

A comparative study on the effectiveness of 3M™ Cavilon™ Durable Barrier Cream and two professional barrier products

KEY WORDS

- ▶ Barrier cream
- ▶ *Ex vivo* test method
- ▶ Incontinence associated dermatitis

Adequate skin hydration is critical for maintaining healthy skin (Verdier-Sévrain and Bonté, 2007), but hyper-hydrated skin – as typically seen in patients where an episode of incontinence has occurred – requires effective clinical management to minimise the risk of incontinence-associated dermatitis and secondary bacterial infection. The objective of this study was to measure and compare the moisture barrier effectiveness of three barrier creams post-application, using an *ex vivo* test method. Results showed the superior barrier performance of 3M™ Cavilon™ Durable Barrier Cream over the other two tested barrier products.

The source of excessive moisture in contact with the skin from incontinent patients can arise from urine, faeces, perspiration or a combination of these. The risk of damage to the skin is directly related to the frequency and amount of moisture next to the skin and the resultant perspiration. (Langemo et al, 2011).

In 2005, a consensus group of clinical experts convened and advocated the labeling of skin damage associated with exposure to stool and urine as incontinence-associated dermatitis (IAD; Gray et al, 2012). The group also defined treatment goals for IAD to include protecting the skin from further exposure to irritants, establishing a healthy environment and eradicating any cutaneous infection. The importance of an effective skin cleaning and protection regimen, and its importance in the management of IAD was also discussed. They state that the skin protectant should “primarily aim to prevent skin breakdown by providing an impermeable or semi-permeable barrier on the skin, thus preventing penetration of water and biologic irritants”.

The consensus is that the use of barrier products is critical in both the prevention and management of IAD. Previous work published as a poster and presented at the Clinical Symposium on Advances in Wound and Skin Care (Grove, 2010), reported on a study to determine the barrier effectiveness of four dimethicone skin protectants.

The conductivity of the skin following soaking/washing to simulate exposure to incontinence and associated care in a group of volunteers was tested. Over the course of the test, the results demonstrated the superior barrier properties of 3M™ Cavilon™ Durable Barrier Cream when compared with other barrier products containing dimethicone, including Proshield® Plus Skin Protectant (H&R Healthcare). The authors of this article have developed a simplified *ex vivo* test method to permit laboratory screening of products for their barrier function.

PRODUCT POSITIONING

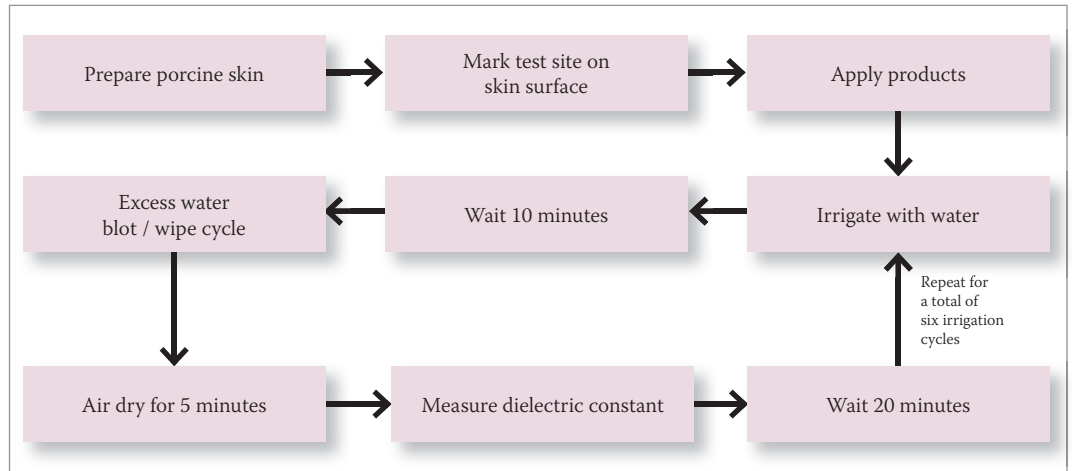
Several barrier cream products claiming to offer skin protection from moist environments are currently available in the UK. These products have differing claims of skin protection and resistance to wash off and as such may offer differing barrier effectiveness for the skin and its absorption of excess moisture. The products used in this study are currently available for clinicians in the management of IAD in UK clinical settings.

OBJECTIVE

The objective of this study was to measure and compare the moisture barrier effectiveness of three barrier creams, post application and subject to simulated incontinence episodes (SIEs) for six cycles using an *ex vivo* test method.

“The objective of this study was to measure and compare the moisture barrier effectiveness of three barrier creams, post application and subject to simulated incontinence episodes...”

Figure 1. A schematic of the test methodology.



METHOD

A schematic of the test methodology is shown in Figure 1.

Test substrate

Six samples of porcine skin (5 cm × 5 cm) were used for each product included in this study. Each piece of skin was laid flat on tissue paper and air dried in a fume cupboard to a baseline meter reading of approximately 10, following the manufacturer’s instructions for reading on the Delfin MoistureMeterD (Hurley, 2013).

Porcine skin was used as opposed to other substrates, in that it is a biological and relevant substrate that is easily and ethically sourced. These properties offer better understanding of moisture effects on hyper-hydrated skin when compared to non-biological substrates.

The extra-small sample probe (XS 5) was used as this has an effective measuring depth of 500 µm. This measuring depth eliminated variability associated with the depth of sample.

Test products

This study was conducted on three products and a control group (Table 1). Test product was applied to each sample according to the manufacturer’s instructions and applied to each of the six porcine skin samples. Thirty measurements of conductivity were made for the control and each of the three products tested at pre-treatment and after each of six SIEs.

Measurement of dielectric constant

The dielectric constant was measured using the Delfin MoistureMeterD (Figure 2). It measured changes in tissue fluid content of the dermis and subcutaneous tissue. The tissue was exposed to a low-power electromagnetic wave. The reflected wave contains information on tissue water content and the dielectric constant of the tissue is determined. Pure water and pure ethanol have dielectric constants of 79 and 22, respectively (Delfin Technologies, 2009).

A total of five readings were taken on each test area and there were six test areas per product.

Table 1. Test products and manufacturer guidance used in this study

Test product	Manufacturer re-application guidance	Supplier
Control group (no barrier cream)	–	–
3M™ Cavilon™ Durable Barrier Cream	Every 2–3 incontinence episodes	3M Health Care
Sorbaderm™ Barrier Cream	Repeat applications as required	Aspen Medical Europe
Proshield® Plus Barrier Cream	Repeat as often as necessary	H&R Healthcare

Simulated incontinence episodes

A 5 cm × 5 cm test area of skin sample was soaked with 1 mL of deionised water for 10 minutes to simulate an incontinence episode. Water was applied to the test area with a 5 mL syringe, ensuring coverage of only the test area.

After 10 minutes, the test areas were blotted dry with tissue paper and a series of wipes were performed to simulate a washing cycle. The wiping protocol comprised:

- ▶ Three wipes in one direction across the test area.
- ▶ Three wipes in one direction at 90° to the first wipe.
- ▶ Repeat wiping protocol a total of two times.

The test area was allowed to air dry within the fume cupboard for a further 5 minutes to remove any surface water. The test area was then measured for moisture using the Delfin MoistureMeterD, adhering to the method previously described.

RESULTS

The barrier effectiveness of each of the products tested compared to the control group (no barrier) is shown in *Figure 3*. Data are expressed as skin conductivity (with an increase in dielectric constant) as a measure of skin moisture content.

This study on an *ex vivo* skin model demonstrates the superior performance of 3M™ Cavilon™ Durable Barrier Cream compared to the control and the other two commercially available barrier products, tested in terms of barrier effectiveness through a series of six SIEs.

All porcine skin samples were conditioned to similar moisture content levels prior to the start of the experiment. A small variability in moisture content was seen initially and recorded in the pretreatment results. The results shown in *Figure 3* display the standard error of the mean for each data point at each wash cycle. The results for each product show a good level of consistency at each SIE, with little variance evident.

The pre-treatment results show that all the skin samples began the experiment with mean dielectric constant within the 5–15 units range. After the application of the barrier product and the first simulated wash, there was a divergence in the skin conductivity measured, suggesting that the effectiveness of the products' performance

Figure 2. Delfin Moisture MeterD with XS 5 Dielectric Probe.



differed from the first SIE. This trend continued through successive SIEs, with the mean Cavilon Durable Barrier Cream (3M) results remaining in the 5–15 range, while the results for the other barrier products increase through successive simulated incontinence episodes to 25–30 dielectric constant.

In view of these results, it appears that the only product tested that offers effective skin barrier properties is the Cavilon Durable Barrier Cream (3M).

The change in dielectric constant of the control skin correlates with its exposure to moisture during each SIE (*Figure 3*). An increase in moisture content of the skin had previously been identified as a risk factor in the maceration and breakdown of skin; both precursors to IAD (Langemo et al, 2011).

These results demonstrate that Cavilon Durable Barrier Cream (3M) provides an effective barrier to moisture absorption and also resistance to repeated exposure to SIE. In contrast, the skin treated with the Proshield® and Sorbaderm™ products show large changes in the dielectric constant, implying a poorer barrier performance compared to Cavilon Durable Barrier Cream (3M).

Both Sorbaderm™ and Proshield® data sets are comparable to the control curve (*Figure 3*),

“This controlled study, using an ex vivo skin model and a dielectric constant measure of moisture absorption, shows the superior barrier performance of 3M® Cavilon® Durable Barrier Cream...”

suggesting that there is no lasting barrier function present in the products and that they are not resistant to exposure to water.

CONCLUSION

It is well documented that increased exposure of the skin to moisture, as typically seen in incontinence, has a detrimental effect on longer-term skin integrity (Cutting, 1999). Therefore, the ability to exclude water and form an effective barrier to the ingress of moisture is an important factor in the selection of a barrier product for use in the incontinent patient.

This controlled study, using an *ex vivo* skin model and a dielectric constant measure of moisture absorption, strongly suggests a superior barrier performance of 3M™ Cavilon™ Durable Barrier Cream over the other two tested barrier products. The barrier performance of Cavilon Durable Barrier Cream (3M), as shown in this study, is an important indicator of its effectiveness in the care of the incontinent patient. WUK

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DISCLOSURE

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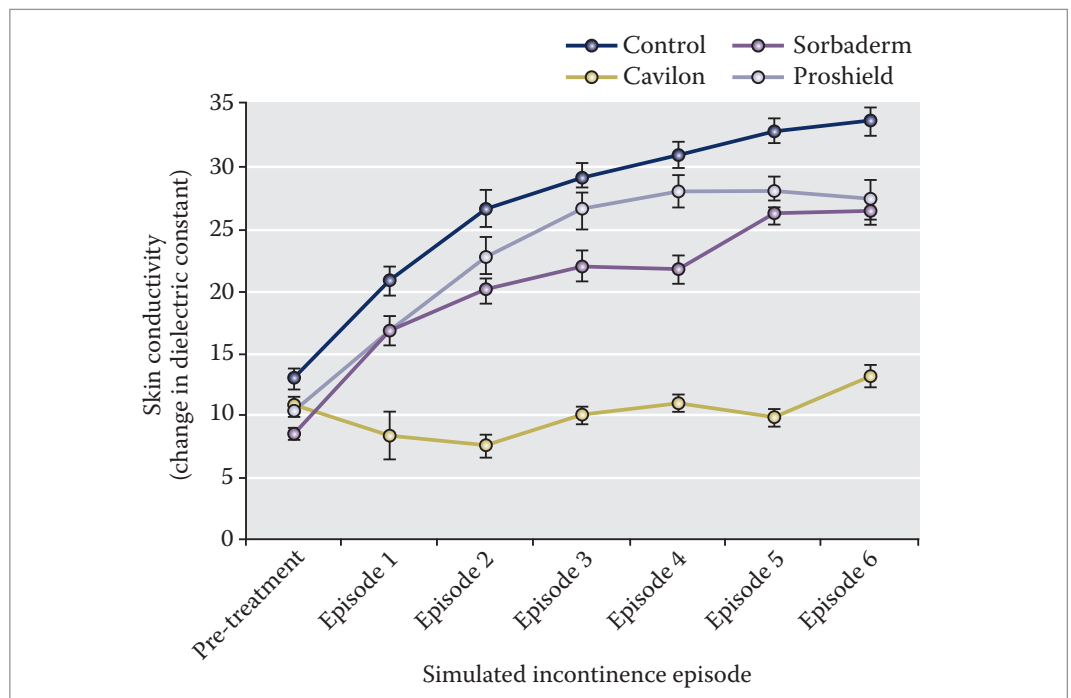


Figure 3. Skin conductivity for each cream tested after six simulated incontinence episodes (mean value ± standard error of mean).