

A. Natali, P.G. Pavan, E. Carniel, P. Dario. *Mechanical characterisation of soft connective tissues with aging. Gerontechnology 2008; 7(2):172.* Aging determines large modification of the micro-structural conformation of soft connective tissues^{1,2}, which includes a variation of the percentage of the single components and the decrease of their mechanical characteristics. This modification results in a change of the macroscopic mechanical behaviour, i.e. at the tissue level. The development of appropriate constitutive models capable of describing the mechanical response of the tissues is important to evaluate their functionality. In fact, this can be interpreted also by means of typical mechanical aspects, such as flexibility and toughness, failure strain and energy, as well as shock adsorbing capability. **Methods** A constitutive formulation for soft tissues has been developed including the specific mechanical characteristics, such as visco-elasticity³ and damage phenomena⁴. The constitutive model accounts also for the anisotropic response given by the specific spatial disposition of the collagen fibres reinforcing the ground matrix of the tissues. The numerical formulation is developed by using a mathematical framework suitable for the finite strain range characterising the mechanical response of soft tissues. The constitutive model has been implemented in general purpose finite element software and adopted to simulate the response of soft tissues under specific loading conditions. The numerical results have been compared with experimental data taken from the literature. **Results and discussion** A comparison of numerical results and experimental data shows that the constitutive parameters of the model can be associated to the conformation of the collagen fibers, as the initial crimp, or to the visco-elastic properties of the tissues related to a change in their liquid content. The different energy dissipation during a loading-unloading cycle (*Figure 1a*) or the different dissipated energy at the failure of the tissue for a monotonic loading (*Figure 1b*) result as a function of the tissue aging. The outcomes show the potential of the approach in evaluating the mechanical performance of soft tissues with aging. The identification of the constitutive parameters is a key step and requires specific procedures, due to the high non-linearity of mechanical response of the soft tissues.

References

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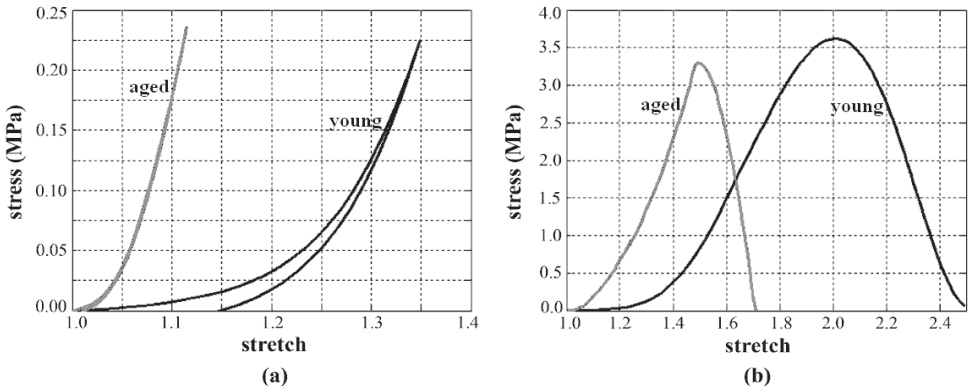


Figure 1 Different behavior of young and aged soft connective tissues as simulated by using a visco-elasto-damage constitutive model: loading-unloading cycle (a) and monotonic loading up to the failure (b)