FINITE ELEMENT STUDY OF STRAINS AROUND SACRAL AND HEEL PRESSURE ULCERS WITH A NEW BI-LAYER DRESSING

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1. Introduction

Pressure Ulcers (PU) are soft tissues wounds occurring after a detrimental external loading. Maximal shear strains are considered as a mechanical biomarker to estimate the risks for PU [1]. These strains can be computed with Finite Element Models (FEM). It is common to use dressings to protect and improve the environment around the wound but the mechanical impact of such devices has been poorly investigated. In this work, FEM of the hell and sacrum are used to numerically evaluate the ability of a new Urgo RID bi-layer dressing to reduce soft tissues internal strains.

2. Materials and Methods

FEM of the sacrum and the heel regions were designed from medical images of one healthy volunteer. Both models included a fat and a skin layer. Achille's tendon and muscles were added for the heel. Bones were not included in the models since they were supposed to be rigid.

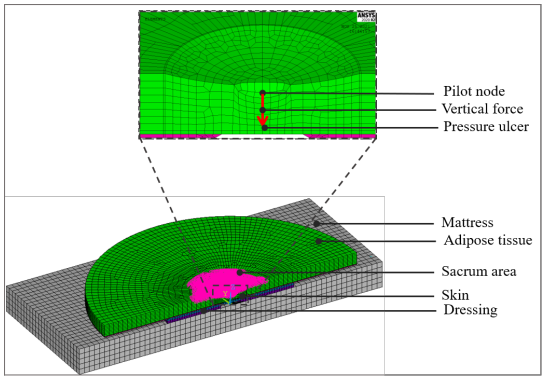

Figure 1: FEM of the sacrum region with a PU.

To simulate a PU, a 30.0 mm cylinder, 1.3 mm deep, was removed from the soft tissues, below bony prominences (see figure 1 for an axi-symmetrical model of the sacrum). Hyperelastic constitutive equations were used to model the tissues with a stiffening around the PU. Materials constitutive behaviours were optimised according to literature experimental cadaveric tests. The dressing was composed of a compressible honeycombed material with a hole under the bony prominences. A second layer, the compress, consisted in an orthotropic linear elastic material. The dressing was glued to the skin and a vertical force equivalent to 47 % and 6 % of the subject weight was applied to the sacrum and the heel respectively. A mattress with a linear elastic material was used as a support in both models.

3. Results

The dressing reduced the strains under the bony prominences in models with and without PU. Volumes of "healthy" tissues, i.e. under 50 % strains [1], were also larger in all models when the dressing was used.

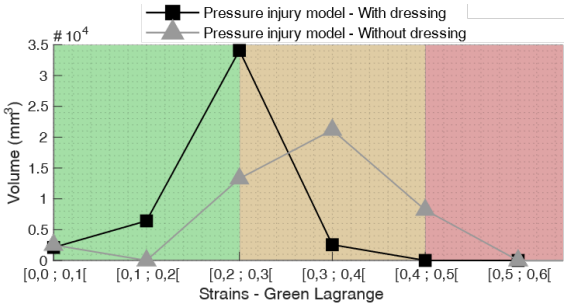

Figure 2: Strains distributions in the sacrum models.

4. Discussion and Conclusions

New concepts of dressings such as the Urgo bi-layer dressing, may provide more than a proper biochemical environment: they can also create mechanical conditions that alleviate the tissues.

5. References

[1] K. K. Ceelen *et al.*, *J. Biomech.*, 41:3399–3404, (2008),