PhD project at the IBHGC: Multi-physics characterization and modeling of pelvic soft tissue response for Pressure Ulcer prevention

Pressure Ulcers are a decubitus complication whose epidemiology is now known and which affects populations at risk: elderly or disabled people. It generally appears when excessive mechanical loads are applied to the skin, such as, for example, during mechanical interaction between a person and a medical device (Manual Wheelchair, prosthetic socket, exoskeleton, etc.) or support surfaces (hospital bed). Pressure Ulcer prevention remains a major health challenge for Europe due to the human and financial cost of prolonged hospitalization, reduced quality of life, loss of autonomy and social isolation.

There are at least two damage mechanisms responsible for the onset of Pressure Ulcers\textsuperscript{1–5}: ischaemia/reperfusion damage initiated by sustained moderate strains and cells damage initiated by direct (shear) deformation. This evidence confirms that computational simulations - based on nonlinear continuum mechanics - can provide important insights into the underlying mechanisms that go beyond the possibilities of traditional diagnostic tools. As a result, several Finite Element (FE) models of the buttock have been proposed in the literature based on MRI or CT scan data\textsuperscript{6–16}.

In a previous study, and as an alternative to MRI-based/CT-scan-based assessment, a methodology combining low-dose biplanar X-ray images, B-mode ultrasound images and optical scanner acquisitions in a non-weight-bearing sitting posture has been proposed for the fast generation of patient-specific FE models of the buttock and applied to 6 healthy subjects\textsuperscript{17,18}. To investigate the ability of a local model of the region beneath the ischium to capture the internal response of the buttock soft tissues predicted by a complete 3D FE model from a limited number of parameters, a simplified model was developed based on data potentially compatible with daily clinical routine\textsuperscript{19}.

To contribute to the development of tools for assessing the risk of injury during prolonged contact, the objective is now to model the temporal evolution of the mechanical response and to take into account biological processes.

For more information or to respond to this vacancy please send an email to pierre-yves.rohan@ensam.eu including:

- a cover letter (stating personal goal and research interests connecting to the topics defined above)
- a complete Curriculum Vitae (including a list of publications if any),
- transcripts of BSc and MSc degrees,
- at least one recommendation letter.

Deadline: April, 1st 2020


