

Introduction

While filling materials are standard for treating open cavitory wounds, their mechanical interaction with soft tissues is still poorly understood. This remains a critical gap, as evidence suggests that large shear strains significantly compromise tissue viability [1]. Consequently, clinicians often struggle to select the most appropriate filling materials [2], and manufacturers face challenges in developing optimized products.

Methods

This study models the mechanical behaviour of filling material within a stage III sacral pressure ulcer characterized by a deep open cavity. Commercially available materials were subjected to uniaxial tensile and compression tests, and the resulting data fitted with an Ogden hyperelastic constitutive law.

The influences of material stiffness, compressibility, filling ratio, and interfacial friction were investigated on a Finite Element model assuming a patient in the supine position.

Results

Analysis of Green–Lagrange shear strains inside soft tissues highlights that completely filling the wound cavity is essential to prevent tissue injuries. The results indicate that softer, more compressible materials are preferable, as they undergo deformation in place of the surrounding soft tissues. Furthermore, the findings suggest that an optimal balance of frictional properties at the tissue interface is necessary.

Conclusions

Future work will involve implementing a poroelastic model for rope wound dressing to account for wound exudation and its interaction with both the filling material and the secondary dressing.

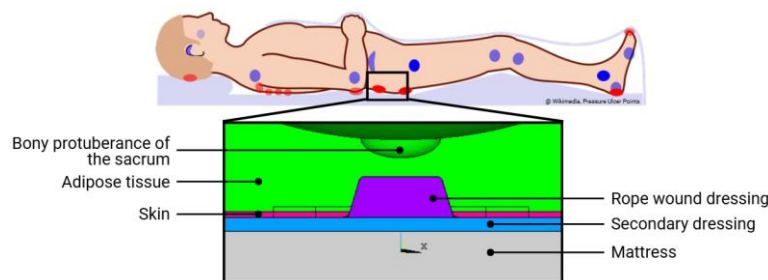


Figure 1: Finite Element Model

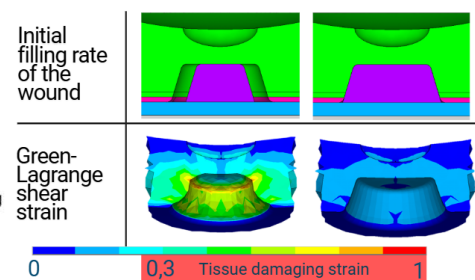


Figure 2: Wound filling rate (left: 60%, right: 100%) influence on tissue viability

Conflict of Interest

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References

1. Ceelen, K. K. et al., Compression-induced damage and internal tissue strains are related. *Journal of biomechanics* 41:3399-3404, 2008.
2. Dinah, F. et al., Gauze Packing of Open Surgical Wounds: Empirical or Evidence-Based Practice? *The Annals of The Royal College of Surgeons of England* 88:33-36, 2006