had 1 male and 2 females, 30-40 years had 12 males and 10 females, 40-50 years had 13 males and 10 females and >50 years had 20 males and 14 females. The difference was significant (P< 0.05).

**Graph I Site of ulcer**



Graph I shows that the occurrence of ulcer was fore foot (males- 12, females- 8), mid foot (males- 26, females- 18) and hind foot (males- 8, females- 10). The difference was significant (P< 0.05).

**Graph I Assessment of size at different intervals**



Graph II shows that the size of ulcer decreased significantly which was 4.2 cm<sup>2</sup> in males and 3.8 cm<sup>2</sup> in females on 0 day, 3.6 cm<sup>2</sup> and 3.2 cm<sup>2</sup> in males and females at 1<sup>st</sup> week, 2.4 cm<sup>2</sup> and 2.6 cm<sup>2</sup> in males and females at 3<sup>rd</sup> week and 1.2 cm<sup>2</sup> and 0.8 cm<sup>2</sup> in males and females respectively at 8<sup>th</sup> week.

## DISCUSSION

Diabetic foot ulcers result from the simultaneous action of multiple contributing causes. The major underlying causes are noted to be peripheral neuropathy and ischemia from peripheral vascular disease. More than 60% of diabetic foot ulcers are the result of underlying neuropathy. The development of neuropathy in affected patients has been shown in animal and in vitro models to be a result of hyperglycemia-induced metabolic abnormalities. One of the more commonly described mechanisms of action is the polyol pathway.<sup>6</sup>

Peripheral arterial disease (PAD) is a contributing factor to the development of foot ulcers in up to 50% of cases. It commonly affects the tibial and peroneal arteries of the calf. Endothelial cell dysfunction and smooth cell abnormalities develop in peripheral arteries as a consequence of the persistent hyperglycemic state. The present study was conducted to evaluate the efficacy of PRP dressings in DFU.<sup>7</sup>

We included 82 patients with DFU. age group 20-30 years had 1 male and 2 females, 30-40 years had 12 males and 10 females, 40-50 years had 13 males and 10 females and >50 years had 20 males and 14 females.

We observed that size of ulcer decreased significantly which was 4.2 cm<sup>2</sup> in males and 3.8cm<sup>2</sup> in females on 0 day, 3.6 cm<sup>2</sup> and 3.2 cm<sup>2</sup> in females at 1<sup>st</sup> week, 2.4 cm<sup>2</sup> and 2.6 cm<sup>2</sup> in males and females at 3<sup>rd</sup> week and 1.2 cm<sup>2</sup> and 0.8 cm<sup>2</sup> in males and females respectively at 8<sup>th</sup> week. This is similar to Saad et al.<sup>8</sup>

Crometti et al<sup>9</sup> conducted a prospective randomized controlled study on 60 diabetic patients who were divided into group A: Conventional ordinary dressing and group B: PRP dressing. Follow-up period was for 3-monthes. Most of ulcers were healed within the estimated time for this study (12 weeks) and There were satisfactory results (less complications) in PRP group (B); infection, exudates and pain which were observed in 5 cases (16%), 3 cases (10%), 10 cases (33.3%) respectively as compared to group (A); 8 cases (26.6%), 12 cases (40%), 18 cases (60%) respectively. Also the rate of healing was good in group (B) with p-value <0.05. We observed that occurrence of ulcer was fore foot (males- 12, females- 8), mid foot (males- 26, females- 18) and hind foot (males- 8, females- 10). This is similar to McAleer et al.<sup>10</sup> Gandhi et al<sup>11</sup> in their prospective study used PRP for the treatment of DFUs. Patients were allocated to one of three groups, according to size of ulcer. The significance of changes in time for wound healing was statistically assessed. The study was completed by 150 patients, and a total of 150 foot ulcers were assessed. Wound size reduction was detected in patients after four weeks of treatment. In DFUs with a 2–5.5 cm<sup>2</sup> surface area, complete closure happened after 7.2 weeks, 5.5–8.5cm<sup>2</sup> DFUs completely closed after 7.5 weeks, and 8.5–12.5cm<sup>2</sup> DFUs healed completely after 8.8 weeks. None of the wounds reopened after eight months of monitoring.

Platelets contain numerous natural growth factors released from their 5 granulations and stimulating healing processes. In 1974, Ross in the in vitro study noted thrombin-activated platelets as a source of growth factors that could initiate the body's natural healing. Added to platelet-poor plasma, they increased activity of smooth muscle cells and fibroblasts. PRP is obtained by repeated centrifugation of autologous whole blood. The resulting concentrate, combined with activating bovine thrombin, forms a gel that seals the wound. The gel is placed on wound bed and protected by a cover dressing. The dressing may stay in place for up to 7 days.<sup>12</sup>

## CONCLUSION

PRP is an effective dressing which shows better result in the management of diabetic foot ulcers. There is significant reduction in size of the ulcer with use.

## REFERENCES

1. Willrich M, Pinzur M, McNeil D, Juknelis A, Lavery L. Health related quality of life, cognitive function, and depression in diabetic patients with foot ulcer or amputation. A preliminary study. *Foot Ankle Int* 2005; 26:128–134.
2. Apelqvist G, Ragnarson U, Persson J, Larsson J. Diabetic foot ulcers in a multidisciplinary setting. An economic analysis of lry healing and healing with amputation. *J Int Med* 1994; 235:463–471.
3. Loot MA, Kenter SB, Au FL. Fibroblasts derived from chronic diabetic ulcers differ in their response to stimulation with EGF, IGF-I, bFGF and PDGF-AB compared to controls. *Eur J Cell Biol* 2002; 81:153–160
4. Van Buul G, Koevoet W, Kops N, Bos P, Verhaar J, Weinans H, et al. Platelet-rich plasma release inhibits inflammatory processes in osteoarthritic chondrocytes. *Am J Sports Med* 2011; 39:2362–2370.
5. Gui-Qiu S, Ya-Ni Zhang B, Jing M, Yan-Hui L, Da-Ming Z, Jin-Lang Q, et al. Evaluation of the effects of homologous platelet gel on healing lower extremity wounds in patients with diabetes. *Int J Low Extrem Wounds* 2012; 12:22–29.
6. Amable PR, Carias RB, Teixeira MV, da Cruz Pacheco I, Correa do Amaral RJ, Granjeiro JM, Borojevic R. Platelet-rich plasma preparation for regenerative medicine: optimization and quantification of cytokines and growth factors. *Stem Cell Res Ther* 2013; 4:67.
7. Delbridge L, Ctercteko G, Fowler C, Reeve T, Le Quesne L. The etiology of diabetic neuropathic ulceration of the foot. *Br J Surg* 2006; 72:1–6.
8. Saad H, Elshahat A, Elsherbiny K, Massoud K, Safe I. Platelet-rich plasma versus platelet-poor plasma in the management of chronic diabetic foot ulcers: a comparative study. *Int Wound J* 2011; 8:307–312.
9. Crovetti G, Martinelli G, Issi M. Platelet gel for healing cutaneous chronic wounds. *Transfus Apher Sci* 2009; 30:145–151.
10. McAleer JP, Sharma SG, Kaplan EM, Persich GZ. Use of autologous platelet concentrate in a non-healing lower extremity wound. *Adv Skin Wound Care* 2007; 19:354–363.
11. Gandhi A, Bibbo C, Pinzur M, Lin S. Role of platelet-rich plasma in foot and ankle surgery. *Foot Ankle Clin* 2009; 10:621–637.
12. Huang S, Wang Z. Influence of PRP on proliferation and osteogenic differentiation of skeletal muscle satellite cells: an in vitro study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010; 110:453–462.