

POSSIBILITIES OF THE USE OF INDENTATION TESTS WHILE STUDYING THE MECHANICAL PROPERTIES OF SOFT TISSUES OF THE HUMAN LOCOMOTOR SYSTEM *IN VIVO, IN SITU*

ABSTRACT:

The aim of this work was to analyze possibilities of the use of indentation tests, while studying mechanical properties of human locomotor system soft tissues *in vivo, in situ*. The synthesis of published findings and the results of our own surveys were used. A mathematical model of the indentation test was created as a part of theory. The geometry of the task was formulated as a solid cylinder penetrating into an infinite half-space made of viscoelastic material. The solution is based on the traditional analytical approach concerning stationary loading of flexible material. This procedure is generalized for Neo-Hooke's hyperelastic material and large deformations. The quantification of dissipative processes is based on the assumption that the stress tensor of a viscoelastic material can be decomposed into a purely elastic constituent and a purely dissipative constituent. The model enables to determine both elastic and viscous properties of the material.

Experimental part of the work includes validation experiments. Based on the findings, it can be stated that myotonometry is a valid diagnostic method that allows an objective assessment of muscle tone status. The condition of objectivity is the assumption that the investigations are carried out by a trained person with practical experience in the field of physiotherapy.

Based on theoretical and empirical considerations, it would be appropriate in the follow-up research to evaluate the effect of compressibility of tissue layers under the indenter on the shape of the deformation tensor and to experimentally verify the curvature of the tissue surface near contact with the indenter. It would also be appropriate to investigate the effect of indentation rate on the course of the bioreogram during pathological conditions of muscle tissue. For these reasons, it can be stated that the described method of indentation tests is currently suitable for research purposes rather than for direct use in clinical practice.

KEYWORDS:

Soft tissues, viscoelasticity, muscle tonus, myotonometer