

mgr inż. Agnieszka Kurek
Faculty of Physics and Applied Computer Science
AGH University of Science and Technology

Atomic Force Microscopy in the diagnosis of uterine diseases based on the mechanical properties of endometrial tissue

Endometrial diseases affect many women around the world. It is one of the significantly limiting fertility factors. Uterine dysfunctions are related to structural and hormonal changes, but they may also be associated with changes in the mechanical properties of the endometrial tissue.

This dissertation aims to present the research results on the endometrial tissue elasticity modification in the context of pathological changes occurring within the endometrial tissue and their possible relationship with fertility. The research material, a fragment of endometrial tissue, was taken from patients who suffer from different endometrial diseases, including infertility. Force spectroscopy was applied to measure the mechanical properties of tissues. This technique allowed the correlation between changes in the value of Young's modulus and the development of polyps and micropolyps in the uterus determination. Moreover, it was found that the value of Young's modulus may depend on fertility.

A cell indentation model was developed to describe a cell with a cortex by a modified Hertz equation. The solution of this model obtained with the finite element method allowed for getting the results reflecting the cell's response to spherical indenter exerting pressure.

Atomic force microscopy has a great potential to use as a complementary diagnostic method for endometrial diseases.

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