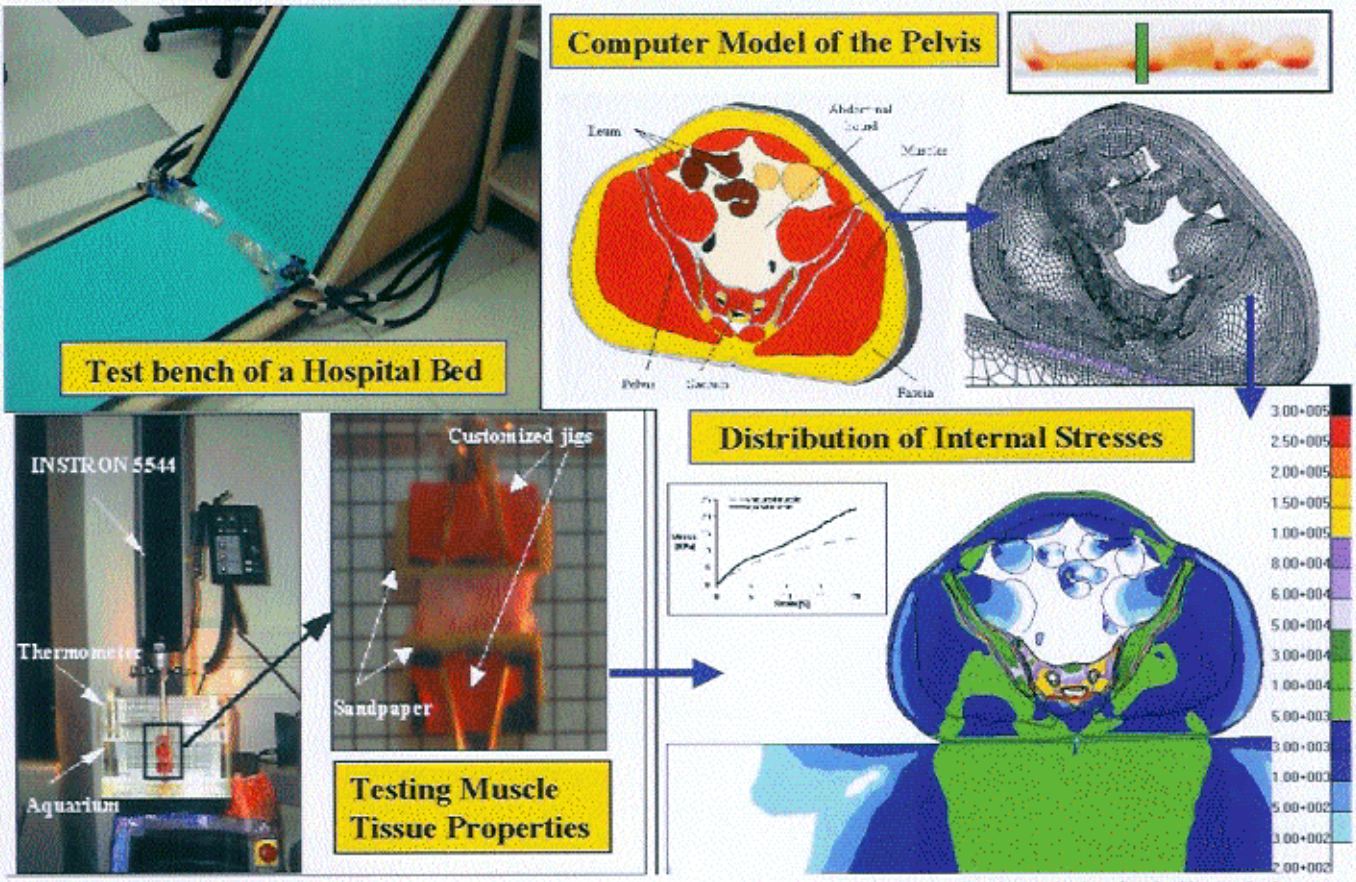

Internal stresses are calculated and displayed, based on data from a bed outfitted with standard pressure contact sensors, in an innovative TAU approach to preventing bedsores.

Deep Monitoring of Patients to Prevent Bedsores

Painful and potentially life-threatening "bedsores" (pressure sores) are the bane of patients and the elderly who are unable to easily shift their weight off of vulnerable skin and underlying tissues which cover the bony parts of their body. Diabetic patients with an impaired ability to detect pain are also especially vulnerable. The intense and prolonged mechanical loading of these vascularized soft tissues can cause metabolic deprivation, excessive deformation and widespread cell death. Despite considerable effort, 10-25% of the hospital patients in modern Western facilities still suffer from bedsores, collectively incurring treatment costs of about $6-7 billion dollars annually, in the U.S. alone. Epidemiological studies reveal that the most severe and intractable sores develop in skeletal muscles, deep within the body. These primarily arise when the unrelenting pressure cuts off or impairs their blood supply. In fact, muscle, a highly vascularized tissue, is more vulnerable than skin to such effects.

Dr. Amit Gefen and his research group at the TAU Department of Biomedical Engineering seek to clarify how mechanical loads and stresses act on the deep muscular tissue of immobilized patients to create such sores. The mechanical properties of muscular tissue also play an important role. Their data, obtained from animal models, computer simulations and human studies shows that the mechanical stresses acting on deep muscles are 10 to 100 times greater than those at the body-support (e.g., mattress) interface. Furthermore, when metabolically deprived or mechanically damaged by such compression (e.g., under the pelvis bone) muscle tissue becomes increasingly stiff as its cells die.

These results suggest that the usual measurements of pressures at the body surface may be insufficient to predict the true risk of bedsores, and that measurements of mechanical stresses deep in the muscular tissues is required.

The researchers are now developing a monitoring system that recommends interventions to relieve pressure at the common sites for injury, based on a real-time evaluation of the actual internal mechanical stresses at those sites. Changing the patient's posture according to these recommendations, as opposed to the usual clinical routine of arbitrary changes, should minimize sore formation. Their prototype system (patent pending): (1) converts measured pressures at the body-support interface to internal muscular tissue stresses, (2) calculates the pressure/temperature insults delivered to deep tissues in real-time, and compares them with injury thresholds, (3) uses computer simulations to provide anatomically-specific alerts, (4) is relatively inexpensive and appropriate for clinical use. Their system now awaits further development to test its effectiveness in the hospital setting.