

Multi-analytical approach in the study of synovial fluid crystals: electron microscopy, spectroscopy and X-ray micro-diffraction.

The presence of particles and crystals in synovial fluid is a common feature in patients with various types of rheumatic disorders.

Some crystals, such as monosodium urate (MSU), calcium pyrophosphate (CPP) and basic calcium phosphate (BCP), are certainly linked to specific diseases (as gout, chondrocalcinosis, inflammatory osteoarthritis, etc.).

Although the exact meaning of their presence in pathologic synovial fluid is not yet entirely clarified, it has been observed that they correlate with the severity of the disease and are recognizable even in early stages of the disease; therefore, their detection and correct identification is an important step in the management of patients.

In clinical practice, crystal identification is based on the analysis of synovial fluid made by optical microscopy in transmitted polarized light, which represents an effective outpatient procedure, relatively simple and cheap.

The main disadvantages of this technique are the lack of specificity, that can be in part due to misinterpretation of the observer, and the presence of other crystals or particles of different nature that can create difficulties of interpretation.

Analytical techniques commonly used by geologists in the mineralogical and crystallographic fields can be applied to better characterize all types of crystals occurring in human synovial fluid in order to understand their specific role in the development of the different rheumatic diseases.

The first step of the research will be to set a protocol for collecting and fixing such small amounts of crystals (max size 20 μm) from the liquid on a suitable holder made of an appropriate material transparent both at the optical microscope and to X-rays. The samples will be successively analyzed by optical and electron microscopy (both SEM and TEM), their chemical features will be defined by micro-X-ray diffraction, micro-Raman spectroscopy and EDS.

The project will be conducted in collaboration with Dr. Luca Peruzzo (IGG-CNR Padova) and Prof. Leonardo Punzi (Head, Rheumatology Unit Department of Medicine Medical School, University of Padova).