

## COMPREHENSIVE RADIOGRAPHIC ASSESSMENT OF EARLY-STAGE OSTEOARTHRITIS OF THE KNEE JOINT

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### Relevance

Osteoarthritis (OA) affects between 10% and 20% of the global population, with its prevalence steadily rising over recent decades [1-5]. Approximately one-third of OA cases primarily involve the knee joints [3]. Research from both domestic and international sources [6-8] highlights that early detection of cartilage degeneration is a promising avenue for improving diagnostic and therapeutic strategies for OA.

**Goal.** To evaluate the effectiveness of magnetic resonance imaging methods, such as T2-relaxometry, combined with laboratory testing of biological markers, in detecting early-stage hyaline cartilage abnormalities in knee osteoarthritis.

**Tasks.** To investigate early knee osteoarthritis. Participants were assessed for pain using a visual analog scale and function via the Oxford Knee Score. Imaging included X-rays, ultrasound, and MRI with advanced sequences such as T2 relaxation mapping to detect early cartilage changes. All procedures followed ethical guidelines and aimed to correlate clinical symptoms with imaging findings for improved early diagnosis of knee OA.

**Material and methods.** A total of 37 individuals aged 35 to 50 years (9 men and 28 women) were examined. Inclusion criteria for the main group were: 1) complaints of intermittent pain and discomfort in the knee joints during walking and physical activity, 2) a history of symptoms lasting at least two years, and 3) no prior treatment with anti-inflammatory, chondroprotective, metabolic, or physiotherapeutic interventions. The control group included 20 age-matched individuals without any clinical signs of joint disease and who were not taking any medications at the time of the study. Exclusion criteria comprised oncological, cardiovascular, endocrine diseases, systemic connective tissue disorders, immunodeficiency, and severe musculoskeletal injuries. All participants provided voluntary informed consent for

a comprehensive clinical, laboratory, and instrumental examination, conducted in accordance with the ethical guidelines outlined in the Helsinki Declaration by the World Medical Association.

## Results

Pain levels on the visual analog scale among patients in the main group ranged from mild to moderate. The KOSS scores in the control group were between 98% and 100%, while in the main group, they ranged from 70% to 87%. According to the KOSS questionnaire results, patients in the main group reported minimal discomfort in daily activities but experienced some functional limitations during more strenuous physical activity. Instrumental examination revealed that 23 patients in the main group were at OA stages 0-1, while the remaining 14 patients were at stages 1-2, based on the J. Lawrence and J. Kellgren classification. Ultrasound examination of the knee joints in 11 patients (30%) showed nonspecific findings, such as mild synovitis (synovial membrane thickening and small joint effusion), degenerative changes in the hyaline cartilage and menisci indicated by structural heterogeneity, and moderate inflammation of periarticular tissues, including collateral ligamentitis. Overall, conventional diagnostic methods like radiography and ultrasound demonstrated limited sensitivity in detecting early degenerative changes in the knee joint.

## Conclusions:

In individuals showing early clinical signs of osteoarthritis, an imbalance between anabolic and catabolic processes in the articular hyaline cartilage leads to alterations in the composition and structural integrity of its extracellular matrix. This can be objectively assessed through a comprehensive instrumental and laboratory evaluation, which includes T2 mapping—a non-invasive and highly sensitive technique for detecting morphological changes—as well as measuring COMP levels in biological fluids and CTX-II. Correlation analysis results indicated that disruption of the three-dimensional structure of type II collagen, as revealed by MRI in early OA patients, is linked to elevated serum COMP concentrations and increased daily urinary excretion of CTX-II.