Finite Element Analysis of Undermining of Pressure Ulcer with

a Simple Cylinder Model

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The study is based on observations where ulcers are formed in the deeper tissue and then moves up to the skin. The study observed stress concentrations for different undermining gaps for pressure ulcers using 2D FE models. The hypothesis stated that the stress distribution changes due to necrosis formation under the pressure sore which further affects the extension of necrosis.

The materials modeled were hard (bone) and soft tissues (fat, muscle and skin). For FEA, only soft tissue was meshed. It was modeled as linear, isotropic and time-independent (E=15kPa, Poisson ratio=0.49). The undermining was simulated by creating gaps at the hard-soft tissue interface (between the two cylinders). The above & below edges of the undermined region formed a ‘no friction’ contact pair. The loading condition was a downward displacement of 1cm to represent gravity. Coefficient of friction between the patient and bed was 1.

Stress concentrations were observed in the region of undermining and in the center of soft tissue just under the hard tissue. The maximum stresses were observed in the region of undermining or hard-soft tissue interface. The stresses increased with increase in undermining gap.

Note:

1. Does not use viscoelastic model.
2. No separate material assignments for skin, fat and muscle.
3. Used displacement of cylinder to represent effect of gravity. No additional forces applied.
4. Patient assumed to be lying on a flat, hard, non-slipping bed. No cyclic loading. No foam properties.