



# Imaging Assessment of Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a severe and disabling disease which affects soft tissues and bones of the joints. The disease generally progresses through three stages of development including synovitis, joint destruction, and deformity. After the initial synovial inflammation, the synovium becomes hypertrophied to form granulation tissue (pannus), which spreads over the cartilage surface causing destruction. At the 'bare areas' of the joint where bone is not covered with cartilage, pannus directly invades into the bone resulting in marginal erosions. In the final stages, a fibrous or bony ankylosis of the joint takes place. The bone erosions seen in plain x-ray films or MRI are used to evaluate the disease progression as well as the effectiveness of the treatment.

VirtualScopics is using medical imaging to help pharmaceutical companies and medical device developers better understand and assess the effects of their compounds in clinical trials. Our proprietary algorithms help isolate selected tissues to precisely quantify erosions, edema, joint space narrowing and inflammation. Computer-aided approaches enable us to provide precise measurement of synovium, bone and other structures.

## Imaging methods to evaluate progression of Rheumatoid Arthritis:

The American College of Rheumatology has standardized the criteria by which arthritis medications are assessed for efficacy. Indicated by ACR 20, ACR 50 and ACR 70, the criteria measures the improvement in tender or swollen joints in addition to improvements in other assessments.

The following imaging biomarkers enable the correlation between clinical signs and symptoms regarding improvements in ACR 20/50/70 and improvements in disease activity scores (DAS) critical in making early development decisions.

## X-Ray

- Sharp Scores – Erosions and Joint Space Narrowing (JSN) in each hand and wrist
- Sharp/van der Heijde scores – Erosions and JSN in each hand, wrist and foot
- Simple Erosion Narrowing Score (SENS) – Simplified version of Sharp/van der Heijde scores

## Ultrasound

- Semi-quantitative measurement of synovial vascularity and synovial hypertrophy
- Quantitative measurement of synovial thickness

## MRI

- OMERACT's Rheumatoid Arthritis MRI Scoring System (RAMRIS) scores the following in the hand and wrist:
  - Bony erosions
  - Bone marrow edema
  - Synovitis
- Quantitative imaging can provide the following measurements:
  - Total volume of enhancing tissue
  - Volume of enhancing synovium
  - Bone marrow edema (total volume, total volume per bone and count per bone)
  - Bone erosions (total volume, total counts, total volume per bone and count per bone)
- Dynamic Contrast-Enhanced MRI (DCE-MRI) images of the wrist or metacarpophalangeal (MCP) joints can be obtained and the following measurements provided for both enhancing tissue and enhancing synovium:
  - Volume transfer constant (Ktrans)
  - Initial area under the curve (IAUC)
  - Blood-normalized IAUC – reduces variability due to injection
  - Rate of early enhancement/relative early enhancement rate
  - Maximum enhancement
  - Late or static enhancement

## Reliable Compliant Systems

Regardless of the assessments performed, VirtualScopics utilizes a **21 CFR Part 11 compliant** system to analyze images. For the biomarker measurements, algorithm-based technology is used to assist the analyst in determining the regions of interest. This leads to improved reproducibility, which is crucial when assessing the impact a sponsor's biologic or device is having upon the treatment of a patient.

At VirtualScopics, we have worked on over 40 DCE-MRI studies encompassing over 1000 patients. We have demonstrated less than 10% variability across sites in a 26-center clinical trial. And, while we employ expert readers in-house, we also maintain the flexibility to work with experts of your choosing.

With extensive imaging knowledge and experience with rheumatoid arthritis and other musculoskeletal studies, our ability to minimize data variability across multi-center trials, our global reach and a strong, proactive project management team, VirtualScopics provides the most comprehensive imaging solution for your studies.



## *Additional VirtualScopics Imaging Services to support your rheumatoid arthritis studies:*

### Pre-Study Services

- Modality selection - MRI, X-Ray, Ultrasound
- Standardization across global imaging sites
- Clinical protocol design support, including image-based biomarker and image modality selection
- Independent review charter development (Imaging charter)
- Special protocol assessment (SPA) development
- Statistical analysis plan development support
- Imaging site qualification, initiation and training
- Method, proof-of-concept and pilot studies
- Support at regulatory meetings

### Study Services

- Ongoing image site management
- Image data quality control and inspection
- Regulatory-compliant image data management processes
- State-of-the-art image analysis techniques
- Traditional image-based biomarkers
- Novel quantitative biomarkers
- Image data results delivered to your specifications
- Medical and scientific reports

### Post-Study Services

- Secure image data management and archiving
- Statistical analysis and mining of image data
- 3D & 4D visualization of results
- Image data regulatory submissions

**For more information on how we can accelerate your clinical trials with our industry-leading technology, Call us at +1 585.249.6231. Or visit [www.virtualscopics.com](http://www.virtualscopics.com).**