Mechanically induced muscle damage

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Introduction
Within the research of the aetiology of decubitus, the present study will focus on mechanically induced damage in muscle tissue. To study the development of damage, a tissue engineered muscle model will be developed. As the damage is initiated on a cellular level, markers for the evolution of cell damage will be applied to establish threshold values for damage development. The markers may be used as biosensors in decubitus prevention. To achieve this, tissue damage will have to be defined in terms of reversible as well as irreversible damage and also cell death.

Objective
To investigate the relationship between sustained compressive loading and the development of tissue damage, with the ultimate aim to:
- provide threshold levels for damage development induced by compression
- establish guidelines for decubitus prevention

Material and methods
Tissue engineered muscle
The method for self-assembly of a tissue engineered muscle, by Dennis et al. [1], will be adapted to create tissue engineered muscles from cell lines without the use of a scaffold material (figure 1).

Markers of cell damage
The tissue engineered muscles will be compressed in a loading device. The degree of cell damage will be evaluated with markers, which should be measurable. Some biochemical candidate markers for reversible as well as irreversible cell damage (and possibly biosensors) are shown in figure 3. Furthermore, a suitable marker for cell death has to be found; for example nuclear staining with propidium iodide.

Future
Short term goals:
- application of protocol for myooid formation
- finding suitable markers for cell damage and cell death

Long term goals:
- optimization of protocol for engineering myooids
- design of a compression device
- compression studies on the myooids
- damage definition and assessment with markers
- effects of electrical stimulation of myooids on tissue development and damage evolution
- implementation of established damage thresholds in numerical model

References: