Conclusions and discussion

The articular cartilage is a material inhomogeneous and anisotropic [3,4]. This biological material is composed of cells (chondrocytes), intercellular amorphous substance and fibrils [1,2]. These components are very hardly separately measurable. Due to this fact it was necessary to consider this material as a finite element of continuum mechanics.
Monitoring the behavior of this material with the help of modern experimental method together with current computational software products could bring answer on causes of beginning of arthritic damage of joint.

Acknowledgements

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FINITE ELEMENT ANALYSES OF MODULAR KNEE JOINT REPLACEMENT

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Introduction

In this work I summarize the up to now progress in a development of a FE model of a knee after a total knee replacement (TKR) operation. Two of them are very simplified and the last one, quite complex but without a soft tissue, is now prepared and introduces only as a geometric model. This problem leads to a dynamic analysis containing in its final version aside all three articulating bones and its replacements also simplified models of main muscles and ligaments.

Methods

Stress analysis of human joints with a FE code is a useful tool especially for a verification of (total) joint replacements. Our laboratory tries to develop a complex FE model because we cooperate on an evolution of a modular TKR system called WDM. WDM system is produced in a metal design (Vitalium) and mechanically and clinically tested also in a ceramic one (Zirconia).
All these models are solved with a software Abaqus/CAE. As for the geometrical models of replacements, they are provided by a producer, Walter, a.s. and if necessary, 3D CAD software Unigraphics is used.

Description of FE models

Two main projects were solved until this moment. Both are static and still very simplified compared to the real joint but they were in fact a simulation of laboratory tests. The first [1] one is a simulation of a test which had as its object to find out critical places of the ceramic knee component of the WDM [2].

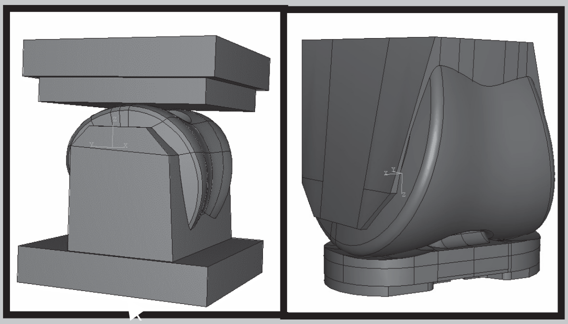

FIG. 1 a, b - Scheme of simple static FE analyses.

The second model [3] serves as pre-test analysis. The aim was to point out all the most loaded areas of a tibial plateau where would be placed a set of four strain gauges to measure deformations of a UHMWPE component. Both models are very similar and in general, they are both static and nonlinear (because of contact formulations), femur is replaced by a simplified homogenous elastic body, tibia and patella are not included. For all the structures, it is supposed that they behave according to an elastic law. For more details, see [1], [3]. All the analysis were performed for a knee in a full extension.

Complex knee joint model

While our laboratory lacks good geometric models of the articulating bones, which are necessary to create an accurate model for the analysis, some corrections had to be made during its preparations. But there is no doubt that several modifications will have to be made before the FE analysis will be carried out. An arrangement of the TKR and also of the bones toward each other in the full flexion hang together with this item.
No bone cement is presented in the problem as well as the patella and all soft tissues. The TKR consists of the femoral part, tibial plateau and its metal base (see. FIG.2).
The problem will solved as a contact static problem (for this instance), 2 tied contacts (bone-implant interfaces) and two penalty contacts - between the TKR components.

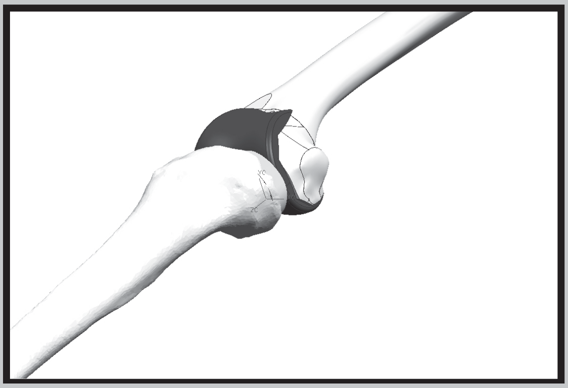

FIG. 2. Complex knee joint geometric model.

Conclusions

This work is only an initial part of a project of our laboratory which should lead to a final goal - a dynamic FE model useful for verification of a total knee replacement and well simulating the force relations inside a human knee. For this reason we chose a way of a gradual increasing of complexity of FE models and permanent validation of such models with laboratory tests. First we want to make a static model as detailed as possible and after that pass over a dynamic model.

Acknowledgements

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MORFOLOGICAL RESULTS OF ACUPUNCTURE STIMULATION FOR SKIN WOUNDS REPARATION IN EXPERIMENT

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[Engineering of Biomaterials, 47-53,(2005),23-24]

Reparative and compensatory processes stimulation for quickest skin recovery is important for aesthetic surgery [1,2,3,4].

Aim

This research is to examine acupuncture stimulation effects for reparative regeneration of skin wounds in experiment.

Methods

Experiment was performed on 36 guinea pigs. The skin and subcutaneous fibrous tissue incision 3,5 cm long was made on 20 cm^2 of cut hair back. The periosteum was separated from the bone. Operations were carried out with Sol. Novocoini 0,25%. Once they put stitches in a wound, Viridis nitentis 1% was used to work up the wound. Animals were divided into 2 groups, 18 animals per a group. Acupuncture stimulation of the acupoint GI4 [5] was applied for the animals of the 1-st group postoperatively while 10 days. 2-nd group animals did not passed postoperative treatment. It

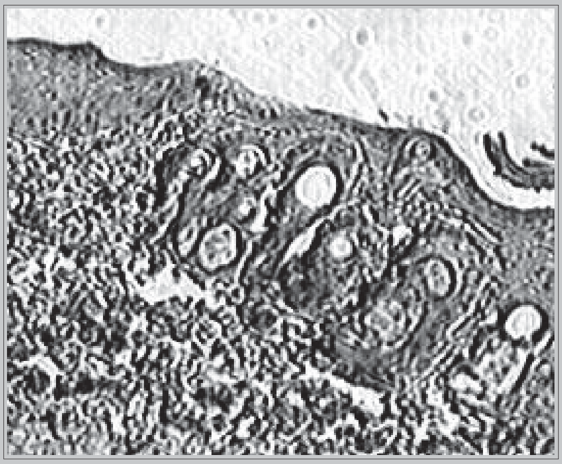

FIG. 1. Reparative regeneration of the skin wound 3 days postoperatively for the animals of the 1-st group.

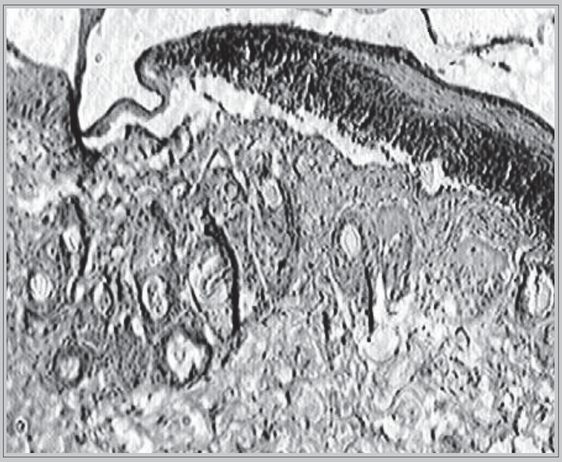

FIG. 2. Reparative regeneration of the skin wound 3 days postoperatively for the animals of the 2-nd group.