In-vitro-analysis of the fluid management by hydroactive wound dressings using a maceration model

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Introduction

Modern wound dressings are expected to maintain a humid wound milieu without allowing maceration at the wound edges. Such hydroactive dressings mainly consist of alginate or contain sodium carboxymethylcellulose. Both polymers form fibres that can be processed to fleece compresses or tamponade strips and exhibit a high fluid uptake. However, highly exuding wounds may lead to macerated wound edges. Moreover, during gel formation loss of shape can be observed which results in reduced wound coverage. Hence, the fluid management of hydroactive dressings was analyzed using a special maceration model.

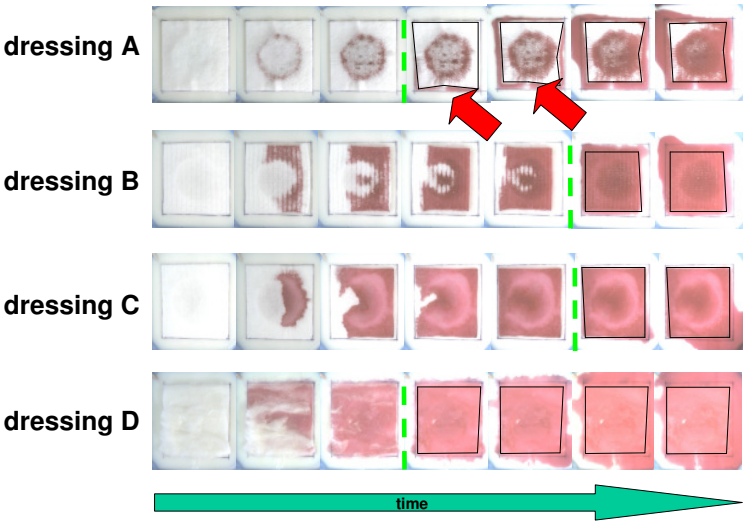

Figure 1: Determination of the fluid management by the hydroactive dressings over time using video documentation (VF0700, Creative Labs, U.S.). The spread of the colored solution allows the measurement of the break point of maceration (green dotted line) at which the dressings stop to take up fluid and start to leak. C and D exhibited an even fluid distribution while it was most notable that only the middle of the dressing A was wetted and that it started to leak before it was completely saturated with fluid (red arrows).

Material & Methods

For the tests, two dressings with sodium carboxymethylcellulose (A: Aquacel®, ConvaTec; B: Aquacel® Extra, ConvaTec), one dressing consisting of cellulose/ethyl-sulfonate-cellulose (C: Suprasorb® Liquacel, Lohmann & Rauscher), and a calcium alginate tamponade (D: Suprasorb® A tamponade, Lohmann & Rauscher) were used. They were applied to an artificial wound in the tissue substitute (10% (w/v) gelatine, 10% (w/v) milk powder) for the maceration test. The evaluation of fluid uptake and distribution in the dressings was performed by video recording. In addition, the shape loss of the dressings, the maximal fluid uptake and the time to maceration was determined.

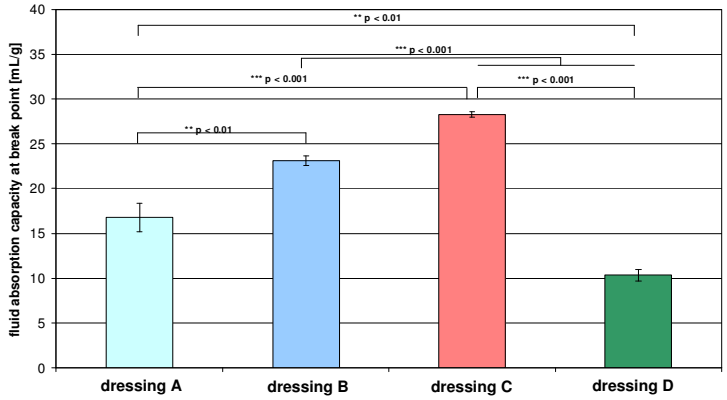

Figure 2: Determination of the fluid absorption capacity at maceration breakpoint in [mL/g] for the different hydroactive dressings. Results shown as mean ± SE (n = 3).

Results

Dressing D demonstrated with just 10mL/g fluid uptake the lowest fluid holding capacity (figures 1 and 2). A low fluid uptake till break point of maceration was also found for A (17mL/g), while B and C exhibited significantly higher values with approx. 23mL/g and 28mL/g, respectively. Moreover, it could be shown that the sodium carboxymethylcellulose dressings A and B exhibit a distinct shrinkage during fluid uptake with approx. 29% and 31% for A and B, respectively (figure 3). Dressing C showed with only 16% shrinkage significantly higher form stability. For D no loss of surface coverage was observed. Moreover, with A and B maceration already occurred before the dressings were completely soaked. Leakage with C and D was only observed after they were completely gelled.

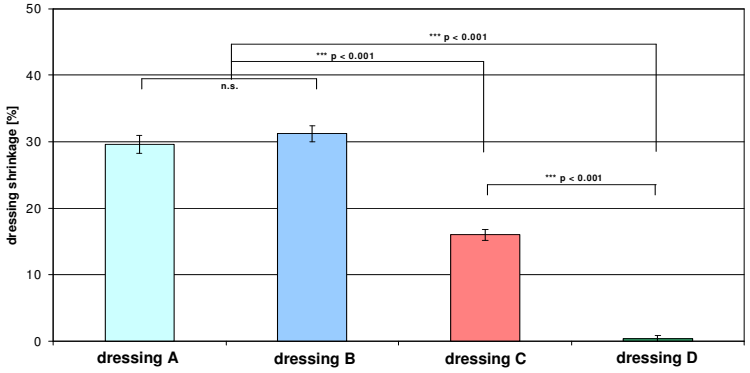

Figure 3: Evaluation of the reduction of the covered area by determination of the dressing shrinkage in [%] . Results shown as mean ± SE (n = 3).

Conclusion

An *in vitro* maceration model was successfully used to quantify and evaluate the differences between hydroactive wound dressings. This model is hence suitable to analyze the fluid management in an *in vivo* like situation *in vitro*.

24th Conference of the European Wound Management Association (EWMA), 14.-16. May 2014, Madrid/Spain