

THE IMPACT OF DRESSING PAD DESIGN FOR PRESSURE INJURY PREVENTION: A FINITE ELEMENT STUDY

Harriet Talbott (1), Ciara Cassidy (2), Michael Laughton (1), Sarah Crossland (1), Elinor Dhesi (2), Euan Motion (2), Runi Brownhill (2), Louise France (1)

1. School of Engineering and Technology, University of Hull, United Kingdom; 2. Smith + Nephew, Hull, United Kingdom

Introduction

Pressure ulcers pose significant healthcare challenges, causing morbidity, prolonged hospitalization, and high costs. Prophylactic dressings can mitigate mechanical forces at vulnerable sites, but performance depends on material properties and interlayer mechanics.[1]

This study compared an unbonded multilayer dressing (UD*), a bonded dressing (BD†), and a single-layer hydrogel dressing (HD‡) regarding mechanical force dissipation.

Methods

This work brings together multiple finite element modelling studies. The following parameters were assigned to the relevant materials or dressings: compressive elastic moduli, Poisson's ratio, and interlayer friction where appropriate. UD* layers: mask, superabsorbent polymer (SAP), and foam were assessed individually; BD† and HD‡ were tested in bulk. Data informed a finite element (FE) heel model incorporating skin, adipose, and bone under compression and shear.

Results

FE simulations showed UD* reduced peak adipose strain by 19.9% versus undressed heel, 3.9% for BD†, and 2.2% for HD‡. In high-strain regions (>0.7), UD* achieved reductions of 67.1% versus no dressing, BD† achieved 26.6%, and HD‡ achieved 8.8%. Comparing the percentage difference of elements experience strain >0.7 in UD* and BD† a difference of 55.3% was evaluated. In another study, when comparing UD* and HD‡ a difference of 63.9% was evaluated. Interlayer sliding in UD* dissipated shear more effectively than bonded or single-layer designs, promoting strain dissipation.

Conclusions

Layer-specific mechanics and interfacial dynamics influence dressing efficacy. UD*'s unbonded architecture provided superior strain reduction compared to bonded and single-layer dressings. This experimental–computational approach offers a framework for optimizing next-generation prophylactic dressings.

Conflict of Interest

The authors disclose that this research was solely funded by Smith+ Nephew Ltd

References

1. Orlova D, Orlov A and Gefen A. The Protective Efficacy of a New Soft Silicone Multilayer Dressing in Reducing the Heel Pressure Ulcer Risk. *Int Wound J.* 2025 Oct;22(10):e70764. doi: 10.1111/iwj.70764.

*ALLEVYN™ COMPLETE CARE Foam Dressing, Smith & Nephew.

†Mepilex™ Border Dressing, Molnlycke.

‡OptiView™, Medline.

