Analysis of the Fluid Handling of Foam Dressings using a Porcine Simulated Wound Model *In-Vitro*

SAWC Poster Presentation 2015

Sarah Roberts[1], Jodie Lovett[2], Christian Stephenson[3]

[1]Principal Development Technologist, [2]Senior Development Technologist, [3]R&D Director. Crawford Healthcare, Kind Edward Court, King Edward Road, Knutsford, Cheshire, WA16 0BE

Introduction

The handling of fluid by wound dressings is paramount to their overall performance in the treatment of chronic wounds. The inability of a dressing to manage wound exudate can lead to maceration of the peri-wound, leakage of fluid from dressings onto surrounding clothing or bedding, or drying out of the wound leading to ineffective moist wound healing. It is important therefore to assess the fluid handling properties of dressings using a method that simulates clinical wound conditions.

In this study, the ability of dressings to manage simulated wound fluid when applied to a clinically relevant wound model was assessed. A wound was made in a section of pork, and fluid supplied to simulate an exuding wound.

Method

A circular section of skin and subcutaneous fat was removed from pork loin to create a wound of 6cm diameter. A foam wound dressing was then applied centrally over the wound. Solution A (142mmol sodium ions, 2.5mmol calcium ions) was fed through a tube in the wound bed at a rate modelling that of a moderately exuding wound (0.71ml/hour[1]). The dressing was left on the wound model for 72 hours, after which time, the fluid pump was stopped, and the dressing left for a final 24 hours. This was in order to determine whether the dressing dried out the wound bed after exudate production stopped. After every 24 hours, the dressing was carefully lifted from the pork and the wound inspected for signs of fluid pooling. The dressing wound contact surface was also inspected for patterns of fluid absorption. The dressing was then carefully re-adhered to the pork. At the end of the experiment, the dressing was assessed for fluid uptake ability, signs of fluid leakage, and the wound bed assessed for signs of fluid pooling or excessive dryness. Photographs of the wound bed and dressing were taken throughout the study. The experiment was repeated using four different foam wound dressings*.

Results

A range of fluid handling abilities were demonstrated by the four foam wound dressings tested in this experiment.

For the first 48 hours of the test, each of the dressings showed some evidence of fluid pooling. This observation was attributed to the depth of the wound cavity and as such the fluid did not initially come into contact with the dressings. Dressing A and Dressing D did absorb some fluid from the beginning of the experiment; however Dressings C and B did not absorb any fluid until the 48 hour time point.

Although Dressing A *(figure one)* began to absorb some fluid from the start of the test, there were significant levels of pooling of fluid in the wound cavity for the duration of the 96 hour test period. The dressing appeared to fill to capacity within 72 hours, causing fluid to leak from the dressing pad into the border. On removal after 96 hours, fluid leaked from the dressing pad back into the wound.

Dressing B *(figure two)* did not absorb any fluid until the 48 hour timepoint. Before this time, fluid pooled in the wound cavity, and subsequently leaked from the edge of the dressing pad. At the point that the dressing began to leak, the dressing pad was only filled to approximately 25% capacity. This indicates a lack of fluid wicking throughout the dressing pad; minimising the area of pad that can absorb wound fluid. At the 72 and 96 hour timepoints, although the dressing had begun to absorb some fluid, considerable pooling in the wound cavity was still observed. When the dressing was lifted at the 72 and 96 hour time points, fluid leaked from the dressing pad back into the wound.

Dressing C *(figure three)* also failed to absorb any fluid until the 48 hour timepoint. There was minimal pooling observed underneath the dressing, however after 72 hours, the dressing began to leak fluid from the edge of the pad. The dressing pad was only around 25% saturated, and as such, it can be surmised that a lack of fluid wicking ability caused only a small proportion of the dressing pad to be available for absorption. On removal, the dressing pad did not release any fluid back into the wound.

Dressing D (figure four) absorbed fluid from the start of the test. Some pooling was seen at the 48 hour timepoint, however, by the 72 hour test period, this had resolved, leaving a moist wound bed. At 96 hours, the dressing continued to handle the fluid well, maintaining a moist wound. No fluid was released from the dressing on removal; the wound contact surface of the dressing remained dry. Over the test period, the dressing filled with fluid evenly, allowing wicking of fluid across the width of the pad.

Conclusion

The simulated wound model was successfully used to determine the fluid handling properties of foam dressings. The fluid handling properties of the dressings varied greatly, with only Dressing D able to handle the delivered fluid over the 96 hour test period.

*Dressing A – Mepilex Border (Mölnlycke Healthcare), Dressing B – Allevyn Gentle Border (Smith & Nephew), Dressing C – Aquacel Foam (Convatec), Dressing D – KerraFoam Gentle Border (Crawford Healthcare)

Only Dressing D was able to handle the delivered fluid over the 96 hour test period

Figure one: Dressing A after 96 hours on the simulated porcine wound model. Fluid has leaked into the dressing borders, and the dressing appears to be saturated with fluid.

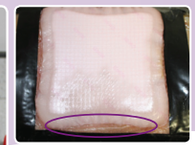

Figure two: Dressing B after 96 hours on the simulated porcine wound model. The distribution of fluid throughout the dressing pad is uneven, with fluid gathering around the edges of the pad. Fluid can be seen to have leaked into the dressing border (circled).

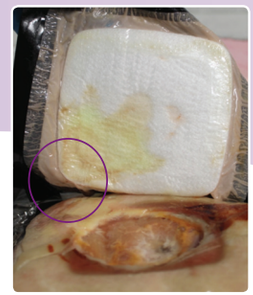

Figure three: Dressing C after 96 hours on the simulated porcine wound model. The distribution of fluid in the pad is uneven, causing fluid to leak from the corner of the pad (circled).

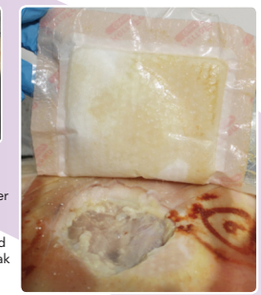

Figure four: Dressing D after 96 hours on the simulated porcine wound model. Fluid is evenly distributed through the dressing pad, and no leaking has occurred.

References:
1. Dealey C, Cameron J, Arrowsmith M. A study comparing two objective methods of quantifying the production of wound exudate. J. Wound Care, 2006; 15(4)