

PATHOGEN REDUCTION IN PLATELET CONCENTRATES USING UVC LIGHT IN COMBINATION WITH STRONG AGITATION: EFFECT ON ACTIVATION MARKERS AND STORAGE STABILITY

Tolksdorf F¹, Walker W H¹, Mohr H², Gravemann U², Mueller T H²

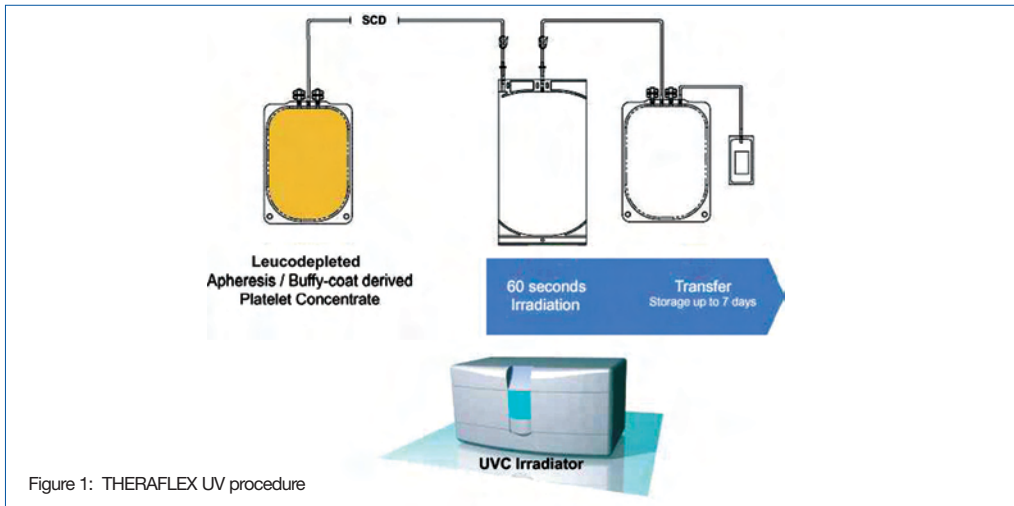
¹ Maco Pharma, Langen, Germany, ² Blood Centre of German Red Cross Chapters of NSTOB, Institute Springe, Germany

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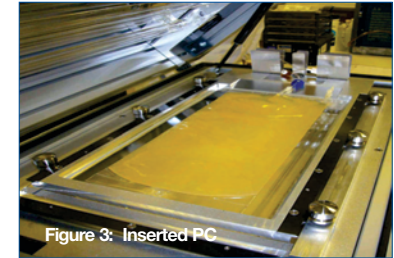
INTRODUCTION

Pathogen Inactivation technologies are proactive measures to enhance the safety of platelet transfusions. Their use can be effective also against emerging unknown pathogens. Current procedures need chemicals like photosensitizers. We developed a procedure, which allows an efficient reduction of pathogens (e.g. bacteria and viruses) in plasma-reduced platelet concentrates (PCs) using short-wavelength UV light (UVC) in combination with strong agitation, i.e. there is no photoactive compound needed (THERAFLEX UV Platelets technology). The irradiation device developed is emitting UVC light at a wavelength of 254 nm. Moreover a mechanism for orbital agitation is installed. UVC irradiation is microprocessor-controlled. Relevant treatment parameters are monitored throughout the entire treatment thus allowing a fully documented and reproducible process. PCs are treated in a twin-bag kit, which comprises of a highly UV-permeable irradiation bag and a container for extended platelet storage. In the present study we investigated the influence of the THERAFLEX UV treatment on activation parameters and on the storage stability of PCs.

MATERIALS & METHODS



Plasma-reduced PCs were treated with the THERAFLEX UV procedure (Fig.1) and stored until day 8 after blood donation (day 6 after treatment). The in vitro quality of UVC treated PCs was evaluated in comparison to untreated control platelets. Control PCs were stored for the same time period. PCs in storage medium SSP+/MacoPharma (containing saline, citrate, acetate, phosphate, magnesium and potassium, identical to PAS-IIIM) were prepared from pools of 5 buffy coats. The average volume was 350 mL (platelet concentration approx. 10^9 /mL) and the plasma concentration was approx. 35%. PCs were transferred into irradiation bags (Fig.2) for UVC treatment at a dose of 0.4 J/cm^2 (approx. 60 sec) (Fig.3). They were strongly agitated during irradiation. Relevant treatment parameters, e.g. UV dose, UV intensity, temperature and irradiation time, were microprocessor-controlled.



RESULTS

Until day 8 of storage in vitro characteristics were only marginally influenced by the THERAFLEX process. Platelet quality was evaluated by measurement of the hypotonic shock response (HSR) and the expression of the activation marker CD62p. HSR reactivity and CD62p levels were only slightly affected by the Theraflex treatment. Annexin V binding percentage, as a marker for apoptosis, remained almost unchanged. Glucose consumption and lactate formation were found to be marginally higher in the treated PCs. pH remained above 7.0 until day 8 after donation (Tab. 1).

| | Pits [$\times 10^9$ /mL] | CD62 [%] | Annexin V [%] | HSR [%] | pH | Glucose [mg/dL] | Lactate [mmol/L] |
|---------------|---------------------------|-------------|---------------|------------|-----------------|-----------------|------------------|
| Day 6* | | | | | | | |
| Control | 9.2 ± 1.1 | 21 ± 6 | 5 ± 1 | 71 ± 5 | 7.29 ± 0.04 | 62 ± 17 | 10.2 ± 2.3 |
| Treated | 8.5 ± 0.9 | 32 ± 5 | 9 ± 4 | 68 ± 4 | 7.22 ± 0.05 | 52 ± 21 | 10.8 ± 1.6 |
| Day 7* | | | | | | | |
| Control | 8.9 ± 0.8 | 24 ± 6 | 7 ± 1 | 72 ± 3 | 7.32 ± 0.05 | 55 ± 19 | 10.4 ± 1.6 |
| Treated | 8.4 ± 0.9 | 42 ± 13 | 10 ± 3 | 68 ± 3 | 7.22 ± 0.06 | 42 ± 20 | 11.8 ± 1.7 |
| Day 8* | | | | | | | |
| Control | 9.4 ± 1.6 | 30 ± 3 | 8 ± 4 | 71 ± 5 | 7.34 ± 0.06 | 45 ± 18 | 11.5 ± 1.6 |
| Treated | 9.1 ± 1.3 | 52 ± 12 | 10 ± 3 | 65 ± 5 | 7.22 ± 0.09 | 31 ± 17 | 13.1 ± 1.7 |

Table 1: In vitro parameters of untreated and treated PCs on day 6, 7 and 8 after blood donation (N = 6, mean \pm SD)

*after blood donation

CONCLUSIONS

THERAFLEX treatment with 0.4 J/cm^2 UVC light has only a minor influence on in vitro parameters of PCs and their storage stability until day 8 after blood donation was maintained.

[1] Polyolefineacetate bags for pathogen inactivation and for storage of platelet concentrates, H Mohr, TH Müller, F Tolksdorf, WH Walker, Vox Sang 2004; 87 (Suppl. 3): 70

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