

LASER POLARIMETRY IN JOINT DISORDER DIAGNOSTICS

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Introduction. First attempt to study human synovial fluid in normal and pathological applying laser polarimetry to determine the nature of pathological changes.

Diagnostic arsenal available for recognition of joint injury and diseases includes several physical methods such as conventional roentgenography, computed tomography, magnetic resonance imaging, ultrasound etc. However, none of the above assesses structural changes in synovial fluid at macro- and micromolecular level, which is important for differential diagnosis.

Methods. Search for such diagnostic tool lead to introduction of laser polarimetry to joint disorders diagnostics. It provides several new parameters for biological tissues assessment at subcellular level.

Aim. Goal of the research is designing a technique for polarimetric assessment of human synovial fluid at macromolecular level to recognize its structural changes and physiological state in osteoarthritis, rheumatoid arthritis, septic arthritis and gout arthritis. Human synovial fluid is optically complex, containing three main components:

1) Optically isotropic – optically homogenous component with high general protein and lactic acid level and low glucose level that includes hyaluronic acid in complex with proteins and large amount of leukocytes

2) Optically anisotropic – liquid-crystal phase containing several types of liquid crystals: fibrin filaments, collagen fibers

3) Optically anisotropic – solid crystal phase formed by cartilage and synovial debris. Basing on the synovial fluid structure described above, following trends can be expected at its exposition to laser beam: Polarimetric map obtained with osteoarthrosis and reactive arthritis.

Results. Comparative analysis of complex polarizationally laser images layers human synovial liquid found:

1. Intensity distribution is coordinatly inhomogenes, formed optically isotropic and optically anisotropic (liquid-crystal phase) components.

2. Laser imagin registration at crossed planes transmission of polarizer and analyzer allows to visualize coordinatly distribution liquidcrystal phase.

3. The objective criteria for diagnosis and differentiation of osteoarthritis, reactive arthritis is defined based on statistical moments 1 - 4 rank of laser images.

Given the above-said laser polarimetry allows to research optical manifestations attached to different joint disorders by selection laser polarimetry imagins of synovial fluid layers.