Comparison of the Effectiveness of Five Different Skin Protective Products

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Abstract

Today, skin protectant products are used more and more frequently in all health care settings. They are used to protect both intact and damaged skin from irritation caused by exposure to incontinence, digestive juices, wound drainage, adhesives and friction. The question is: are they all the same in their ability to protect the skin from moisture and/or water soluble skin irritants? This was the objective of a moisture resistance study. If the skin protectant is not effective, thus not protecting the skin from moisture and ensuing irritation, the skin will become increasingly hydrated upon repeated exposure to moisture. As skin becomes increasingly hydrated due to exposure to moisture, there is a corresponding increase in electrical conductivity.[1] A skin electrical conductance meter can, therefore, be used to measure efficacy of moisture barriers.

In this study, test sites (5 cm x 3 cm) were mapped out onto the left and right forearms of 18 healthy adult subjects. Four commonly used skin protectant products and a developmental product were randomly assigned to the test sites and one test site was left untreated as a control. Skin hydration was assessed using a skin electrical conductance meter at various time points before and after a series of simulated normal washings. Analysis of variance with Tukey Studentized Range test (performed at the $\alpha = 0.05$ level) indicate that significant differences exist among the products with regard to moisture barrier effectiveness and in resistance to wash-off.

Background

Resistance to soap and water wash-off is an important economic and performance factor in selecting moisture barriers. For economic reasons, a long-lasting, wash-off resistant moisture barrier needs to be applied less often, saving both materials and labor costs. For performance reasons, a long-lasting, wash-off resistant moisture barrier helps to ensure therapeutic levels of protection between washes, even if the caregiver cannot reapply the barrier.

In 1981, Tagami et al. reported that as skin becomes increasingly hydrated due to exposure to moisture, there is a corresponding increase in electrical conductivity.[1]

Furthermore, in 1993, Lutz and Willard reported a technique (based on Tagami's observations) by which the wash-off resistance of moisture barriers could be assessed with electrical conductance measurements.[2]

Objective

The objective of this study was to measure and compare moisture barrier effectiveness and wash-off resistance of five skin protectant products. This was done 30 minutes after application of the products to the skin to assess for initial efficacy, and again after each of four simulated normal skin washes to assess for product durability.

Methodology

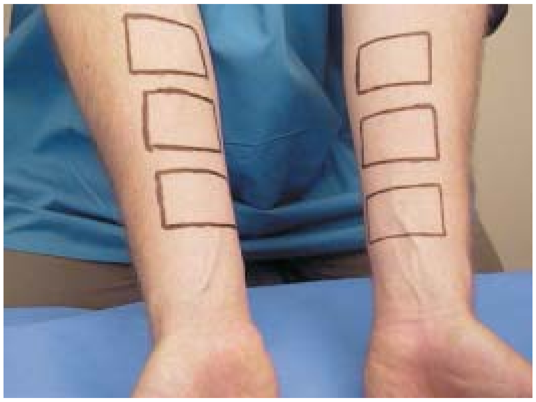
Products Under Evaluation

- 3M™ Cavilon™ No Sting Barrier Film
- Smith & Nephew No-Sting Skin-Prep™
- Convatec Ilex® Skin Protectant Paste
- Smith & Nephew Triple Care® Extra Protective Cream
- Developmental Protective Cream

Subjects

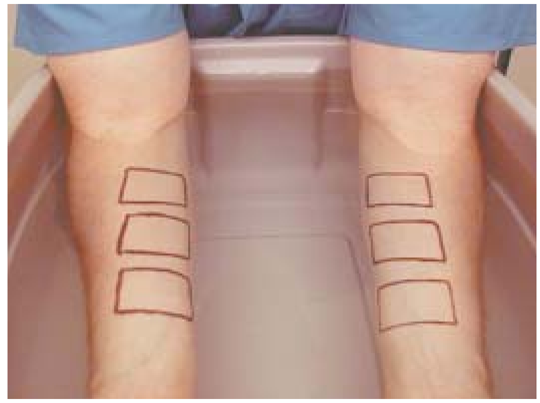
Eighteen healthy adult volunteers between the ages of 18–65 were enrolled into this study. Data from one subject, which was a statistical outlier, was excluded from the analysis. Subjects were instructed not to use any skin care products (other than their normal shower soap) on the test sites for seven days prior to the start of the study.

Test Sites



- Left and Right Volar Forearms
- Six (5 cm x 3 cm) Test Sites:
  - → Four test products
  - → One untreated control
  - → One unrelated developmental product

Water Challenge



- Tepid water for 10 minutes
- Repeated prior to each electrical conductance measurement:
  - → 30 minutes after product application
  - → After each Simulated Normal Wash

Upon removal from the water bath, test sites were kept moist until the electrical conductance measurements. The sites were kept moist by gently applying paper towels cut to the size of the test sites and moistened with tepid water.

Product Application

Assignment of the various test products to the individual test sites was randomized so that each test product occupied each test site within the study with approximately an equal frequency in order to eliminate any position or order bias. Previously, it was determined that, for most moisturizers, 4 ml per cm^2 of skin represented a “normal” use amount. Since the size of each test site was 15 cm^2, the cream and paste test products were delivered at a rate of 0.06 ml/test site using an Eppendorf Repeater pipette. The cream and paste test products were then rubbed into the skin for one minute using a finger covered with a latex finger cot. Fresh finger cots were used for each product application to avoid cross contamination of the test sites. The two barrier film products were applied with the provided applicator, gently rubbing the barrier film onto the test site for one minute, and then allowing it to dry completely.

Electrical Conductance Assessment of Moisture Barrier Effectiveness

- One by one, the moist paper towels were removed and test sites blotted dry of surface moisture.
- Test sites were immediately measured with a SKICON-200 skin electrical conductance meter (Skin Surface Hydrometer, model SKICON-200, I.B.S. Co., Ltd., 33–19 Motohama-cho, Hamamatsu-shi, shizukoka-kan, 430, Japan).
- Triplicate measurements were taken from each site.

Simulated Normal Wash Procedure

1. Application of 5 ml of a no-rinse skin cleanser* to a soft cotton pad.

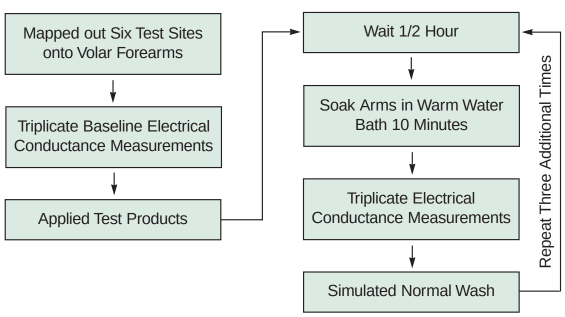
2. Gentle cleansing in a circular motion for 20 seconds.

3. Left lather on test site for an additional 20 seconds.

4. Test sites blotted dry with a soft paper towel.

* 3M™ Cavilon™ Antiseptic Skin Cleanser

Summary of Procedures



Statistical Methods

The source data used in the statistical analysis were the triplicate skin electrical conductance measurements taken at baseline, 30 minutes after treatment, and after each of the four simulated normal washes.

$$\text{\% Barrier Efficacy @ Time } X = 100 - \text{\% Barrier Ineffectiveness @ Time } X$$

$$\begin{array}{c}\text{\% Barrier}\\ \text{Ineffectiveness}\\ \text{@ Time } X\end{array} = \left[\frac{(\text{Conductance @ Time } X) - (\text{Conductance @ Baseline})}{\begin{pmatrix}\text{Conductance of}\\ \text{Untreated Control}\\ \text{@ Time } X\end{pmatrix} - \begin{pmatrix}\text{Conductance of}\\ \text{Untreated Control}\\ \text{@ Baseline}\end{pmatrix}}\right] \text{X } 100$$

Statistical Procedures

The data were analyzed using ANOVA techniques for a randomized balanced block design experiment. This was followed by Tukey's Protected t-test which allowed for a comparison of all possible combinations of test products while, simultaneously, controlling the level of significance within each time period. Additionally, a within treatment paired t-test was used to compare peak electrical conductance for each test product to that of the untreated control, at each time period. This was used to determine if the test product provided significant moisture barrier protection compared to the untreated control. All hypothesis testing was performed at the $\alpha = 0.05$ level.

Results

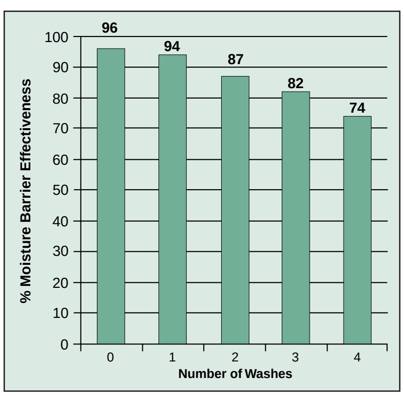
Within Treatment Analysis: Within treatment analysis utilized multiple paired t-tests to compare each product to the untreated control at each time period. This analysis examined whether or not the product provided significant moisture barrier effectiveness. The results are summarized as follows:

1. 3M™ Cavilon™ No Sting Barrier Film provided significant moisture barrier effectiveness initially after application to the skin, and through four simulated normal washes.
2. Smith & Nephew No-Sting Skin-Prep™ failed to provide any significant moisture barrier effectiveness.
3. Convatec Ilex® Skin Protectant Paste provided significant moisture barrier effectiveness initially after application to the skin and through two simulated normal washes.
4. Smith & Nephew Triple Care® Extra Protective Cream provided significant moisture barrier effectiveness initially after application to the skin and through four simulated normal washes.
5. The developmental skin barrier provided significant moisture barrier effectiveness initially after application to the skin and through four simulated normal washes.

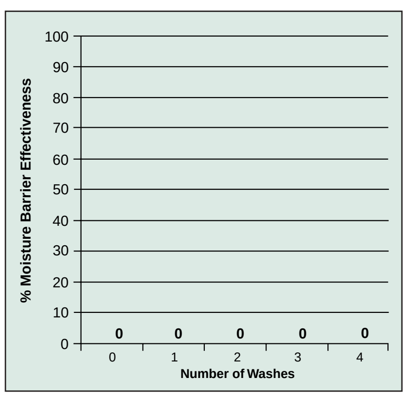
Between Treatment Analysis: Between treatment analysis utilized Analysis of Variance (ANOVA) to compare the *degree* of moisture barrier protection provided by each product at each time point. The results are summarized as follows:

1. 3M™ Cavilon™ No Sting Barrier Film provided a significantly better moisture barrier than the other four test products initially upon application to the skin, and through all four simulated normal washes.
2. Convatec Ilex® Skin Protectant Paste, Smith & Nephew Triple Care® Extra Protective Cream and the developmental skin barrier were statistically equivalent at all wash time points.
3. Smith & Nephew No-Sting Skin-Prep™ was significantly less effective than the other test products initially upon application to the skin and through two simulated normal washes. At wash #3, Smith & Nephew No-Sting Skin-Prep™ was not statistically different than Convatec Ilex® Skin Protectant Paste, Smith & Nephew Triple Care® Extra Protective Cream or the developmental skin barrier. At wash #4, Smith & Nephew No-Sting Skin-Prep™ was not statistically different than Smith & Nephew Triple Care® Extra Protective Cream.

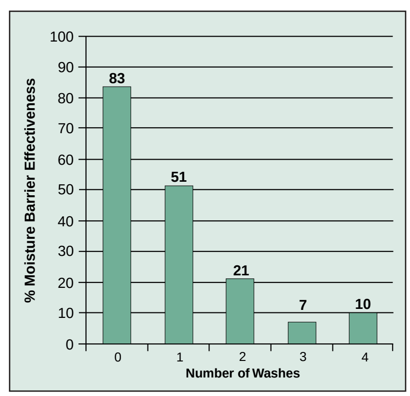
3M™ Cavilon™ No Sting Barrier Film



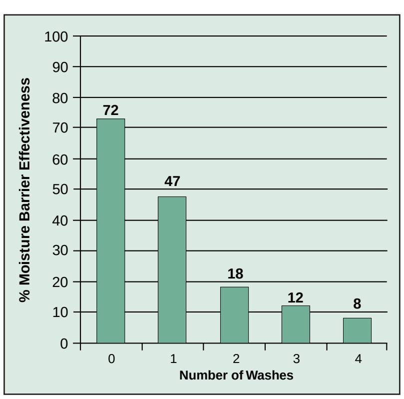
Smith & Nephew No-Sting Skin-Prep™



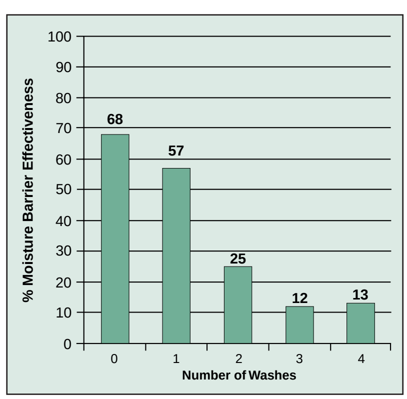
Convatec Ilex® Skin Protectant Paste



Smith & Nephew Triple Care® Extra Protective Cream



Developmental Skin Barrier



Conclusions

Significant differences exist in the ability of the skin protectants tested to protect the skin from external moisture.

3M™ Cavilon™ No Sting Barrier Film maintained moisture barrier function through four simulated normal skin washes (the maximum number of washes tested in this study). Additionally, Cavilon No Sting Barrier Film provided statistically superior moisture barrier effectiveness throughout the study compared to the other products tested.

Smith & Nephew No-Sting Skin-Prep™ did not provide any significant moisture barrier at initial application or after any simulated normal skin washes.

Convatec Ilex® Skin Protectant Paste maintained moisture barrier function during simulated normal skin washes one, two and four, but not three.

Smith & Nephew Triple Care® Extra Protective Cream and the developmental barrier maintained moisture barrier through four simulated normal skin washes (the maximum number of washes tested in this study).

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