

# Effects of locally applied autologous Platelet-Rich Fibrin® (PRF®) on split-thickness skin graft donor sites

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## Aim

To study the effect of Platelet-Rich Fibrin® (PRF®) on the epithelialization rate of split-thickness skin graft donor sites and recipient wound beds in 20 patients undergoing transplantation for chronic leg ulcers.

## Conclusion

We successfully used PRF® to treat split-thickness skin graft donor sites and recipient leg ulcers in patients undergoing skin transplantation.

Based on initial positive effects of PRF® a randomized, controlled, observer-blinded study was started in April 2006 to investigate the role of PRF® in wound healing.

## Introduction

Clinical use of fibrin sealant was reported in the beginning of the 20<sup>th</sup> century<sup>1</sup>. The addition of platelets is a relatively new concept.

Fibrin sealing mimics the last phases of the coagulation cascade, where fibrinogen is converted to fibrin. This supports the natural woundhealing process.

Platelets contain potent growth factors that stimulate new tissue synthesis, e.g. platelet-derived growth factor (PDGF)<sup>2</sup>.



Figure 1. PRF® in syringe.

PRF® consists of up-concentrated fibrinogen (14-20 mg/ml) and platelets (Fig. 1).

*In vitro* studies on growth factors and fibrin/fibrinogen have shown a stimulatory effect on fibroblast proliferation and migration<sup>3</sup>. Fibrin may also protect growth factors from proteolytic degradation<sup>4</sup>.

PRF® stimulated fibroblast proliferation *in vitro* (Fig. 2).

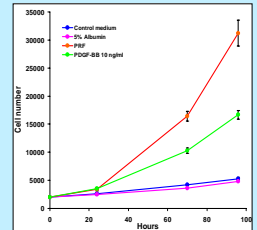


Figure 2. Growth of human skin fibroblasts in different medias<sup>5</sup>.

## Methods

Six ml PRF® was prepared preoperatively at the bedside from 120 ml of the patients' own blood. Processing took less than 30 minutes. Two equally sized adjacent donor sites were inflicted on the thigh by an electrodermatome (Fig. 3).



Figure 3. Harvesting of graft and creation of donor site wound.

One donor site was randomized to treatment with PRF® and standard treatment, the other standard treatment alone (Fig. 4). Standard treatment consisted of a Vaseline fabric, calcium alginate and a polyurethane dressing.



Figure 4. PRF® is applied using the sterile spraypen.

After surgical debridement, the recipient wound was skin-transplanted. One half was then randomized to treatment with PRF® and standard treatment, the other to standard treatment alone (Fig. 5).

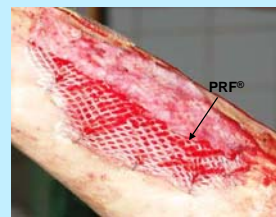


Figure 5. PRF® applied on transplanted wound bed.

On postoperative days 5 and 8, epithelialization of donor site wounds was evaluated in a blinded manner macroscopically and microscopically from 4-mm punch biopsies (Fig. 6) stained with hematoxylin-eosin.



Figure 6. Punch biopsy from donor site day 5 through the dressings.

## Results

Biopsies of unmeshed grafts day 0 are shown in Figure 7.

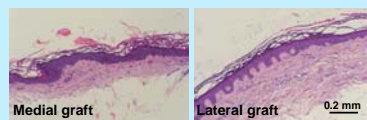


Figure 7. Graft biopsies day 0.

Biopsies from PRF®-treated and control donor site wounds are shown in Figure 8. PRF®-treated donor site showed 50% epithelialization compared with 20% for control wound.



Figure 8. Wound biopsies day 5. Arrow: epithelial tongue.

Transepidermal water loss was measured on day 8 on normal skin and donor site wounds (Fig. 9).

Long-term effects of PRF® on skin barrier function, pigmentation and elasticity will be assessed using non-invasive techniques after 1, 3 and 12 months.

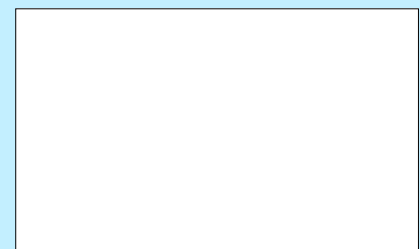


Figure 9. Transepidermal water loss (g/m<sup>2</sup>h) in two patients.

## Discussion

The addition of platelets to fibrin may enhance the stimulatory effect of fibrin on keratinocytes explained by growth promoting factors being bound to fibrin/fibrinogen and thereby protected from degradation. Fibrin/fibrinogen itself or biologically active fragments may also stimulate keratinocytes.

The effect of PRF® on tissue sealing and repair is yet to be clarified. This ongoing, clinically controlled study deals with acute, standardized wounds and chronic transplanted leg ulcers.

## References

- Bergel S. Über Wirkungen des Fibrins. Dtsch Med Wochenschr 35:633, 1909.
- Deuel TF et al. Growth factors and wound healing: Platelet-derived growth factor as a model cytokine. Annu Rev Med 1991;42:567-84
- Rybarczyk BJ et al. Matrix-fibrinogen enhances wound closure by increasing both cell proliferation and migration. Blood 2003;102: 4035-4043.
- Sahni A et al. Fibrinogen and fibrin protect fibroblast growth factor-2 from proteolytic degradation. Thromb Haemost 2000;83: 736-741.
- Data not published, assay performed by Rasmus Lundquist.