Comparison of in-vitro performance characteristics of a new silicone dressing with four other silicone wound dressings used for pressure injury prevention and/or wound treatment

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***M. Thuy Duong Le**, MSc. Chem. Eng., Coloplast A/S; **P. Haberer**, MA, BSN, RN, CWOCN, Coloplast US; **C. Sahlertz**, Bachelor Chem. Bio. Tech. Coloplast A/S; **C. Toxvaerd**, MSc. Hum. Biol. Coloplast A/S.*

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Introduction

Recognition of the huge economic, health-related and social burdens of pressure injuries has resulted in considerable efforts to reduce their occurrence. In recent years, evidence has established that some types of modern dressings used in wound treatment furthermore have the potential to supplement standard pressure injury prevention measures by further reducing pressure injury incidence.[1,2]

Pressure redistribution, friction, shear and microclimate are four key parameters for the performance of a modern dressing to be used as part of a pressure injury prevention protocol, whereas for the management of wounds, fluid handling is the key feature.

With an increasing focus on reducing complexity in the health care system, dressings designed with ideal properties for both treatment and prevention can thus be beneficial[3], emphasizing the need for a dressing which can perform optimally in both areas.

By offering a combination of optimal fluid handling as well as strong performance on the four key pressure injury prevention parameters, a health care facility may potentially reduce the number of stock keeping units.

Aim

The aim was to compare the in-vitro performance characteristics of a new silicone dressing with four other silicone wound dressings used for pressure injury prevention and/or wound treatment.

Methods

Pressure injury prevention key parameters
Pressure redistribution

The pressure redistribution performance of five dressings* was determined by performing Interface Pressure Mapping (IPM) using a pressure sensor type 5051 from Tekscan™. Ten samples of each dressing were tested. The samples were placed on the pressure sensor with the top film side downwards facing the pressure sensor (silicone adhesive upwards). A predefined compression load was applied to the dressing with an Instron® apparatus, and the pressure sensor recorded the force distribution. Data analysis of the recorded force distributions results in the evaluation of pressure redistribution performance with two parameters; peak pressure and coefficient of variation (COV). The peak pressure is an indicator of the maximum pressure, and the COV is an indicator of how evenly the pressure is distributed.

Friction and shear

Five dressings* were tested for friction and shear performance according to the test method, friction and shear testing using steel sled, described in the literature.[4] Testing was performed at the external lab, EC-service, Corp. Five samples of each dressing were tested, and triple determination was performed on all five samples of each dressing resulting in 15 measurements per dressing.

Microclimate

The microclimate performance of five dressings* was tested according to the method described in EN 13726-2, Test methods for primary wounds dressings – Part 2: Moisture Vapour Transmission Rate (MVTR) of permeable film dressings, section 3.2.[5] Ten samples of each dressing were tested.

Wound treatment key parameter
24h Fluid handling

Five dressings* were tested for fluid handling capacity according to the method described in EN 13726-1, Test methods for primary wounds dressings – Part 1: Aspects of absorbency, section 3.3.[6] Ten samples of each dressing were tested.

Results

A comparison of means was performed for all pairs using a Tukey-Kramer HSD with 99% confidence interval (JMP13, SAS Institute).

Pressure injury prevention
Pressure redistribution

The pressure redistribution performance is evaluated with the two parameters, peak pressure and COV. The lower peak pressure and the COV, the greater the pressure redistribution performance.

- *Peak pressure*
  Dressing A had a statistically significant lower peak pressure than dressing B and D (p<0.0001), and numerically lower peak pressure than dressing E (p=0.057). Dressing A had a statistically significant higher peak pressure than dressing C (p=0.0060). (Figure 1)

- *Coefficient of variation*
  Dressing A had a statistically significant lower COV than dressing B, D (p<0.0001) and E (p=0.0005). The COV of dressing A compared with dressing C was not statistically different (p=0.20). (Figure 1)

Friction and shear

Low friction coefficients indicate reduced resistance to friction forces, which in return means less stresses to tissue, although too low friction coefficients would pose a risk of the body sliding. On the other hand, the higher the maximum shear stress difference, the greater the dressing´s resistance to shear stresses.

- *Static friction coefficient*
  Dressing A had a statistically significant lower static friction coefficient than dressing C (p<0.0001), but not statistically significant from dressing B (p=0.70), D (p=0.21) and E (p=0.99). (Figure 2)

- *Dynamic friction coefficient*
  Dressing A had a statistically significant lower dynamic friction coefficient than dressing C (p<0.0001) and D (p=0.0010), but not statistically significant from dressing B (p=0.047) and E (p=0.93). (Figure 2)

- *Maximum shear stress difference*
  Dressing A had a statistically significant higher maximum shear stress difference than dressing C (p<0.0001) and a statistically significant lower than dressing D (p<0.0001). Dressing A was not statistically significant from dressing B (p=0.50) and E (p=0.20). (Figure 3)

Moisture vapor transmission rate

The higher the MVTR, the greater the evaporation of moisture, which in turn reduces the humidity at the skin surface. Dressing A had a statistically significant higher MVTR than all four comparative dressings. (p<0.0001). (Figure 4)

Wound management
24-hour fluid handling

Dressings must be able to remove excess exudate from the wound while maintaining a moist wound bed. Fluid handling is the sum of permeability and absorption.

- *Permeability*
  Dressing A had a statistically significant higher 24h permeability capacity than dressing C (p<0.0001), D (p=0.0002), and E (p=0.0070), however not statistically significant from dressing B (p=0.55). (Figure 5)

- *Absorption*
  Dressing A had a statistically significant higher 24h absorption capacity than all four comparative dressings (p<0.0001). (Figure 6)

- *Fluid handling capacity*
  Dressing A had a statistically significant higher 24h fluid handling capacity than all four comparative dressings. (p<0.0001). (Figure 7)

Conclusion

The new silicone dressing (dressing A) had a statistically significant higher 24h total fluid handling in comparison with all the other dressings, consistent with the performance in relation to absorption and permeability. Additionally, dressing A had statistically significant lower peak pressure than three of the other dressings. In conclusion, dressing A has an overall strong performance, regarding the combination of both pressure injury prevention and wound treatment parameters.

*(A) Biatain® Silicone (Coloplast), (B) Mepilex® Border (Mölnlycke), (C) Allevyn Life (Smith & Nephew), (D) AQUACEL® Foam Pro (ConvaTec), (E) Optifoam® Gentle (Medline).

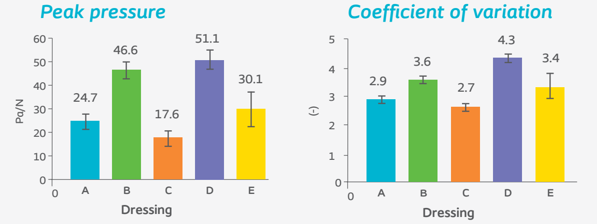

Figure 1: The average pressure redistribution performance of five dressings. The pressure redistribution performance is evaluated with the two parameters; peak pressure and coefficient of variation. n=10.*

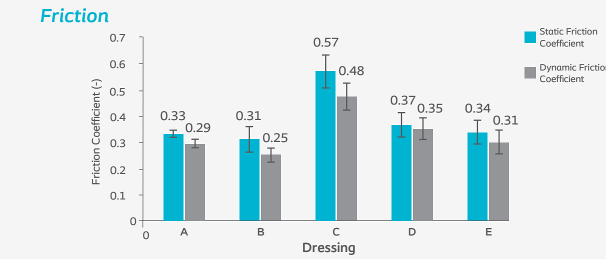

Figure 2: The average static and dynamic friction coefficients of five dressings. n=5.*

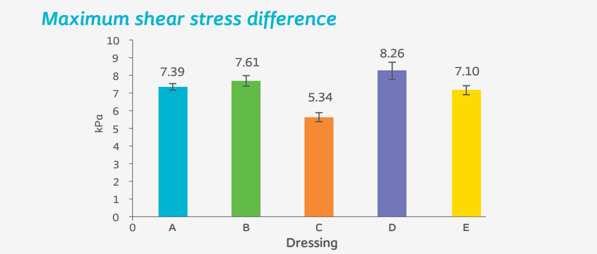

Figure 3: The average maximum shear stress difference of five dressings. n=5.*

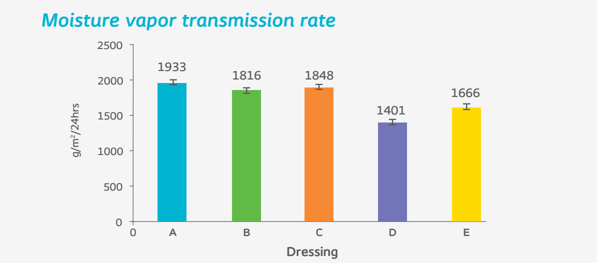

Figure 4: The average moisture vapor transmission rate of five dressings. n=10. Note: Sample values differing by more than 20% from the mean were discarded according to EN 13726-2, section 3.2, thus n=8 for dressing D and n=9 for dressing B.*

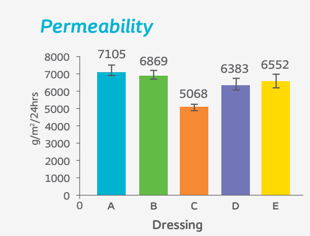

Figure 5: The average permeability capacity of five dressings. n=10.*

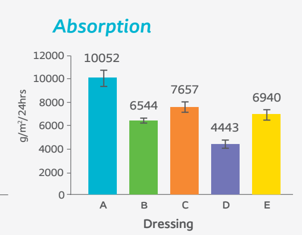

Figure 6: The average absorption capacity of five dressings. n=10.*

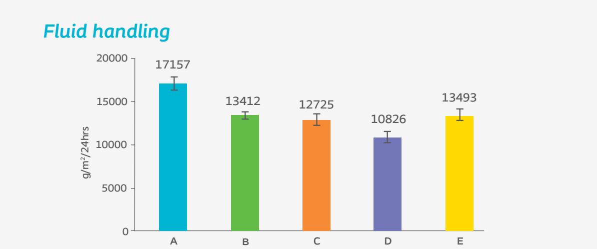

Figure 7: The average fluid handling capacity of five dressings. The fluid handling capacity is the summation of absorption and permeability. n=10.*

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