

Pragmatic use of US in osteoarthritis

Plovdiv, 13. January 2018

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Basel**

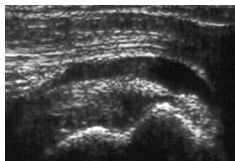
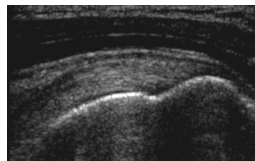
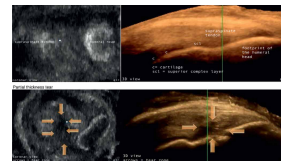
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1980

2000

2017



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Tamborrini G et al, Inter-rater reliability ...using 3D ultrasound. J Ultrason. 2016 Sep;16(66):252-9

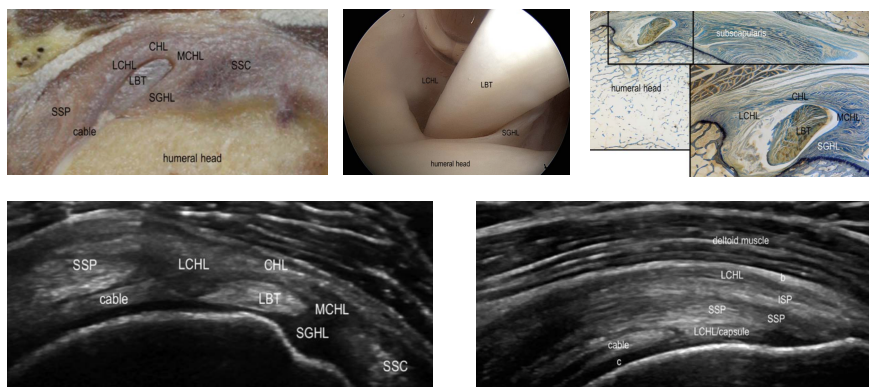
US or MRI/CT etc.? – advantages of MSUS

- higher resolution
- no radiation
- patients with claustrophobia
- no problem with metal implants

- combination of diagnostics and therapy (injection)
- real time sonopalpation
- dynamic and multiplanar scanning - tomography
- visualisation of inflammation and vessels

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Tamborini G et al, Ultrasound of the Shoulder. 2017. ISBN 978-3-7322-9490-9

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SONOHISTOLOGY

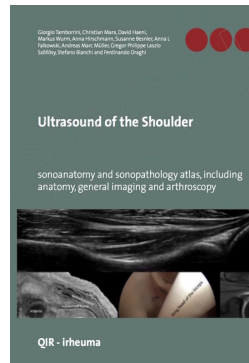
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requirements for hrMSUS

- > knowledge of anatomy + pathology
- > knowledge of disease processes
- > know limitations
- > know other techniques



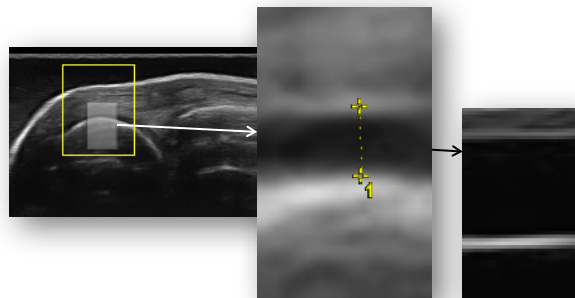
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Tamborini G et al, Muskuloskelettaler Ultraschall 2017 ISBN 978-3-7431-6381-2

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articular cartilage

- > anechoic band
- > homogeneous
- > sharp
- > regular
- > continuous margins



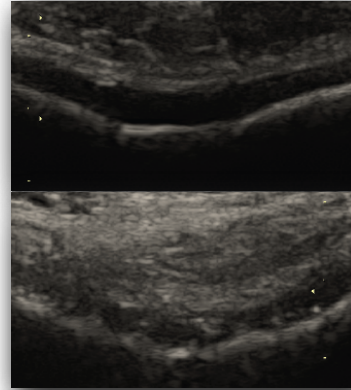
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Grassi W et al, Ultrasonography in osteoarthritis, Semin Arthritis Rheum, 2005;34(6 Suppl. 2):19-23

Pelletier J.P., Wildi L, Tamborini G Biomarkers in Osteoarthritis. 103-125; ISBN 978-81-308-0459-0

articular cartilage

- > loss of sharpness
- > loss of homogeneity
- > loss of anechogenicity
- > irregularities of the margins
chondrosynovial and osteochondral interface
- > focal or diffuse thinning



15.01.18 Iagnocco A. Imaging the joint in osteoarthritis: a place for ultrasound? Best Pract Res Clin Rheumatol 2010;24:2738
 Mc Cune WJ et al, Sonographic evaluation of osteoarthritic femoral condylar cartilage. Clin Orthop Relat Res, 1990;254:230–5.
 Iagnocco A et al, Sonographic evaluation of femoral condylar cartilage in osteoarthritis and ra, Scand J Rheumatol, 1992;21:201–3

agreement

moderate to substantial

- > femoral cartilage thickness
- > ultrasound vs radiographs for
osteophyte presence

substantial to excellent

- > osteophytes
- > measurement of effusion size

Table 1 (Inter-rater reliability: results of comparison between two ultrasound observers)

	Kappa (95% CI)	ICC (95% CI)
Osteophyte (right femur)	0.77 (0.31,1.23)	
Osteophyte (left femur)	0.65 (0.41,1.35)	
Osteophyte (right tibia)	0.88 (0.18,1.12)	
Osteophyte (left tibia)	0.88 (0.41,1.35)	
Effusion size (right)		0.70 (0.45,0.95)
Effusion size (left)		0.85 (0.72,0.98)
Effusion presence (right)	0.65 (0.21, 1.1)	
Effusion presence (left)	0.77 (0.31, 1.23)	
Notch thickness (right)		0.68 (0.43,0.94)
Notch thickness (left)		0.62 (0.32,0.92)
Lateral femoral cartilage thickness (right)		0.06 (0.00,0.54) *
Lateral femoral cartilage thickness (left)		0.50 (0.14,0.86)
Medial femoral cartilage thickness (right)		0.57 (0.25,0.90)
Medial femoral cartilage thickness (left)		0.42 (0.02,0.82)

Abraham et al. BMC Musculoskeletal Disorders 2011, 12:70

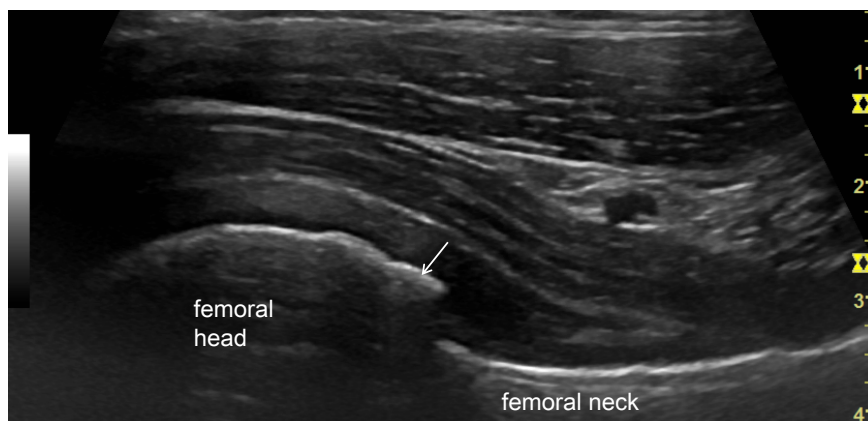
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bone

- > osteophytes
- > central erosions
- > ankylosis
- > hypertrophy of subchondral bone

15.01.18 Keen HI et al, Can uls improve on rx assessment in oa of the hands? ...pathology, Ann Rheum Dis, 2008;67:1116–20
 Vlychou M et al, Ultrasonographic evidence of inflammation is frequent in Osteoarthritis Cartilage, 2009;17:1283–7
 Naredo E et al, Ultrasound validity in the measurement of knee cartilage thickness. Ann Rheum Dis 2009;68



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bone

- hrMSUS can reliably assess osteophytes
- good agreement in osteophytes detection vs MRI
- more sensitive than CR and clinical examination

15.01.18 Wittoek R et al, Structural and inflammatory us findings in erosive ..., Ann Rheum Dis, 2010;69:2173–6
 Wittoek R et al, Reliability and construct validity of ultrasonography of soft tissue and... Ann Rheum Dis, 2011;70:278–83.
 Mathiessen A et al, Ultrasonographic assessment of osteophytes in 127 patients with ... Ann Rheum Dis. 2013 Jan;72(1):51-6

synovial tissue

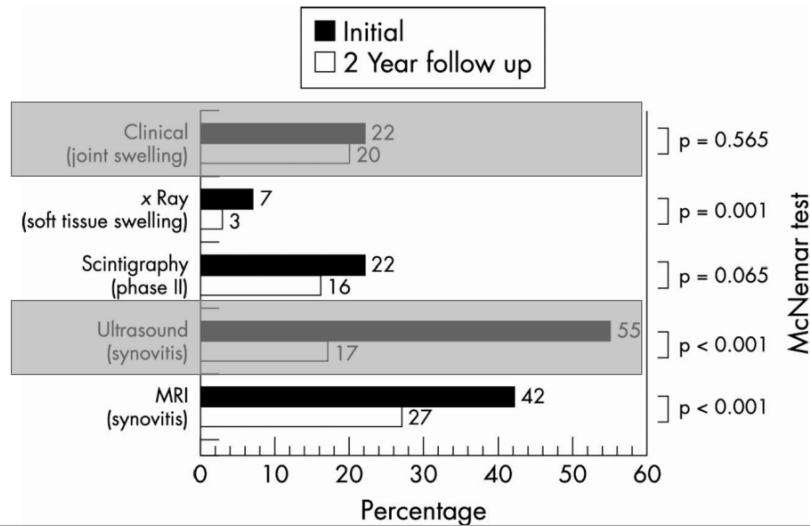
sensitivity in detecting synovitis better than clinical examination and equivalent to MRI (knee)

study of 600 knee OA patients > 44% effusion
 > 17% with synovial thickening

D'Agostino MA et al, EULAR report on the use of ultrasonography in painful knee osteoarthritis. Part 1: prevalence of inflammation in osteoarthritis. Ann Rheum Dis 2005;64:1703–9

15.01.18 Epis O et al, Synovial tissue inflammation in early and late osteoarthritis, Ann Rheum Dis, 2005;64:1263–7
 Karim Z et al, Validation and reproducibility of ultrasonography in the detection of synovitis ...: Arthritis Rheum, 2004;50:387–94
 Kane D et al, UIS is superior to clinical examination in the detection and localization ..., J Rheumatol, 2003;30:966–71

Detection of soft tissue lesions (%) by the different modalities in group I (n=392 finger joints = 100%).



Backhaus M et al. Ann Rheum Dis 2002;61:895-904

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synovial tissue

- > PD validated e.g. knee and hip
- > correlation of synovitis with pain severity in patients with knee OA
- synovitis as predictor of structural damage and joint replacement

Conaghan PG et al, Clinical and ultrasonographic predictors of joint replacement for knee osteoarthritis: results from a large, 3 year, prospective EULAR study. Ann rheum dis 2009.

Walther M et al, Correlation of pwr us with vascularity of the synovial tissue of the knee joint in ..., Arthritis Rheum, 2001;44:331-8

Walther M et al, Synovial tissue of the hip at power Doppler US: correlation between vascularity ..., Radiology, 2002;225:225-31

Naredo E et al, Ultrasonographic findings in knee oa: a comparative study with clinical ..., Osteoarthritis Cartilage, 2005;13(7):568-74

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hrMSUS assessment of other structures involved in OA

- menisci
- bursa
- tendons, ligaments
- joint capsule

15.01.18 Naredo E et al, Ultrasonographic findings in knee oa: a comparative study with clinical and Osteoarthritis Cartilage 2005;13:568-74
De Miguel E et al, Clinical and ultrasonographic findings related to knee pain in osteoarthritis. Osteoarthritis Cartilage 2006;14:540-4
Uson J, et al. Pes anserinus tendino-bursitis: what are we talking about? Scand J Rheumatol 2000;29:184-6

Summary diagnostic hrMSUS in OA

assessment of inflammatory signs

measurements of articular cartilage thickness and osteophytes

15.01.18 Moller I et al., Ultrasound in the study and monitoring of osteoarthritis, Osteoarthritis Cartilage, 2008;16(Suppl. 3):4-7
Mancarella L, et al., Ultrasound detected synovitis with power Doppler signal is associated with severe radiographic damage and reduced cartilage thickness in hand osteoarthritis, Osteoarthritis Cartilage, 2010;18(10):1263-8

interventional hrMSUS in OA

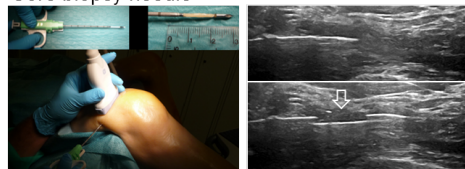
atraumatic joint aspiration

therapeutic injection

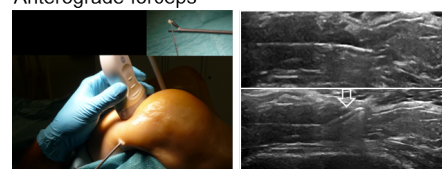


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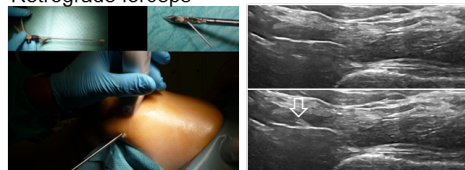
Core biopsy needle



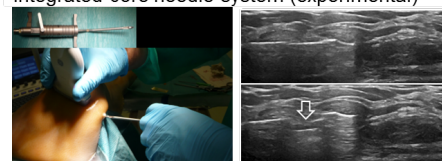
Anterograde forceps



Retrograde forceps



Integrated core needle system (experimental)

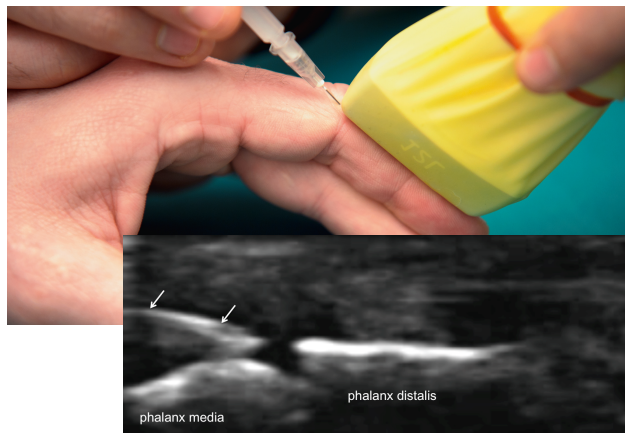


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Musculoskeletal ultrasound – irheuma - QIR



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Tamborini G et al, Infiltrationen peripherer Gelenke 2017 ISBN 9783741267086

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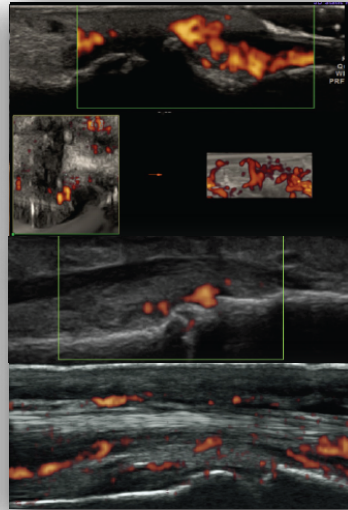
limitations of hrMSUS in OA

- limited acoustic windows
- difficult detection of inflammation activity in large/deep joint
- limited view of many internal joint structures
- no visualisation of bone marrow changes
- operator dependent imaging technique

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	Osteoarthritis	Rheumatoid Arthritis
Bone	Osteophytes Erosions and mucoid cysts especially in erosive finger/hand osteoarthritis	Erosions Secondary osteoarthritic signs, e.g. osteophytes
Cartilage	Loss of sharpness Loss of homogeneity Loss of anechogenicity Irregularities of the anterior and posterior margins Focal or diffuse thinning of the cartilage	Loss of sharpness Loss of homogeneity Loss of anechogenicity Focal or diffuse thinning of the cartilage
Joint/bursa/tendon	Joint effusion Synovial hypertrophy and hyperemia Joint capsule thickening Bursitis Meniscal tears, meniscal extrusion	Joint effusion Synovial hypertrophy and hyperemia invading the bone erosions Joint capsule thickening Bursitis, tenosynovitis, rheumatoid nodules, tendon tears, secondary nerve entrapment



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conclusions I

hrMSUS

- ✓ validated tool for overall joint assessment in OA
- ✓ cartilage damage
- ✓ bone changes
- ✓ joint inflammation
- ✓ adjacent soft tissue lesions

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conclusions II

hrMSUS

- ✓ multiplanar image acquisition
- ✓ ultrasound tomography
- ✓ 3D/4D
- ✓ view dynamic structures in real-time
- ✓ ultrasound guided interventions

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