Increasing the negative pressure in the model of generating standardized wounds by the method of suction blister induction

C. Wagner*, A. Böhling*, S. Bielfeldt* and K.-P. Wilhelm**
proDERM Institut für Angewandte Dermatologische Forschung GmbH, Schenefeld/Hamburg, Deutschland und **Universität zu Lübeck, Lübeck, Deutschland

Background

The suction blister method is a well-established method of separating in vivo neatly the epidermis from the dermis without causing chemical or thermal damage. It is commonly used to sample biological material and to induce standardized epidermal wounds. The induction of fully developed blisters by applying a negative pressure of up to 40 kPa takes three to four hours on healthy skin of the volar forearms [1]. As this process is time consuming and therefore demanding for the subjects, an expectable time reduction of this process by increasing the applied negative pressure is of scientific interest. However there is the risk of quality loss by applying a higher pressure. Bursting of blisters or subcutaneous bleeding might occur. Therefore it is important to find the optimal balance between the negative pressure and the duration while maintaining high quality.

Methods

Four suction blisters were inducted with suction cups (Figure 1) on the volar forearms of 6 subjects with intact, healthy skin in the test area by SUCTION BLISTER SYSTEM (proDERM, Germany). The applied pressures were adjusted between 45 and 80 kPa with or without a 30 min lead time with a reduced pressure. The development and duration until the final shape of the blisters were documented.

Results

The mean duration was between 88.5 ± 15.39 and 95 ± 17.72 min (Figure 2). The lead time did neither improve the quality of blisters (Figure 3, lower right image) nor reduced the time of induction.

Conclusion

This test provided evidence that an increase of negative pressure of more than 40 kPa reduced the time of formation while maintaining a consistent high level of blisters’ quality. The induction time was reduced approximately by half when applying a negative pressure between 45 and 80 kPa.

At pressures of 60 kPa and higher no further reduction of time to generate the blister was observed. Some more cases of erythema in the area of the blister and also around were noted with the applied pressures of 45 kPa and higher but no increase of cases with blister rupture occurred. There were no advantages of a 30 min lead time with a low pressure of 35 kPa before setting the target value.

We conclude that a negative pressure of 45 kPa is optimal to generate high quality blisters in about 90 minutes, a time which is clearly less demanding than an induction of blisters at 40 kPa or less. However, in case that blister fluid or blister roofs should be analyzed e.g. on parameters that could be influenced by a reaction of inflammation lower pressures or even a different method of sampling is recommended.

References