Supplementary online material – Summary Tables

MAKING A DIAGNOSIS OF OSTEOARTHRITIS – KNEE

Q2: What is the accuracy of different imaging modalities for detecting OA features (soft tissues and bone involvement)?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome				
Akgul O 2014 [1]	110	Cross-sectional	US	Physical examination		**Se**	**Sp**	**LR+**	**LR-**
					Popliteal cyst	0.66	0.98	42.22	0.34
Esen S 2013 [2]	100	Cross-sectional	US	Physical examination		**Se**	**Sp**	**LR+**	**LR-**
					Effusion	0.76	0.51	1.63	0.42
					Pes anserinus bursitis	0.50	0.95	12.25	0.52
					Popliteal cyst	0.36	0.88	3.27	0.72
Ike RW 2010 [3]	14	Cross-sectional	US	Physical examination, synovial fluid aspiration		Physical examination		SF aspiration	
						Se	**Sp**	**Se**	**Sp**
					Effusion	1	0	1	0
Pendleton A 2008 [4]	86	Cross-sectional	US	Physical examination		**Se**	**Sp**	**LR+**	**LR-**
					Synovitis	0.73	0.15	0.87	1.74
					Effusion	0.67	0.50	1.34	0.66
Chatzopoulos D 2008 [5]	196	Cross-sectional	US	Radioisotope scan		**Se**	**Sp**	**LR+**	**LR-**
					Popliteal cyst	0.28	0.90	2.89	0.79
Lee LC 2008 [6]	95	Cross-sectional	US	Surgery	US cartilage grading correlated to histologic grading over anterior and middle areas (r=0.40 and 0.36, p<0.001)				
Yoon CH 2008 [7]	51	Cross-sectional	US	CR MRI	**US vs CR (cartilage)**	Minimal thickness medial condyle			r=0.417
						Maximal thickness medial condyle			r=0.412
					US vs MRI (cartilage)	Minimal thickness medial condyle			r=0.568
						Maximal thickness medial condyle			r=0.844
Song IH 2008 [8]	41	Cross-sectional	US	MRI	**Effusion superior recess (Se)**				0.72
					Effusion lateral recess (Se)				0.81

Se: sensitivity; Sp: specificity; LR+: positive likelihood ratio; LR-: negative likelihood ratio; CR: conventional radiography; MRI: magnetic resonance imaging; US: ultrasonograhy; sd: standard deviation; r: correlation coefficient

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome				
Bhattacharya R 2007 [9]	77	Cross-sectional	CR	Surgery		**Se**	**Sp**	**LR+**	**LR-**
					Skyline (PFJ)	0.81	0.60	2.08	0.30
					Lateral (PFJ)	0.83	0.39	0.37	0.43
Chang CB 2008 [10]	151	Cross-sectional	CR	Surgery	**JSN/cartilage**	Se 0.83		Sp 0.50	
Dervin G 2001 [11]	152	Cross-sectional	CR	Surgery		**AP full-extension**		**45°flexion**	
						Se	**Sp**	**Se**	**Sp**
					JSN/cartilage	0.73	0.99	0.78	0.96
Waldstein W 2013 [12]	84	Cross-sectional	CR	Surgery	poor correlation lateral JSW/Outerbridge grades: r= -0.154; p = 0.146 significant correlation Outerbridge grades/ lateral KLG: r= 0.553; p=0.001				
Cicuttini F 2003 [13]	252	Cross-sectional	CR	MRI	Significant correlation medial and lateral cartilage volume/ JSN TFJ (p<0.001); no significant correlation with lateral TFJ JSN , p=0.059				

Se: sensitivity; Sp: specificity; LR+: positive likelihood ratio; LR-: negative likelihood ratio; CR: conventional radiography; MRI: magnetic resonance imaging; r: correlation coefficient; PFJ: patellofemoral joint; JSN: joint space narrowing; JSW: joint space width

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome						
Boegard T 1999 [14]	58	Cross-sectional	MRI	Radioisotope scan	**k**	MT	MF	LT	LF	patella	Femoral trochlea
					Subchondral lesions	0.72	0.79	0.59	0.64	0.49	0.64
					Osteophytes	0.20	0.30	0.14	0.31	0.03	0.10
					Cartilage defects	0.54	0.26	0.42	0.15	0.06	0.18
Crema MD 2013 [15]	20	Cross-sectional	MRI (3D)	MRI (2D)		**Se**		**Sp**			
					Bone attrition	0.84		0.99			
					Cartilage morphology	0.96		0.98			
					BMLs	0.84		0.97			
					Effusion	0.88		1			
					Meniscal tear	0.96		0.97			
					Meniscal extrusion	1.0		0.95			
					Osteophytes	0.86		0.85			
					Subchondral cysts	0.80		0.98			
					Popliteal cysts	0.99		0.99			
Gudbergsen H 2013 [16]	192	Cross-sectional	MRI	CR	KLG correlated to cartilage damage, BMLs , meniscal pathology (r=0.15-0.76) BLOKS assessed knee joint pathology cosegregated with compartment and grade specific KLG (P < 0.0001)						
De Lange Borkaar 2014 [17]	42	Cross-sectional	MRI	Surgery	Synovitis grade r=0.57 p<0.001						
Fernandez Madrid F 1995 [18]	9	Cross-sectional	MRI	Surgery	Synovitis: Se 1.0						
Bergman A 1994 [19]	9	Cross-sectional	MRI	Surgery	The location and extent of the subchondral signal abnormalities on MR corresponded to the focal areas of fibrous tissue replacement of fatty marrow						
Broderick L 1994 [20]	28	Cross-sectional	MRI	Surgery		**Se**	**Sp**	**LR+**	**LR-**		
					Cartilage score	0.76	0.98	49.65	0.24		

CR: conventional radiography; MRI: magnetic resonance imaging; r: correlation coefficient; MT: medial tibia; MF: medial femur; LT: lateral tibia; LF: lateral femur; k: kappa statistics; Se: sensitivity; Sp: specificity; LR+: positive likelihood ratio; LR-: negative likelihood ratio; KLG: Kellgren and Lawrence grade; BMLs: bone marrow lesions

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome		
Kalunian K 2000 [21]	8	Cross-sectional	MRI	Surgery	Meniscal tears: Se 0.33, Sp 0.96		
Loeuille D 2011 [22]	30	Cross-sectional	MRI	Surgery, physical examination (SF aspiration)	No significant correlation between SF volume and histologic edema and congestion with MRI synovitis score		
Saadat E 2008 [23]	8	Cross-sectional	MRI	Surgery		**Se**	**Sp**
					Cartilage lesions	0.72	0.69
Takayama Y 2013 [24]	16	Cross-sectional	MRI	Surgery	AUC= 0.881 (T1p) AUC=0.681 (T2)		
Von Engelhardt L 2010 [25]	32	Cross-sectional	MRI	Surgery	**Grading of cartilage lesions**	**Se**	**Sp**
					1	0.20	0.95
					2	0.52	0.78
					3	0.36	0.89
					4	0.70	0.94
Wong CS 2013 [26]	28	Cohort	MRI	Surgery	T2 inversely correlated with GAG concentration (r2 = 0.375, p = 0.001) T1p values inversely correlated with GAG concentration (r2 = 0.200, p = 0.025)		
Yoshioka H 2004 [27]	16	Cross-sectional	MRI	Surgery		**Se**	**Sp**
					Cartilage lesions	1.0	0.676
Zanetti M 2000 [28]	16	Cross-sectional	MRI	Surgery	Significant differences between the zone with the edema pattern (zone 1) and the control zone (zone 6) for bone marrow fibrosis (P = 0.014), bone marrow necrosis (p = 0.021), and trabecular abnormalities (p = 0.011), not for bone marrow edema (p=0.069), cysts (p=0.343), bone marrow bleeding (p=0 .696).		
Graichen H 2004 [29]	21	Cross-sectional	MRI	Surgery	**Cartilage Volume**	r=0.98	
					Cartilage thickness	r=0.92	

Se: sensitivity; Sp: specificity; SF: synovial fluid; AUC: area under the curve; T1p: T1 relaxation time; T2: T2 relaxation time; MRI: magnetic resonance imaging

MANAGEMENT OF OSTEOARTHRITIS – KNEE

Q4: In people with OA do imaging have an impact on management?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome	
Brealey SD 2007[30]	553	RCT	MRI	-	**Change in management**	**Change in therapeutic confidence**
					Treatment altered: MRI 261/279 Orthopedic referral 258/266; Treatment not altered MRI 18/279 , Orthopedic referral 8/266. p=0.059	Increased: MRI 163/259, orthopedic 119/241 No change: MRI 87/259, orthopedic 100/241 Decreased: MRI 9/259, orthopedic 22/241 p = 0.002
Ritchie JF 2014[31]	50	Cross-sectional	CR	-	change in management: 166/400 opinions	
MRI: magnetic resonance imaging; CR: conventional radiography						

PROGNOSIS OF OA-KNEE

Q5: What is the prognostic (prediction of outcome) value of imaging in OA?

Cross-sectional studies, CR: symptoms

Reference	No of subjects	Study design	Imaging modality	Outcome					
Barker K 2004 [32]	123	Cross-sectional	CR	KLG/WOMAC	Mean (sd) WOMAC pain KL2 62.5 (22.2) vs KL3 48.3 (19.3)vs KL4 47.2 (16.5)				
Cubukcu D 2012 [33]	114	Cross-sectional	CR	KLG/WOMAC	Correlation coefficient: WOMAC pain −0.046 p>0.05; WOMAC stiffness −0.119 p>0.05				
Bevers K 2014 [34]	180	Cross-sectional	CR	KLG/pain	No associations between KLG and pain scores				
Neogi T 2010 [35]	2940	Cross-sectional	CR	KLG/inconsistent pain vs consistent pain		**OR (95% CI)**			
					KLG 0	1			
					KLG 1	1.01 (0.80-1.27)			
					KLG 2	0.78 (0.61-0.99)			
					KLG 3	0.51 (0.41,0.63)			
					KLG 4	0.27 (0.18,0.36)			
Sanghi D 2011 [36]	180	Cross-sectional	CR	KLG/VAS pain and WOMAC		**VAS pain**	**WOMAC pain**	**WOMAC stiffness**	**WOMAC function**
					KLG 2	5.86 (1.25)	9.86 (1.91)	2.14 (1.35)	21.36 (5.03)
					KLG 3	6.27 (0.81)	10.32 (2.04)	2.28 (1.25)	23.50 (5.73)
					KLG 4	6.31 (1.05)	10.98 (1.71)	2.56 (1.42)	24.82 (5.74)
					p	0.15	0.03	0.32	0.05
Madsen OR 1995 [37]	20	Cross-sectional	CR	KLG/ pain and function	**Pain disability score**		r = 0.50, p < 0.05		
					Muscle strength , walking and stair climbing		No significant correlation		

CR: conventional radiography; KL/KLG: Kellgren and Lawrence grade; WOMAC: Western Ontario and MacMaster Univerisities Osteoarthritis Index; R: correlation coefficient; VAS: visual analogue scale; OR (95% CI): odds ratio and 95% confidence interval.

Reference	Study design	No of subjects	Imaging modality	Outcome				
Cicuttini F 1996 [38]	Cross-sectional	250	CR	JSN/osteophytes and pain			**OR (95%CI)**	
					AP view	**JSN**	2.13 (0.78,5.87)	
						osteophytes	5.00 (2.40,10.43)	
					Lateral view	**JSN**	1.54 (0.57,4.14)	
						osteophytes	2.87 (1.41,5.82)	
					Skyline view	**JSN**	1.42 (0.53,3.82)	
						osteophytes	7.56 (3.85,14.81)	
Hernandez Vaquero D 2012 [39]	Cross-sectional	1329	CR	Ahlback grade/Hospital for Special Surgery Knee-Rating Score	Mean (sd)	I 56.91 (10.75); II 55.64 (12.01) III 51.86 (12.96); IV 49.44 (12.69) V 47.35 (12.59) p<0.001		
Lim W 2008 [40]	Cross-sectional	107	CR	Varus alignment/ WOMAC pain	**WOMAC pain mean, sd (no significant differences)**	Least varus	Moderate varus	Most varus
						34.9 ± 16.3	35.7 ± 14.6	36.5 ± 14.6
Illingworth K 2014 [41]	Cross-sectional		CR MRI	JSW/KOOS and WOMAC		**Medial TF (r, p)**	**Lateral TF (r, p)**	
					KOOS pain	0.03 p>0.05	0.06 p>0.05	
					KOOS symptoms	0.16 p<0.05	0.15 p<0.05	
					WOMAC pain	0.08 p>0.05	0.05 p>0.05	
					WOMAC stiffness	0.10 p>0.05	0.09 p>0.05	
Knoop J 2012 [42]	Cross-sectional	105	CR MRI	CR and MRI/bony tenderness		**MTF (OR, p)**	**LTF (OR, p)**	**PF (OR, p)**
					JSW	0.90 (0.82)	0.96 (0.95)	1.80 (00.27)
					CR osteophytes	0.77 (0.59)	0.85 (0.81)	1.34 (0.58)
					Cartilage integrity	0.77 (0.59)	0.85 (0.81)	1.34 (0.58)
					MRI osteophytes	0.92 (0.32)	1.06 (0.60)	1.09 (0.20)
					BMLs	0.97 (0.76)	0.91 (0.53)	0.84 (0.21)
					Effusion	0.75 (0.52)		
					Synovitis	0.84 (0.70)		
Link TM 2003 [43]	Cross-sectional	50	CR MRI	CR and MRI/WOMAC	**Cartilage lesions**	Significantly higher WOMAC pain and function		
					Central osteophytes	Significantly higher WOMAC stiffness		
					BMLs, effusion, popliteal cysts, subchondral cysts, meniscal and ligamentous lesions	No significant differences in WOMAC subscales		

CR: conventional radiography; MRI: magnetic resonance imaging; AP: anteroposterior; JSN: joint space narrowing; sd: standard deviation; WOMAC: Western Ontario and MacMaster Univerisities Osteoarthritis Index; TF: tibiofemoral; KOOS: Knee injury and Osteoarthritis Outcome Score; JSW: joint space width; BMLs: bone marrow lesions

Cross-sectional studies, CR: structure

Reference	No of subjects	Study design	Imaging modality	Outcome				
Hernigou P 2002 [44]	40	Cross-sectional	CR CT	Intercondylar notch width/ACL damage		Normal ACL	Damaged ACL	No ACL
					CT notch width (mean, sd)	19.6 (1.7)	14.2 (2.5)	10.4 (2.5)
					CR notch width (mean, sd)	18.7 (2.3)	14.8 (2.9)	10.5 (2.7)
Janakiramanan N 2008 [45]	202	Cross-sectional	CR	Alignment/MRI cartilage lesions	**OR (95%CI) of medial cartilage defects for valgus degree**		0.90 (0.82, 0.98)	
Issa S 2007 [46]	146	Cross-sectional	CR	Alignment/MRI cartilage lesions	Medial lesions were associated with greater varus malalignment, lateral lesions with valgus malalignment			
Khan FA 2008 [47]	306	Cross-sectional	CR	Alignment/compartmental OA	**Medial OA: varus angle per degree**		1.39 (1.29,1.49)	
					Lateral OA: valgus angle per degree		1.55 (1.36,1.75)	
Wang L 2013 [48]	26	Cross-sectional	CR	Alignment/MRI T1p		Varus	Neutral	Valgus	p
					LF (mean, sd)	64±14	58±10	53±2	0.0016, 0.047
					MF (mean. Sd)	69±9	-	59±10	0.048
					MT (mean, sd)	-	49±11	43±6	0.014
Friedrich K 2010 [49]	24	Cross-sectional	CR	Alignment/T2	T2 values of patients with varus alignment were higher than those of patients with valgus alignment p<0.0001			
Teichtahl A 2006 [50]	121	Cross-sectional	CR	Alignment/JSN and osteophytes	**OR (95%CI) for degree of valgus**		JSN	Osteophytes
					Medial		0.77 (0.70, 0.85)	0.90 (0.83, 0.97)
					Lateral		1.62 (1.31, 2.01)	1.13 (1.05, 1.22)
von Eisenhart Rothe 2006 [51]	26	Cross-sectional	CR	Alignemt/MRI cartilage thickness	Medial thickness score		r=-0.54; p=0.01	
					Lateral cartilage thickness		r=0.66; p=0.001	
Boissonneault A 2014 [52]	664	Cross-sectional	CR	CR OA/alignment	Lateral compartment knee OA (no OA as reference): more valgus OR 1.03 (1.00, 1.07) Medial compartment knee OA (no OA as reference: more varus OR 0.97 (0.94, 1.00)			

CR: conventional radiography; MRI: magnetic resonance imaging; CT: computer tomography; ACL: anterior cruciate ligament; sd: standard deviation; OR (95% CI): odds ratio with and 95% confidence interval; T1p: T1 relaxation time; T2: T2 relaxation time; JSN: joint space narrowing.

Reference	No of subjects	Study design	Imaging modality	Outcome				
Ozgul G 2013 [53]	50	Cross-sectional	CR	PF angle and sulcus angle/KLG		KLG 1	KLG 2-4	p
					PF angle (mean sd)	23.0±4.5	19.6±6.2	0.005
					Sulcus angle (mean sd)	128.4±6.9	130.0±7.6	0.29
van der Esch M 2014 [54]	298	Cross-sectional	CR	Association between compartments and within compartments of JSN, osteophytes, sclerosis, cysts	Association among features within the joint and association among features within each compartment			
Cotofana S 2012 [55]	61	Cross-sectional	CR	Osteophytes/MRI cartilage thickness	Significantly lower cartilage thickness in different compartment in knees with osteophytes			
Ferraro B 2010 [56]	483	Case-control	CR	2D:4D type 3 finger pattern/knee OA	OR (95% CI) 2.59 (1.54,4.37)			

CR: conventional radiography; MRI: magnetic resonance imaging; sd: standard deviation; OR (95% CI): odds ratio with and 95% confidence interval; KLG: Kellgren and Lawrence grade; 2D:4D : 2^{nd} finger/4^{th} finger ratio

Cross-sectional studies, CR: function

Reference	No of subjects	Study Design	Imaging modality	Outcome				
Holla JF 2011 [57]	497	Cross-sectional	CR	CR/range of motion		**TF medial (p)**	**TF lateral (p)**	**PF (p)**
					JSN	0.001	0.83	0.96
					Osteophytes	0.0001	0.01	0.0001
					Subchondral sclerosis	0.02		
					Tibial tubercles spiking	0.07		
McDaniel C 2011 [58]	138	Cross-sectional	CR	CR/gait velocity and standing balance		Gait velocity	Standing balance	
					JSN	r=-0.19	r=-0.04	
					Osteophytes	r=-0.16	r=-0.01	
					KLG	r=-0.12	r=-0.02	

CR: conventional radiography; TF: tibiofemoral; PF: patellofermoral; JSN: joint space narrowing; KLG: Kellgren and Laerence grade; r: correlation coefficient

Cross-sectional studies, MRI: symptoms

Reference	No of subjects	Study design	Imaging modality	Outcome			
Ai F 2010 [59]	28	Cross-sectional	MRI	MRI/severe pain		**OR (95%CI)**	
					Cartilage defects	0.63 (0.34,1.82)	
					Medial meniscal lesion	1.43 (0.28,7.21)	
					Lateral meniscal lesion	0.87 (0.24,3.12)	
					BML	0.38 (0.15,2.98)	
					Effusion	0.043 (0.00235,0.83)	
De Lange Brokaar 2014[17]	42	Cross-sectional	MRI	MRI synovitis/pain	Spearman's correlation 0.32 p=0.041		
Ballegaard C 2014 [60]	95	Cross-sectional	MRI DCE	MRI/KOOS pain		**KOOS pain**	
					Perfusion	r= -0.42 (p<0.0001)	
					Hoffa synovitis	r= -0.21 (p=0.046)	
					Slope	r= -0.33 (p<0.0001)	
Lo GH 2009 [61]	160	Cross-sectional	MRI	MRI/pain		Weightbearing pain (OR 95%CI)	Non weightbearing pain (OR 95%CI)
					Effusion	4.30 (1.71,10.83)	1.72 (0.60,4.89)
					Synovitis	3.04 (0.57,16.17)	0.94 (0.17,5.06)
					BMLs	3.20 (0.96,10.68)	1.47 (0.37,5.39)
Kornaat P 2006 [62]	71	Cross-sectional	MRI	MRI/pain and stiffness	OR (95%CI)	**Pain**	**Stiffness**
					Cartilage defects	1.12 (0.40, 3.14)	1.35 (0.48, 3.82)
					Osteophytes	1.05 (0.38, 2.91)	1.44 (0.52, 4.04)
					Subchondral cysts	1.71 (0.81, 3.63)	1.25 (0.60, 2.59)
					Meniscal tear	1.26 (0.58, 2.74)	0.64 (0.30, 1.39)
					Meniscal subluxation	1.03 (0.48, 2.21)	1.63 (0.76, 3.46)
					Effusion	9.99 (1.13, 149)	4.67 (1.11, 26.14)
					Popliteal cyst	1.68 (0.80, 3.53)	1.32 (0.64, 2.73)
					BMLs	1.36 (0.65, 2.84)	1.57 (0.76, 3.25)

MRI: magnetic resonance imaging; OR (95% CI): odds ratio with and 95% confidence interval; BML: bone marrow lesions; KOOS: Knee injury and Osteoarthritis Outcome Score; r: correlation coefficient

Reference	No of subjects	Study design	Imaging modality	Outcome				
Torres L 2006 [63]	143	Cross-sectional	MRI	MRI/VAS pain	**increase in median knee pain severity (VAS pain) for 1-unit increase in lesion score**			
					Bone attrition	1.91		
					Bone cysts	0.82		
					Osteophytes	0.50		
					Cartilage	0.53		
					Meniscal tears	1.99		
					Meniscal extrusion (1 vs 0)	-2.96		
					Meniscal extrusion (2 vs 0)	2.22		
					Synovitis/effusion (1 vs 0)	1.93		
					Synovitis/effusion (2-3 vs 0)	9.82		
Lange AK 2007 [64]	41	Cross-sectional	MRI	Meniscal tears/WOMAC and function	Mean (sd)	**Tear**	**No tear**	**p**
					WOMAC pain	6.5 (3.2)	5.3 (2.6)	0.26
					WOMAC stiffness	3.8 (1.5)	3.6 (1.6)	0.71
					WOMAC function	23.9 (10.6)	21.1 (11.7)	0.47
					Habitual physical activity level	136 (56)	134.4 (60.5)	0.93
					6 minute walk	504.2 (79)	560.9 (65.6)	0.04
					Gait velocity	1.08 (0.16)	1.10 (0.21)	0.77
					Balance	95.6 (18.8)	81.5 (19.1)	0.04
Bhattacharrya R 2003 [65]	154	Cross-sectional	MRI	meniscal tears/WOMAC and VAS pain		**Tear**	**No tear**	**p**
					WOMAC (mean, sd)	29 (4.1)	29 (3.0)	0.91
					VAS pain (mean, sd)	31 (8.3)	34 (3.1)	0.67
Wenger A 2012 [66]	53	Cross-sectional	MRI	Area covered by the meniscus/pain	Mean, sd	**pain**	**No pain**	**p**
					Medial meniscus	41% (10)	44% (7)	0.01
					Lateral meniscus	-	-	>0.05
Seah S 2012 [67]	37	Cross-sectional	MRI	BMLs/pain at night	**BML grade 3 vs 1 (OR 95% CI)**	0.38 (0.07,2.01)		
					BML grade 3 vs 2	0.44 (0.08,2.58)		
Felson DT 2001 [68]	287	Cross-sectional	MRI	BMLs/pain		**OR (95%CI)**		
					BMLs	3.31 (1.54,7.41)		
					Large BMLs	(1.04, 111.11)		
MRI: magnetic resonance imaging; VAS: visual analogue scale; WOMAC: Western Ontario and MacMAster Univerisities Osteoarthritis Index; sd: standard deviation; BML: bone marrow lesions								

Reference	No of subjects	Study design	Imaging modality	Outcome	Reference		
Sower M 2003 [69]	113	Cross-sectional	MRI	BMLs and cartilage defects/pain		**OR (95% CI)**	
					BMLs	0.85 (0.365,1.98)	
					Cartilage defects	0.203 (0.023,1.80)	
Sengupta N 2006 [70]	217	Cross-sectional	MRI	Osteophyte BMLs/pain	OR (95% CI) 0.690 (0.245, 1.942)		
Wluka AE 2004 [71]	117	Cross-sectional	MRI	cartilage volume/WOMAC	**WOMAC pain**	r=-0.17 p=0.05	
					WOMAC stiffness	r=-0.16 p=0.08	
					WOMAC function	r=-0.20 p=0.03	
Hernandez Molina G 2008 [72]	1627	Cross-sectional	MRI	Bone attrition/pain	OR (95% CI)=1.2 (0.7, 2.0)		
Baker K 2010 [73]	454	Cross-sectional	MRI	synovitis/pain	OR (95% CI)=2.35 (1.57,3.50)		
Hill C 2001 [74]	458	Cross-sectional	MRI	Effusion and popliteal cysts/pain		**Pain (%)**	**No pain (%)**
					Small effusion	37.1	62.3
					Moderate effusion	36.0	13.2
					Large effusion	18.6	1.4
					Popliteal cysts	33.0	20.8
Hill C 2005 [75]	403	Case-control	MRI	ACL tear/VAS pain	VAS pain (mean, sd): complete ACL tear 44.3 mm, intact ACL 44.1 mm (p= 0.95)		
Lindsey CT 2004 [76]	53	Cross-sectional	MRI	Cartilage volume/WOMAC pain	medial tibia volume and WOMAC pain score: r= −0.31 (p=0.017)		
Cotofana S 2013 [77]	633	Cross-sectional	MRI	cartilage defects/pain		**OR (95%CI)**	
					Weightbearing pain	1.64 (1.20,2.19)	
					Non weightbearing pain	1.52 (1.02,2.28)	
					Infrequent pain vs no pain	1.85 (1.23,2.80)	
					Frequent pain vs no pain	2.62 (1.80,3.81)	
					Moderate/severe pain	1.80 (1.32,2.47)	

MRI: magnetic resonance imaging; OR (95%CI): odds ratio, 95% confidence interval ; WOMAC: Western Ontario and MacMAster Univerisities Osteoarthritis Index; sd: standard deviation; BML: bone marrow lesions; OR (95%CI): odds ratio, 95% confidence interval; ACL: anterior cruciate ligament

Cross-sectional studies, MRI: structure

Reference	No of subjects	Study design	Imaging modality	Outcome				
Gale DR 1999 [78]	291	Case-control	MRI	Meniscal subluxation/JSN	**Medial meniscus**	r=0.55 p=0.0001		
					Lateral meniscus	r=0.40 p=0.0001		
Friedrich K 2009 [79]	37	Cross-sectional	MRI	Meniscal pathology/T2	Mean (sd) T2 in patients with meniscal tears vs patients without meniscal tears: 50.1 (6.1) vs 45.7 (4.8) p=0.0021			
Hovis K 2011 [80]	304	Cross-sectional	MRI	ACL abnormalities/WORMS	Significantly higher total WORMS scores in abnormal ACL compared to normal ACL			
Jungmann P 2013 [81]	135	Case-control	MRI	Shallow trochlea/PF WORMS and T2		**Shallow trochlea**	**Deep trochlea**	**p**
					PF WORMS (mean,sd)	11.2 (0.5)	5.7 (0.6)	<0.001
					T2 (mean,sd)	40.9 (0.5)	42.7 (0.6)	0.037
Kalichman L 2007 [82]	2013	Cross-sectional	MRI	Lateral patellar tilt ratio and bisect offset/JSN and osteophytes	LPTA associated with lower degree of lateral and medial patellar JSN and lateral osteophyte. BO associated with higher degree of lateral and medial patellar JSN and lateral osteophytes.			
Kornaat P 2005 [83]	205	Cross-sectional	MRI	MRI cartilage defects /MRI cartilage defects				**OR (95%CI)**
					TF cartilage defects in case of PF cartilage defects			3.95 (2.12,7.37)
					PF cartilage defects in case of PF BME			13.6 (4.69,39.44)
					TF cartilage defects in case of TF BME			3.99 (1.48,10.77)
					PF cartilage defects and ipsilateral meniscal tears			3.7 (1.0,15)
					TF cartilage defects/ipsilateral meniscal tears			9.8 (2.5,38)
Krasnutotsky K 2011 [84]	58	Cross-sectional	MRI	Quantitative synovial volume/KLG JSN JSW	Significant correlation with KLG, JSN and JSW			
Lo GH 2009 [85]	160	Cross-sectional	MRI	Meniscal derangments/large BMLs	**OR (95%CI)**	**Medial compartment**	37.21 (2.22,621.64)	
						Lateral compartment	4.47 (1.61,12.37)	
Oda H 2008 [86]	161	Cross-sectional	MRI	Bone bruise/effusion	OR (95%CI)= 2.74 (1.31,5.72)			
Stein V 2010 [87]	160	Cross-sectional	MRI	Intecondylar notch/ACL tear	OR (95%CI)= 1.00 (0.058,17.01)			

MRI: magnetic resonance imaging; JSN: joint space narrowing; T2: T2 relaxation time; sd: standard deviation; PF: patellofemoral; WORMS: whole organ magnetic resonance imaging score; LPTA: Lateral patellar tilt ratio; TF: tiobiofemoral; BME: bone marrow edema;KLG: Kellgren and Lawrence grade; JSN: joint space narrowing; JSW: joint space width; BMLs: bone marrow lesions: OR (95%CI): odds ratio and 95% confidence interval

Cross-sectional studies, US: all outcomes

Reference	No of subjects	Study design	Imaging modality	Outcome				
Song IH 2008 [8]	41	Cross-sectional	US (CEUS)	Effusion, synovitis, PD, slope/VAS pain	**Slope**	r=0.386; p=0.018		
					Superior recess PD	r=0.366; p=0.020		
Naredo E 2005 [88]	50	Cross-sectional	US	Effusion, meniscal displacement and popliteal cyst/symptoms	**Effusion**	OR (95% CI)= 18.4 (1.04,323.52)		
					medial meniscal displacement	OR (95% CI)= 32.83 (1.86,577.99)		
					Popliteal cyst	OR (95% CI)= 6.10 (108.71)		
D'Agostino M 2005 [89]	600	Cross-sectional	US	effusion/sudden knee pain	OR (95% CI) = 1.39 (1.008,1.93)			
De Miguel Mendieta E 2006 [90]	121	Cross-sectional	US	Effusion and popliteal cyst/pain	**Suprapatellar effusion**	OR (95%CI) = 6.5 (1.87,22.37)		
					Popliteal cyst	OR (95%CI) = 5.5 (1,31.05)		
Hall M 2014 [91]		Case-control	US	Effusion, synovitis and popliteal cyst/VAS pain and WOMAC pain		**VAS pain**	**WOMAC pain**	
					Effusion	r=0.3 p<0.01	r= 0.3 p<0.01	
					Synovitis	r= 0.3 p<0.01	r= 0.3 p<0.01	
					Popliteal cyst	r= 0.1 n.s.	r= 0.1 n.s.	
Iagnocco A 2010 [92]	82	Cross-sectional	US	US score/VAS pain and Lequesne Index	Associations between total US score and VAS pain (p=0.004) and Lequesne Index (p<0.0001)			
Wu P 2012 [93]	112	Cross-sectional	US	US/VAS pain at motion and rest, WOMAC pain	p	VAS pain (motion)	VAS pain (rest)	WOMAC pain
					Suprapatellar synovitis	0.45	0.17	0.23
					Suprapatellar effusion	0.008	0.20	0.55
					Medial meniscal extrusion	0.19	0.40	0.27
					Medial compartment synovitis	0.001	0.001	0.001
					Lateral compartment synovitis	0.60	0.64	0.77
					Marginal osteophytes	0.39	0.66	0.46

US: ultrasonography; CEUS; contrast enhanced ultrasound; PD: power Doppler; VAS: visual analogue scale; OR (95%CI): odds ratio and 95% confidence interval; r: correlation coefficient; KOOS: Knee injury and Osteoarthritis Outcome Score; ADL: activities of daily living; QoL: quality of life; WOMAC: Western Ontario and MacMAster Univerisities Osteoarthritis Index

US: ultrasonography; CEUS; contrast enhanced ultrasound; PD: power Doppler; VAS: visual analogue scale; OR (95%CI): odds ratio and 95% confidence interval; r: correlation coefficient; KOOS: Knee injury and Osteoarthritis Outcome Score; ADL: activities of daily living; QoL: quality of life; WOMAC: Western Ontario and MacMAster Univerisities Osteoarthritis Index

Cross-sectional studies, radioisotope scan: all outcomes

Reference	No of subjects	Study design	Imaging modality	Outcome				
Kim HR 2008 [94]	30	Cross-sectional	SPECT	SPECT score/symptoms	Mean, sd	symptomatic	asymptomatic	p
					MT	1.37 (0.17)	0.21 (0.11)	<0.001
					MF	0.91 (0.15)	0	<0.001
					LT	0.43 (0.08)	0.29 (0.16)	>0.05
					LF	0.41 (0.09)	0.07 (0.07)	0.006
					Patella	1.26 (0.12)	0.43 (0.17)	0.001
					Femoral trochlea	0.83 (0.12)	0.29 (0.16)	0.023
Kraus VB 2009 [95]	159	Cross-sectional	radioisotope scan	Captation/severity of knee symptoms	Significant correlation between captation and symptoms severity p=0.0012			
McCrae F 1992 [96]	100	Cross-sectional	radioisotope scan	Abnormalities/pain	OR (95% CI)= 45.1 (6.07, 335)			

SPECT: single proton emission computed tomography; MT: medial tibia; MF: medial femur; LT: lateral tibia; LF: lateral femur; OR (95% CI): odds ratio and 95% confidence interval

Longitudinal studies, CR: symptoms, joint replacement

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Bruyere O 2002 [97]	212	RCT	CR	3 years	JSW and mJSW/WOMAC		**WOMAC pain**	**WOMAC stiffness**	**WOMAC function**
						Baseline JSW	r =-0.10 p =0.16	r=0.12, p =0.09	r = - 0.19, p =0.11
						Baseline mJSW	r = - 0.08, p =0.27	r = - 0.05, p =0.51	r = - 0.12, p =0.31
						Change in JSW	r = - 0.29, p =0.017	r = - 0.22, p =0.06	-
						Change in mJSW	r = - 0.24, p = 0.044	r = - 0.05, p =0.67	-
Collins JE 2014 [98]	1753	Cohort	CR	6 years	KLG/pain trajectories		**KL3 vs KL2**		**KL4 vs KL2**
						Mild	1.0 (0.6,1.6)		3.6 (0.9,15.0)
						Low moderate	2.6 (1.7,4.1)		21.9 (6.1,79.1)
						High moderate	2.6 (1.6,4.3)		25.5 (6.8,95.8)
						Severe	4.3 (2.1,8.6)		80.6 (18.7,346.8)
Conaghan PJ 2010 [99]	531	Cohort	US CR	3 years	KLG and effusion/joint replacement	**KLG**	HR (95%CI)= 4.08 (2.34 , 7.12)		
						US effusion	HR (95%CI)= 2.63 (1.70, 4.06)		
Podsiadlo P 2014 [100]	114	Cohort	CR	6 years	Osteophytes/TKR	grade of medial tibiofemoral osteophyte: OR (95%CI)= 2.0 (1.27, 3.13) p=0.003			

OR (95% CI): odds ratio and 95% confidence interval; JSW: joint space width; mJSW: minimal joint space width; r: correlation coefficient; KL/KLG: Kellgren and Lawrence grade; US: ultrasonography; CR: conventional radiography; TKR: total knee replacement; RCT: randomized controlled trial

Longitudinal studies, CR: structure

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Cahue S 2004[101]	217	Cohort	CR	18 months	Alignment/PF progression	Medial PF progression varus/non varus (OR, 95%CI)= 1.98 (1.15,3.43)			
						Lateral PF progression valgus/non valgus (OR 95% CI)= 1.25 (0.79–1.96)			
Cerejo R 2002[102]	230	Cohort	CR	18 months	Alignment/CR progression		KLG 0-1	KLG 2	KLG 3
						Varus/medial progression (OR 95% CI)	2.50 (0.67,9.39)	4.12 (1.92,8.82)	10.96 (3.10,38.77)
						Valgus/lateral progression (OR 95% CI)	-	2.46 (0.95,6.34)	10.44 (2.76,39.49)
Brouwer B 2007[103]	1501	Cohort	CR	6 years	Alignment/KLG	**Varus (OR, 95%CI)**		1.39 (0.48,4.05)	
						Valgus (OR, 95%CI)		2.90 (1.07,7.88)	
Felson DT 2009 [104]	160	Cohort	CR	1 year	Alignment/medial JSN progression	**Varus vs neutral (OR, 95%CI)**		0.33 (0.05, 2.24)	
						Valgus vs neutral (OR, 95%CI)		4.82 (1.93, 12.00)	
Felson DT 2005 [105]	270	Cohort	CR	30 months	Increase in osteohypte score/ radiographic progression	OR (95% CI)= 1.3 (1.0,1.7)			
Miyazaki T 2002 [106]	74	Cohort	CR	6 years	Alignment/mJSW	sensitivity 0.66, specificity 0.62			
Moisio K 2011 [107]	159	Cohort	CR		Alignment/MRI cartilage loss		**Medial (OR 95% CI)**	**Lateral (OR 95% CI)**	
						Neutral vs varus	0.49 (0.24,1.01)	-	
						Valgus vs varus	0.24 (0.10,0.58)	-	
						Neutral vs valgus	-	0.32 (0.16,0.66)	
						Varus vs valgus	-	0.41 (0.20,0.85)	

OR (95% CI): odds ratio and 95% confidence interval; CR: conventional radiography; PF: patellofemoral; KLG: Kellgren and Lawrence grade; JSN: joint space narrowing; mJSW: minimal joint space width

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome		
Sharma L 2001[108]	230	Cohort	CR	18 months	Alignment/progression	**Medial progression varus/non varus**	OR 95% CI= 5.00 (2.77,9.02)
						Lateral progression valgus/non valgus	OR 95% CI= 3.88 (1.82,8.24)
Cicuttini F 2004 [109]	117	Cohort	CR	2 years	Knee angle/MRI cartilage volume	Change in CV per degree of angle increase	p
						MT	0.16
						MF	0.004
						LT	0.05
						LF	0.57
Davies Tuck M 2008 [110]	100	Cohort	CR	2 years	Femoral sulcus angle/MRI patellar cartilage loss	No significant association between femoral sulcus angle and subsequent cartilage loss	
Eckstein F 2011 [111]	152	Cohort	CR MRI	2 years	CR and MRI/MRI cartilage thickness loss	predictors	**AUC (p)**
						mJSW (mm)	0.738 (0.0035)
						alignement	0.767 (0.0012)
						OP_score_cMF	0.637 (0.0163)
						JSN_score_MFTC	0.741 (0.0001)
						ThCtAB_MT (mm)	0.568 (0.0001)
						ThCtAB_cMF (mm)	0.805 (0.0193)
Bruyere O 2003[112]	105	Cohort	CR	3 years	Baseline JSW/JSN	r= -0.34, p=0.003	
Felson DT 2013[113]	5147	Cohort	CR	4 years	Radiographic progression in the previous year/radiographic progression	OR (95% CI)= 4. (2.4,6.7)	

CR: conventional radiography; MRI: magnetic resonance imaging; OR (95% CI): odds ratio and 95% confidence interval; CV: cartilage volume; MT: medial tibia, MF: medial femur; LT: lateral tibia; LF: lateral femur; AUC: area under the curve; mJSW: minimal joint space width; OP: osteophyte; cMF: centra medial femur; JSN: joint space narrowing; MFTC: medial femorotibial compartment; ThcTab: mean cartilage thickness over the bone area; MT: medial tibia; r: correlation coefficient; ROI: region of interest

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Woloszynski T 2012[114]	68	Cohort	CR (fractal analysis)		Fractal signature analysis/radiographic progression	AUC (95% CI) for radiographic progression: Medial ROI 0.77 (0.68, 0.86); Lateral ROI 0.71 (0.63, 0.79)		
Kraus VB 2009[115]	138	Cohort	CR	3 years	Fractal signature analysis/radiographic progression	AUC 0.74 (0.65–0.84)		
Mazzuca S 2005 [116]	174	Cohort	CR radioisotope scan	30 months	KLG and bone uptake/radiographic progression		**Se**	**Sp**
						MT uptake (50 th percentile)	0.57	0.60
						Baseline KLG	0.65	0.64
Mazzuca S 2006[117]	319	Cohort	CR	30 months	CR/radiographic progression (JSN and osteophytes)		**JSN (OR 95%CI)**	**Osteophytes (OR 95% CI)**
						JSW	0.67 (0.49, 0.91)	-
						Controlateral OA	1.53 (0.82, 2.85)	-
						Ipsilateral PF OA	3.01 (1.63, 5.57)	2.31 (1.37, 3.88)
Bijsterbosch J 2014[118]	236	Cohort	CR		Hand OA/knee OA progression	hand OA with baseline knee OA 2.5 (0.9 to 6.9); hand OA without baseline knee OA 2.7 (1.3 to 5.9)		
Neogi T 2006 [119]	495	Cohort	CR		Chondrocalcinosis/MRI cartilage loss	RR (95% CI)= 0.4 (0.2,0.7)		
Buck RJ 2013 [120]	869	Cohort	CR	1 year	KLG/MRI cartilage loss	cKLG moderate+severe vs minimal+doubtful OR (95% CI) 2.49 (1.46,4.26)		
Wirth W 2014 [121]	922	Cohort	CR	1 year	JSN/change in cartilage thickness		**LFTC (mean, sd)**	**MFTC (mean, sd)**
						No JSN	-8 (84)	-2 (87)
						Lateral JSN	-81 (168)	15 (117)
						Medial JSN	-20 (100)	-63 (154)

CR: conventional radiography; MRI: magnetic resonance imaging; AUC: area under the curve; Se: sensitivity; Sp: specificity; KLG: Kellgren and Lawrence grade; MT: medial tibia; JSN: joint space narrowing; OR (95% CI): odds ratio and 95% confidence interval; LFTC: lateral femorotibal compartment; MFTC: medial femorotibial compartment; JSW: joint space width, BML: bone marrow lesions; r: correlation coefficient

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Pelletier J 2007 [122]	110	Cohort	CR MRI	2 years	CR and MRI/medial cartilage loss and JSW		**Cartilage loss**	**JSW**
						JSW	r= 0.32 p=0.001	-
						Meniscal extrusion	r= -0.32 p=0.001	r= -0.32 p=0.001
						Medial meniscal tear	r= -0.21 p=0.03	r= -0.32 p=0.001
						Lateral meniscal tear	r= 0.15 p=0.13	r= -0.09 p=0.33
						BMLs	r= -0.27 p=0.005	r= 0.11 p=0.25
Sharma L 2008 [123]	153	Cohort	CR MRI	2 years	MRI/medial cartilage loss		**Cartilage volume (MT)**	**Cartilage thickness (MT)**
						Medial meniscal damage (OR 95%CI)	1.57 (1.29, 1.91)	1.40 (1.16, 1.69)
						Medial meniscal extrusion (OR 95%CI)	1.99 (1.36, 2.91)	1.81 (1.23, 2.65)
						Varus (OR 95%CI)	1.16 (1.07, 1.26)	1.20 (1.10, 1.31)
Wang Y 2005 [124]	132	Cohort	CR	2 years	JSN and osteophytes/change in plateau area		**Medial plateau (p)**	**Lateral plateu (p)**
						JSN	0.98	0.24
						Osteophytes	0.02	0.25
						Basal area	<0.001	0.11
Cicuttini F 2005 [125]	28	Cohort	CR MRI	2 years	JSW/cartilage loss Cartilage loss and JSN/joint replacement	JSW and cartilage volume r= 0.35 (p=0.06)		loss of medial TF cartilage volume to predict joint replacement at 4 years: OR=9.0, P<0.07 change in JSW: OR=1.1, P<0.92
Tanamas S 2009 [126]		SLR	CR		Alignment/radiographic progression	No quantitative synthesis, references were reviewed		

CR: conventional radiography; MRI: magnetic resonance imaging; OR (95% CI): odds ratio and 95% confidence interval; MT: medial tibia; JSN: joint space narrowing; JSW: joint space width; r: correlation coefficient; TF: tibiofemoral; SRL: systematic literature review

Longitudinal studies, MRI: joint replacement

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Cicuttini F 2004 [127]	123	Cohort	MRI	2 years	Cartilage volume loss/joint replacement	Rate of cartilage loss 3-8% year OR (95%CI)= 2.3 (0.4, 12.2)			
						Rate of cartilage loss >8% year OR (95%CI)= 7.1 (1.4, 36.5)			
Eckstein F 2013 [128]	110	Case-control	MRI	1 year	Change in cartilage thickness/joint replacement	Longitudinal change in cMFTC 1 year before TKA and immediately before TKA was greater in TKA case AUC=0.59 (0.52,0.57)			
Raynauld J 2011[129]	123	RCT	CR MRI	4-7 years	CR and MRI/joint replacement		**OR (95%CI)**		
						JSW	0.579 (0.42, 0.79)		
						Medial meniscal tear	5.687 (1.75, 18.49)		
						Medial meniscal extrusion	4.058 (1.34, 12.23)		
						BMLs score	1.196 (1.04, 1.37)		
Wluka AE 2005 [130]	117	Cohort	MRI	2 years	Cartilage defects/ annual cartilage loss and joint replacement		**Cartilage defects**	**No cartilage defects**	**p**
						Lateral TF	4.6% (3.2%, 5.9%)	5.8% (3.2%, 8.4%)	0.42
						Medial TF	4.7% (3.1%, 6.4%)	6.5% (4.3%, 8.6%)	0.21
						Joint replacement		OR (95%CI) = 6.0, (1.6, 22.3)	
Wang Y 2012 [131]	107	Cohort	MRI	2-4.5 years	Vastus medialis area and cartilage volume/WOMAC pain, radiographic progression, joint replacement	inverse association between vastus medialis CSA and WOMAC knee pain	Radiographic progression: Baseline tibial cartilage volume Medial p=0.001; Lateral p<0.001	Knee replacement over 4 years (change in vastus medialis area between 0 and 2 years) 0.62 (0.41, 0.96) OR 95% CI	
Tanamas S 2010 [132]	88	Cohort	MRI	4 years	BMLs and cysts/joint replacement	Medial compartment OR 95%CI 1.72 (0.93, 3.18) Lateral compartment 0.95 (0.48, 1.88)			
Scher C 2008 [133]	65	Cohort	MRI	3 years	BMLs/joint replacement	OR 95% CI 5.22 (1.08,25.08)			
Eckstein F 2009 [134]	156	Cohort	MRI	1 year	Denuded areas and cartilage thickness/cartilage loss	denuded area in MFTC : significantly greater cartilage loss in MT ($P < 0.01$) and cMT ($P< 0.001$), MF($P < 0.05$) and cMF ($P < 0.001$); smaller baseline cartilage thickness in MT: greater cartilage loss in MT ($P < 0.05$) and cMT ($P < 0.05$); smaller baseline cartilage thickness in cMF : greater cartilage loss in cMF ($P < 0.05$)			

CR: conventional radiography; MRI: magnetic resonance imaging; OR (95% CI): odds ratio 95% confidence interval, sd: standard deviation ; cMFTC: central medial tibiofemoral compartment; TKA: total knee arthroplasty; AUC: area under the curve; JSW: joint space width; BMLs: bone marrow lesions; TF: tibiofemoral; WOMAC: Western Ontario and MacMAster Univerisities Osteoarthritis Index; CSA: cross-sectional area; MFTC: medial tibiofemoral compartment; MT: medial tibia; cMT: central medial tibia; cMF: central medial femur; RCT: randomized controlled trial.

Longitudinal studies, MRI: symptoms and function

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Amin S 2008 [135]	265	Cohort	MRI	30 months	ACL tears/VAS pain, cartilage loss, WOMAC function		**Complete tear**	**No complete tear**
						VAS pain (sq mean 95% CI)	45.3 (38.1, 52.5)	39.8 (36.4, 43.2)
						Cartilage loss OR(95% CI)	1.1 (0.6, 1.8) (medial), 1.0 (0.4, 2.2) lateral, 0.8 (0.5, 1.4) PF	
						WOMAC function (sq mean 95% CI)	25.8 (22.3, 29.3)	22.3 (21.8, 25.2)
Everhart J 2014 [136]	1433	Cohort	MRI	4 years	SSR/incident symptoms, radiographic progression		**Incident symptoms (OR 95% CI)**	**Radiographic progression**
						Medial SSR	0.48 (0.30, 0.75)	0.91 (0.55, 1.24)
						Lateral SSR	1.27 (0.86, 1.88)	0.89 (0.69, 1.14)
Moisio K 2009 [137]	182	Cohort	MRI	2 years	Denuded areas/incident pain	No significant association between baseline denuded areas and incident pain		
Pellettier J 2008 [138]	27	Cohort	MRI	2 months	Synovitis score/VAS pain, WOMAC, MRI	WOMAC pain 0.07 p=0.71; WOMAC stiffness 0.10 p=0.63; VAS pain 0.01 p=0.93	Cartilage volume loss 0.20 p=0.34; BME score 0.04 p=0.83	WOMAC function 0.20 p=0.34
Hill CL 2007 [139]	270	Cohort	MRI	30 months	Change of synovitis and change of effusion/pain and cartilage loss	Change of synovitis: r=0.21, p=0.0003 Change of effusion: n.s.		
						Baseline synovitis/ cartilage loss in the medial compartment 2.9 (1.3, 6.5). Not significant for lateral and PF compartments. No significant relationship between change in score and cartilage loss		

MRI: magnetic resonance imaging; ACL: anterior cruciate ligament; VAS: visual analogue scale; WOMAC: Western Ontario and MacMaster Universities Osteoarthritis Index; OR (95% CI): odds ratio and 95% confidence interval; SSR: subchondral bone surface; r: correlation coefficient; PF: patellofemoral

Longitudinal studies, MRI: structure

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome		
Berthiaume M 2005 [140]	32	Cohort	MRI	2 years	Meniscal extrusion/cartilage volume loss	Anterior horn extrusion p=0.01; Middle horn extrusion p=0.02; Meniscal tear p=0.83; Meniscal degeneration p=0.94.	
Chang AM 2011 [141]	159	Cohort	MRI	2 years	meniscal tears/cartilage loss	**Medial meniscal tear**	body tear: central subregion 4.18 (1.80, 9.72); External subregion 5.39 (2.44, 11.88). Anterior subregion 3.22 (1.49, 6.96); Posterior horn, posterior subregion 2.63 (1.23, 5.62)
						Lateral meniscal tear	body tear : Central subregion 3.81 (1.12, 13.00); External subregion 3.99 (1.01, 15.85); Anterior subregion 3.24 (1.02, 10.35); Posterior subregion 6.47 (1.74, 24.05); Posterior horn 3.94 (1.26, 12.38)
Crema MD 2014 [142]	148	Cohort	MRI (dGEMRIC)	1 year	Meniscal pathology/dGEMRIC	Regions with meniscal pathology had significantly lower dGEMRIC compared to those without meniscal pathology both cross-sectionally and longitudinally	
Wang Y 2010 [143]	126	Cohort	MRI	2 years	Medial meniscal extrusion/increase in BMLs and cysts	Increase in medial TF BMLs OR 95% CI= 3.3 (1.2, 9.1) Increase in medial TF cysts OR 95% CI= 6.8 (2.0, 23.8)	
Raynauld J 2006 [144]	110	Cohort	MRI	2 years	Meniscal extrusion, cartilage volume, BMLs/cartilage loss	Severe medial meniscal extrusion -0.28 (p= 0.08); Medial compartment cartilage volume -0.36 (p= 0.012); Bone oedema -0.30 (p= 0.06)	
Hunter DJ 2006 [145]	257	Cohort	MRI	30 months	Meniscal damage and position/cartilage loss	**OR (95%CI)**	**Medial compartment** / **Lateral compartment**
						subluxation: 3-4 mm	0.9 (0.4,1.9) / 1.7 (0.6,5.0)
						5-6 mm subluxation	3.2 (1.5,6.9) / 3.0 (1.3,7.0)
						≥7 mm subluxation	2.4 (1.1,5.0) / 4.6 (2.0,10.8)
Crema MD 2014 [146]	163	Cohort	MRI	3 years	subchondral sclerosis/cartilage loss		**OR 95% CI**
						MF	1.7 (0.5, 5.9)
						MT	1.87 (0.,7.1)
						LF	0.5 (0.1,3.8)
						LT	0.7 (0.1,8.2)
						patella	2.1 (0.5,8.5)

MRI: magnetic resonance imaging; dGEMRIC: delayed gadolinium contrast enhanced magnetic resonance imaging; TF: tibiofemoral; BMLs: bone marrow lesions; OR (95% CI): odds ratio and 95% confidence interval

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Eckstein F 2009 [147]	80	Cohort	MRI	1 year	JSN/cartilage thickness	No significant differences between knees with more JSN compared to those with less JSN			
Driban JB 2011 [148]	44	Cohort	MRI	2 years	BMLs volume/cartilage lesions		**Cartilage volume**	**Cartilage thickness**	**Full-thickness lesions**
						Femur BMLs	r= 0.03 (-0.29, 0.34)	r= -0.11 (-0.41, 0.21)	r= 0.48 (0.20, 0.69)
						Tibial BMLs	r= 0.16 (-0.18, 0.46)	r= -0.13 (-0.43, 0.21)	r= 0.43 (0.12, 0.66)
Carrino JA 2006 [149]	32	Cohort	MRI	1.5 years	BME/subchondral cysts	11/12 newly developed subchondral cysts developed in areas of previous BME			
Hunter DJ 2006 [150]	217	Cohort	MRI	30 months	BMLs/cartilage loss	Medial TF p<0.0001, lateral TF cartilage p<0.0001			
Hernandez Molina G 2008 [151]	258	Cohort	MRI	30 months	BMLs/medial cartilage loss and ACL tears	Cartilage loss (OR 95% CI) 1.6 (0.8,3.1); ALC tears 5.9 (2.2,16.2)			
Felson DT 2003 [152]	223	Cohort	MRI	30 months	BMLs/radiographic progression	**Lateral BMLs**	OR (95% CI) 6.5 (3.0,14.0)		
						Medial BMLs	OR (95% CI) 6.1 (2.2,16.5)		
Kothari A 2010 [153]	177	Cohort	MRI	2 years	BMLS, subchondral cysts and bone attrition/cartilage loss in the same subregion		**OR (95% CI)**		
						BMLs	3.74 (1.59,8.82)		
						Subchondral cysts	0.47 (0.11,2.03)		
						Bone attrition	1.85 (0.71,4.82)		
Felson DT 2010 [154]	113	Cohort	CR MRI	2 years	Alignment and BMLs/WORMS and BLOKS cartilage score		**BLOKS medial cartilage (OR 95% CI)**	**WORMS medial cartilage (OR 95% CI)**	
						alignment	5.9 (1.5,24.0)	2.1 (0.7,6.3)	
						BMLs	1.9 (0.5,7.2)	5.5 (1.2, 25.4)	

MRI: magnetic resonance imaging;MF: medial femur, MT: medial tibia; LF: lateral femur; LT: lateral tibia; JSN: joint space narrowing; BMLs: bone marrow lesions; BME: bone marrow lesions; r: correlation coefficient; TF: tibiofemoral; ACL: anterior cruciate ligaments; OR (95% CI): odds ratio and 95% confidence interval

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome		
Wluka AE 2002 [155]	123	Cohort	MRI	2 years	Initial cartilage volume/cartilage volume loss	Initial cartilage volume predicted subsequent cartilage volume loss p=0.01	
Madan-Sharma L 2008 [156]	186	Cohort	MRI	2 years	BMLs, cysts, cartilage loss, osteophytes, meniscal tears, meniscal subluxation, joint effusion/JSN progression		**OR (95% CI)**
						BMLs	1.8 (0.51,5.17)
						Subchondral cysts	2.7 (0.8,6.4)
						Cartilage loss	1.7 (0.4,6.7)
						Osteophytes	2.1 (0.6,6.4)
						Meniscal tears	3.57 (1.1–10.0)
						Meniscal subluxation	2.73 (1.2,5.4)
						effusion	1.35 (0.7,2.4)
Yusuf E 2011 [157]		SLR	MRI				

MRI: magnetic resonance imaging ; CR: conventional radiography; BMLs: bone marrow lesions; BLOKS: Boston Leeds osteoarthritis knee score; WORMS: whole organ magnetic resonance imaging score; OR (95% CI): odds ratio and 95% confidence interval; cMF: central medial femur; JSN: joint space narrowing

Longitudinal studies, US and radioisotope scan

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Dieppe P 1993 [158]	94	Cohort	Radioisotope scan	5 years	Radiographic progression	OR (95% CI)= 1.86 (0.82,4.23)

US: ultrasonography; OR (95% CI): odds ratio and 95% confidence interval

Q6: What is the prognostic (prediction of therapeutic response) value of imaging in OA?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Barrett JP 1990 [159]	248	Cohort	CR	6 months	Radiographic severity/response to intraarticular HA		**Pain on walking**	**Pain at rest**	**Pain at night**
						Radiographic grade 2	r=0.80	r= 0.67	r= 0.42
						Radiographic grade 3	r= 0.08	r= 0.14	r= -0.20
Gaffney K 1995 [160]	84	RCT	CR	6 weeks	OA severity 0-3/response to intraarticular trimacynolone vs palcebo	No association between improvement in VAS pain and radiographic score			
Gudbergsen H 2012 [161]	192	RCT	CR MRI	16 weeks	mJSW, alignment and MRI scores/pain reduction in response to very low energy diet vs low energy diet	mJSW r =-0.02 (p =0.81); KL r =-0.07 (p = 0.29); r = 0.08 (p= 0.27); cartilage score r =-0.09 (p= 0.24); BML score r =-0.04 (p= 0.62); r =-0.08 (p= 0.29); effusion score r = 0.02 (p= 0.72); synovitis score r = 0.01 (p=0.94); meniscal extrusion score medial r =0.09; (p = 0.23) lateral r = 0.04 (p= 0.60); meniscal pathology score medial r = 0.04 (p = 0.60) Lateral r =-0.06 (p= 0.44)			
Gudbergsen H 2011 [162]	30	RCT	CR MRI	32 weeks	KLG and MRI score/change in WOMAC pain and function during weight reduction		**Change in WOMAC pain**	**Change in WOMAC function**	
						KLG	r = 0.13; (p= 0.50)	r = 0.03; (p= 0.88)	
						MRI score	r = 0.19; (p = 0.31)	r = -0.003; (p= 0.98)	
Hellio le Graverand M 2013 [163]	1452	RCT	CR	96 weeks	KLG/structural progression in patients treated with cidunistat or placebo	the loss of JSW after 48weeks in KLG2 patients was smaller with cindunistat 50 mg/day than with placebo (least squares (LS)-mean vs placebo (95% CI): 0.072 (0.006 to 0.138); p=0.032), but did not differ for cindunistat 200 mg/day versus placebo. No significant differences at 96 weeks.			

MRI: magnetic resonance imaging; CR: conventional radiography; US: ultrasonography; mExt: meniscal extrusion; BMLs: bone marrow lesions; Str Ran: strontium ranleate; LB: placebo; r: correlation coefficient; HA: hyaluronic acid; VAS: visual analogue scale; mJSW: minimal joint space width; KL/ BML: bone marrow lesions; WOMAC: Western Ontario and MacMAster Universities Osteoarthritis Index; r: correlation coefficient; RCT: randomized controlled trial

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome						
Keurentjes J 2013 [164]	723	Cohort	CR	5 years	KLG/improvement of Qol after knee replacement		**KLG 0-2 vs KLG 3-4 Md (95% CI)**				**p**
						Physical functioning	19.1 (8.48–29.7)				<0.001
						Role physical	17.4 (26.32–41.1)				0.15
						Bodily pain	9.02 (23.43–21.5)				0.15
						General Health	9.23 (1.31–17.2)				0.02
						Vitality	8.44 (20.28–17.2)				0.06
						Social functioning	7.44 (24.18–19.1)				0.21
						Role emotional	8.87 (211.8–29.6)				0.40
						PCS	5.64 (1.26–10.0)				0.01
						MCS	20.18 (24.45–4.10)				0.94
						NRS satisfaction	1.2 (0.1–2.4)				0.04
Case JP 2003 [165]	82	RCT	CR	12 weeks	KLG and medial JSN/WOMAC response to diclofenac vs paracetamol		**WOMAC pain (p)**		**WOMAC stiffness**		**WOMAC function**	
							Dicl/par	**Dic/plb**	**Dicl/par**	**Dic/plb**	**Dicl/par**	**Dic/plb**
						KLG 1-2	0.002	0.003	<0.001	0.002	<0.001	0.002
						KLG 3-4	0.85	0.37	>0.999	>0.999	0.28	0.48
						JSN 0-1	0.005	0.002	<0.001	<0.001	0.002	<0.001
						JSN 2	0.63	0.29	0.99	0.99	0.41	0.70
Sawitzke A 2008 [166]	375	RCT	CR	24 months	KLG/radiographic progression during treatment with glucosamine, chondroitin sulphate and celecoxib	OR for radiographic progression compared with the placebo group was <1 in patients with K/L grade 2 knees in all treatment groups, whereas it was>1 in patients with K/L grade 3 knees in all treatment groups						
Mazzuca S 2010 [167]	379	RCT	CR	30 months	Alignment/radiographic progression in doxycycline vs placebo	varus knees exhibited a greater loss of JSW than non-varus knees						

CR: conventional radiography; KLG: Kellgren and Lawrence scale;JSW: joint space width; MD: mean difference; PCS: physical component score; MCS: mental component score; NRS: numerical rating scale; JSN: joint space narrowing; WOMAC: Western Ontario and MacMaster Universities Osteoarthritis Index; Dic: diclofenac, plb: placebo; OR: odds ratio; RCT: randomized controlled trial.

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome		
Toh E 2002 [168]	60	Cohort	CR	12 weeks	Alignment, sclerosis, cysts, osteophytes, JSN/WOMAC response to intraarticular HA		**OR (95% CI)**
						Alignment	0.91 (0.29,2.80)
						Subchondral sclerosis	0.97 (0.32,2.93)
						Subchondral cysts	2.94 (0.89,9.67)
						osteophytes	0.41 (0.13,1.26)
						Lateral JSN	0.17 (0.05,0.619)
						Medial JSN	0.037 (0.008,0.15)
Pendleton 2008 [4]	86	Cohort	US	6 weeks	US/WOMAC response to intraarticular methylprednisolone	Higher baseline US scores: significant improvements in outcome at both week 1 (p<0.01 for WOMAC pain and function, p<0.05 for stiffness) and week 6 (p<0.01 all subscales)	
Chao J 2010 [169]	67	RCT	US	12 weeks	US inflammation/WOMAC response to triamcinolone	statistically significant improvement in pain subscales among non-inflammatory patients than among inflammatory patients at 12 weeks (p=0.03)	
Hirsch G 2013 [170]		SLR				No quantitative synthesis, references were reviewed	
Anandacoomarasamy A 2008 [171]	32	Cohort	MRI	6 months	Cartilage volume/response to intraarticular HA	no correlation between baseline MRI measures and clinical response	
Knoop JD 2014 [172]	91	Cohort	MRI	12 weeks	MRI/change in WOMAC function in response to exercise program	Cartilage integrity TF p=0.92, PF -0.25 p=0.01; BMLs TF p=0.28; PF –p=0.45; osteophytes TF p=0.88 PF p=0.83; Inflammation –p=0.45; Meniscal abnormalities p=0.51	

CR: conventional radiography; JSN: joint space narrowing; WOMAC: Western Ontario and MacMAster Universities Osteoarthritis Index; HA: hyaluronic acid; US: ultrasonography; NSAIDs: non-steroidal anti-inflammatory drugs; Glu: glucosamine; CS: chondroitin sulphate; MRI: magnetic resonance imaging; TF: tibiofemoral; BMLs: bone marrow lesions; PF: patellofemoral.

FOLLOW-UP OF OA

Q7: When, how often and under what clinical circumstance should imaging be used in the follow-up of osteoarthritic joints?

CR: sensitivity to change

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Pessis E 2003 [173]	20	Cohort	CR MRI	1 year	Sensitivity to change JSW and MRI score	SRM: JSW -0.11 MRI score 1.03			
Wirth W 2014 [121]	922	Cohort	MRI	1 year	Sensitivity to change ThCtAb depending on JSN	**SRM**		**Medial compartment**	**Lateral compartment**
						No JSN		-0.02	-0.09
						JSN	**Medial**	-0.41	-0.20
							Lateral	-0.13	-0.48
Conrozier T 2005 [174]	160	Cohort	CR	1 year	Sensitivity to change mJSW	SRM: 0.40			
Hellio Le Graverand MP 2008 [175]	62	Cohort	CR	1 year	Sensitivity to change of mJSW	**SRM**		**Lyon Schuss**	**Fixed flexion**
						KLG1		0.51	0.0
						KLG2		0.0	0.0
						KLG3		0.0	0.01
						KLG4		0.65	0.01
Mazzuca S 2008[176]	74	Cohort	CR	1 year	Sensitivity to change of mJSW	• Lyon Schuss: SRM 0.46 • Fixed flexion: SRM 0.05			
Piperno M 1998[177]	44	Cohort	CR	1 year	Sensitivity to change of mJSW		**Lyon Schuss**		**Full extension**
						KLG2	3.08		2.5
						KLG3	2.5		2.3
Spector TD 2005 [178]	231	RCT	CR	1 year	Sensitivity to change of medial mJSW	**placebo**	**Risedronate 5**		**Risedronate 15**
						-0.28	-0.18		0.24
Mazzuca S 2003 [179]	86	Cohort	CR	14 months	Sensitivity to change of medial mJSW	SRM -0.29			
Botha-Scheepers S 2007 [180]	378	Cohort	CR	2 years	Sensitivity to change of mJSW	SRM 0.56			

CR: conventional radiography; MRI: magnetic resonance imaging; JSW: joint space width; SRM: standardized response mean; JSN: joint space narrowing; ThCtAb: mean cartilage thickness over the bone area; mJSW: minimal joint space width; KLG: Kellgren and Lawrence grade

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Cicuttini F 2004 [181]	102	Cohort	CR MRI	2 years	Sensitivity to change of cartilage volume and JSN at the patellofemoral		**Lateral view**	**Skyline view**	
						Midpatellar JSW	0.05	0.13	
						mJSW	0.02	0.3	
						Cartilage volume	0.96		
Hellio Le Graverand MP 2010 [182]	55	Cohort	CR MRI	2 years	Sensitivity to change of cartilage thickness and mJSW		**Cartilage thickness**	**Lyon Schuss**	**Fixed flexion**
						KLG2	-0.15	-0.32	-0.62
						KLG3	-0.48	-0.62	-0.20
Hellio Le Graverand MP 2013 [163]	60	RCT	CR MRI	2 years	Sensitivity to change of cartilage volume, JSW and JSA	**JSA**	**JSW**	**CV medial tibia**	**CV medial femur**
						-0.30	-0.27	-0.45	-0.15
Mazzuca S 2001 [183]	255	Cohort	CR	2-3 years	Sensitivity to change of JSN	SRM 0.29			
Pavelka K 2004 [184]	89	Cohort	CR	2 years	Sensitivity to change of mJSW	SRM -0.50			
Vignon E 2003 [185]	32	Cohort	CR	2 years	Sensitivity to change of mJSW	SRM: Standing AP 0.23; Lyon Schuss 0.48			
Wirth W 2013 [186]	445	Cohort	CR MRI	2 years	Sensitivity to change of mJSW and cartilage thickness	SRM: MFTC -0.43; mJSW -0.31			
Boegard T 2003 [187]	55	Cohort	CR	25 months	Sensitivity to change of mJSW	medial MJS: md= 0.056 (−0.070, 0.182), p=0.37 lateral MJS: md=−0.080 (−0.226, 0.067), p=0.28 PF joint: md= 0.019 (−0.16, 0.20), p=0.84			
Mazzuca S 2004 [188]	86	Cohort	CR	16 and 30 months	Sensitivity to change of JSN	SRM 16 months: 0.34 SRM 30 months 0.48			
Miyazaki T 2002 [189]	174	Cohort	CR	6 years	Sensitivity to change of mJSW	SRM 1.16			
Bruyere O 2003 [190]	212	RCT	CR	3 years	Sensitivity to change of mJSW	SRM (computer assisted) 0.44 SRM (manual) 0.40			
Gossec L 2008 [191]	100	Cohort	CR	30 months	Sensitivity to change of KLG, OARSI JSN and JSW	**SRM**	**Full extension**	**Semiflexed**	
						KLG	0.10	0.22	
						OARSI JSN	0.15	0.34	
						JSW	0.20	0.49	

CR: conventional radiography; MRI: magnetic resonance imaging; JSW: joint space width; SRM: standardized response mean; JSN: joint space narrowing; JSA: joint space area; CV: cartilage volume; MFTC: medial femorotibial compartment; MJS: medial joint space; PF: patellofemoral

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Lanyon P 1996 [192]	108	Cohort	CR	31 months	Sensitivity to change of PF mJSW		**Skyline view**	**Lateral view**
						Mean change (sd) in JSW	-0.5 (-0.1,-0.8) lateral facet -0.5 (-0.2,-0.8) medial facet	-0.2(0.1,-0.5)
La Valley P 2005 [193]	482	Cohort	CR	30 months	Sensitivity to change of JSN	No change 0%; Change on both views 43%; Change on PA view 23% ; Change on lateral view 34%		
Nevitt M 2007 [194]	153	Cohort	CR	37 months	Sensitivity to change of mJSW	SRM 0.41		
Reginster JY 2001[195]	212	RCT	CR	3 years	Sensitivity to change of mJSW	Mean (sd) change in mJSW: placebo -0.31 (-0.57, -0.04) Glucosamine 0.07 (-0·17, 0.32)		
Sugiyama S 2003 [196]	172	Cohort	CR	4 years	Sensitivity to change of mJSW	SRM 1.23		
Reichmann W 2011 [197]		SLR	CR		Sensitivity to change of JSW	SRM 0.33 (0.26, 0.41)		
Duryea J 2010 [198]	150	Cohort	CR MRI	1 year	Sensitivity to change of JSW, cartilage volume and cartilage thickness	SRM: mJSW -0.15; JSW -0.31; MT volume -0.10; LT volume -0.22; MF volume -0.39; LF volume -0.06; MT thickness -0.04; LT thickness -0.22; MF thickness -0.34; LF thickness -0.13		

CR: conventional radiography; MRI: magnetic resonance imaging; JSW: joint space width; SRM: standardized response mean; JSN: joint space narrowing; mJSW: minimal joint space width; sd: standard deviation; MT: medial tibia; LT: lateral tibia; MF: media femur; LF: lateral femur; SLR: systematic literature review

CR: structural progression

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome		
Bartlett SJ 2011 [199]	312	Cohort	CR	1-2 years	Evaluation of trajectories of JSN progression	• 71% patients presented stability over 2 years • 7% moderate progression • 20% low progression • 2% rapid progression	
Bruyere O 2007 [200]	62	Cohort	CR MRI	1 year	Correlation between JSN and WORMS progression	• correlation between the progression of the WORMS and radiographic medial JSN: (r=0.35, p=0.006) • ROC measuring the value of WORMS change over 1 year for the prediction of JSN >0.3 mm AUC (95%CI) 0.73 (0.56,0.89, p=0.013)	
Cicuttini F 2005 [125]	28	Cohort	CR MRI	2 years	Correlation between cartilage volume and JSW changes	r= -0.11 (p=0.58)	
Crema MD 2014 [201]	267	Cohort	CR MRI	30 months	Correlation between MRI features and JSN progression		**OR (95%CI)**
						Worsening of cartilage damage	4.9 (2.6, 9.3)
						Worsening of meniscal damage	4.8 (1.8, 13.0)
						Worsening of meniscal extrusion	5.1 (1.5, 17.0)
Fukui N 2010 [202]	68	Cohort	CR	36 months	Correlation between radiographic progression and pain and function scores	Baseline JKOM (pain and function) score similar for progressors and non progressors. End of follow-up: the score for non progressors declined, while that for the subjects with progressed joints remained high	
Teichtahl A 2009 [203]	78	Cohort	CR	2 years	Correlation between TF cartilage loss and alignment	Annual change in cartilage volume per degree of angle increase: medial tibial cartilage volume (%) -0.44 (-0.95, -0.04) p=0.03 Lateral tibial cartilage volume (%) 0.01 (-0.4, 0.4) p=0.95	
Teichtah l A 2008 [204]	99	Cohort	CR	2 years	Correlation between PF cartilage loss and alignment	Annual change of knee angle for annual change in total patella cartilage volume -23.4 (-38.7, -8.1) p= 0.0003	

CR: conventional radiography; MRI: magnetic resonance imaging; JSN: joint space narrowing; WORMS: whole organ magnetic resonance imaging score; OR (95% CI) odds ratio and 95% confidence interval; JSW: joint space width; JKOM: Japanese knee osteoarthritis measure; TF: tibiofemoral; PF: patellofemoral.

MRI: sensitivity to change

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Eckstein F 2009 [134]	156	Cohort	MRI	1 year	Sensitivity to change of cartilage volume and thickness	**SRM**	**MFTC**	**LTFC**	
						CV	-0.21	-0.12	
						ThCtAb	-0.31	-0.11	
Eckstein F 2009 [147]	156	Cohort	MRI	1 year	Sensitivity to change of cartilage thickness	cMF -0.50; ccMF -0.45 ; CMTFC -0.47			
Eckstein F 2008 [205]	158	Cohort	MRI	3 months	Sensitivity to change of cartilage volume and thickness	• Mean differences in ThCtAB (3 month vsbaseline) were +0.13% in MT, +0.09% in cMF, +0.58% in LT and +0.98% in cLF • ThCtAB between the first and second measurement was not significant in MT and cMF • The tAB increased significantly in all cartilage plates			
Eckstein F 2009 [206]	80	Cohort	MRI	1 year	Sensitivity to change of cartilage thickness according to the presence of baseline JSN	**SRM**	**MFTC**	**MT**	**MF**	**cMF**
						JSN 0-1	-0.23	-0.28	-0.13	-0.19
						JSN 2-3	-0.46	-0.45	-0.25	-0.37
Blumenkrantz G 2004 [207]	38	Cohort	MRI	2 years	Sensitivity to change of cartilage thickness and volume	Mean change (sd)			**KLG 1-2**	**KLG 3-4**
						lateral condyle cartilage thickness			-10.5 (11.0)	-9.4 (11.2)
						lateral condyle cartilage volume			-7.0 (5.8)	-5.3 (7.3)
						Medial condyle cartilage thickness			-7.7 (10.3)	-2.5 (10.4)
						Medial condyle cartilage volume			-10.2 (14.2)	-5.4 (14.5)
Eckstein F 2011 [208]	719	Cohort	MRI	1 year	Sensitivity to change of cartilage thickness	**SRM**	**MFTC**		**LTFC**	
						KLG2	-0.11		-0.13	
						KLG3	-0.31		-0.23	
						KLG4	-0.38		-0.39	
Hunter DJ 2009 [209]	150	Cohort	MRI	1 year	Sensitivity to change of cartilage volume and normalized cartilage volume	**SRM**	**Cartilage volume**		**Normalized Cartilage volume**	
						Femur	-0.10		-0.09	
						Lat tibia	-0.24		-0.26	
						Med tibia	-0.04		-0.01	
						Patella	-0.18		-0.16	
						Trochlea	-0.006		-0.01	

MRI: magnetic resonance imaging; SRM: standardized response mean; MFTC: medial tibiofemoral compartment; LTFC: lateral tibiofemoral compartment; CV: cartilage volume; ThCtAb: mean cartilage thickness over the bone surface; MT: media tibia; cMF: central medial femur; JSN: joint space narrowing; MF: medial femur; KLG: Kellgren and Lawrence grade

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Hunter DJ 2010 [210]	150	Cohort	MRI	1 year	Sensitivity to change of cartilage volume	SRM: -0.39			
Maschek S 2014 [211]	724	Cohort	MRI	1 year	Sensitivity to change of cartilage thickness		**KLG2**	**KLG3**	**KLG4**
						cartilage thickness SRM	-0.14	-0.35	-0.50
Cromer T 2014 [212]	23	RCT	CR MRI	1 year	Sensitivity to change	**MJSW (SRM)**		-0.46	
						Cartilage volume	**Medial tibia**	-0.56	
							Medial femur	-0.74	
						Cartilage thickness	**Medial tibia**	-0.61	
							Medial femur	-0.59	
Buck RJ 2010 [213]	70	Case-control	MRI	2 years	Proportion of patients presenting with cartilage thinning or thickening	20/70 patients cartilage thinningin the medial compartment 14/70 patients cartilage thickening in the medial compartment 13/70 patients cartilage thinning in the lateral compartment 6/70 patients cartilage thickening in the lateral compartment			
Eckstein F 2007 [214]	9	Cohort	MRI	2 years	Sensitivity to change of cartilage thickness and volume	Cartilage volume: MFTC SRM=0.76 LFTC SRM= 0.92 Cartilage thickness: MFTC SRM= 0.92			
Hudelmaier M 2010 [215]	23	Cohort	MRI	2 years	Sensitivity to change of cartilage thickness and volume	Cartilage volume: -0.44 Cartilage thickness: -0.58			
Iranpour-Bourjeni T 2011 [216]	24	Cohort	MRI	2 years	Sensitivity to change of cartilage volume	SRM 0.51			
Raynauld J 2004 [217]	32	Cohort	MRI	2 years	Sensitivity to change of cartilage thickness	SRM 0.84			
Raynauld J 2006 [144]	110	RCT	MRI	2 years	Sensitivity to change of cartilage volume	SRM -1.3			
Raynauld J 2008 [218]	107	RCT	MRI	2 years	Sensitivity to change of BMLs and cysts size	SRM cysts 0.13 SRM BMLs 0.13			
Raynauld J 2008 [219]	301	RCT	MRI	2 years	Sensitivity to change of cartilage thickness and volume		**Licofelone**	**Naproxen**	
						CV	2.11	-2.8	
						ThCtAb	-2.3	-2.9	

MRI: magnetic resonance imaging; SRM: standardized response mean; KLG: Kellgren and Lawrence grade MFTC: medial tibiofemoral compartment; LTFC: lateral tibiofemoral compartment; CV: cartilage volume; ThCtAb: mean cartilage thickness over the bone area; BMLs: bone marrow lesions

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome						
Raynauld J 2009 [220]	355	RCT	MRI	2 years	Sensitivity to change of cartilage volume		**Licofelone**		**Naproxen**		
						CV	8.1		9.5		
Eckstein F 2012 [221]	441	Cohort	MRI	4 years	Yearly sensitivity to change of cartilage thickness from baseline to year 4		**BL/Y1**	**Y1/Y2**	**BL/Y2**	**Y1/Y3**	**BL/Y4**
						SRM	-0.42	-0.28	-0.56	-0.55	-0.78
Amin S 2005 [222]	323	Cohort	CR	30 months	Performance of CR in detecting MRI progression	Medial compartment: OR(95%CI)= 3.7 (2.2,6.3) Lateral compartment: OR (95% CI) 5.7 (2.3,14.0)					
Gandy S 2002 [223]	11	Cohort	MRI	30 months	Sensitivity to change of cartilage volume	SRM 0.26					
Hunter DJ 2006 [150]	217	Cohort	MRI	30 months	Correlation of cartilage loss and BMLs	Ipsilateral change in score: medial TF cartilage: 0.65 (0.003); lateral TF cartilage: 0.68 (0.01)					
Pellettier J 2008 [224]	27	Cohort	MRI	2 months	Sensitivity to change of synovitis and BMLs	Synovitis score: SRM 0.67 BMLs score: SRM 0.76					
Brandt KD 2006 [225]	30	Cohort	MRI	14 days	Sensitivity to change of effusion and synovitis volume		**NSAIDs**	**ACET**			
						Synovitis (SRM)	0.55	0.79			
						Effusion (SRM)	0.97	0.65			
Driban JB 2013 [226]	629	Cohort	MRI	6 months	Subchondral sclerosis progression depending on BMLs progression	subchondral sclerosis in BML progression OR 95% CI = 3.1 (1.10, 9.61) subchondral sclerosis in BML regression OR 95% CI= 1.74 (0.56,5.37)					
Eckstein F 2014 [227]	189	Case-control	MRI	16-20 months	Cartilage loss in patients undergoing TKA vs controls	OR = 1.36 (1.08,1.70)					

MRI: magnetic resonance imaging; CR: conventional radiography; SRM: standardized response mean; OR (95% CI) odds ratio and 95% confidence interval; CV: cartilage volume; ThCtAb: mean cartilage thickness over the bone area; BL: baseline; Y: year; TF: tibiofemoral

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Felson DT 2012 [228]	62	Cohort	MRI	6-12 weeks	Rate of progression in BMLs	• At 6 weeks: 40.8% (20/49) knees showed BMLs changes beyond the MDD • At 12 weeks: 38.8% (19/49) knees showed BMLs changes beyond the MDD			
Hunter DJ 2006 [229]	217	Cohort	MRI	24 weeks	Sensitivity to change of cartilage morphology, BMLs, ostoephytes, synovitis/effusion	SRM: Cartilage morphology -0.46; BME -0.18; osteophytes -0.33; Synovitis/effusion-0.36; Cartilage volume: medial tibia -0.05; lateral tibia -0.27; patella -0.20			
Hunter DJ 2010 [230]	29	Cohort	MRI	6 months	Change in cMF ThCtAb	no significant changes in cartilage thickness for any of the regions of interest on the TF joint over 3 or 6 months			
Hunter DJ 2011 [231]		SLR	MRI		Sensitivity to change of cartilage, synovium measures and BMLs		**Medial TF**	**Lateral TF**	**PF**
						Quantitative measures:	-0.86	-1.01	-0.63
						Semiquantitative measures	0.55	0.37	0.29
						Semiquantitative measures for the synovium	0.47		
						BMLs	0.43		
Kubota M 2010 [232]	180	Cohort	MRI	6 months	Change in BME score in radiographic progressors vs non progressors	**Mean (sd)**	**Progressors**	**Non progressors**	**p**
						KLG2	5.1 (5.2)	5.0 (2.6)	0.06
						KLG3	2.7 (1.8)	11.0 (6.3)	0.04
						KLG4	0.6 (1.2)	1.2 (2.6)	0.57

MRI: magnetic resonance imaging; SRM: standardized response mean; OR (95% CI) odds ratio and 95% confidence interval; BMLs: bone marrow lesions; NSAIDs: non-steroidal anti-inflammatory drugs; ACET: RCT on paracetamol; MDD: minimal detectable difference; BME: bone marrow edema; TKA: total knee arthroplasty

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Felson DT 2010 [154]	113	Cohort	MRI	24 months	WORMS and BLOKS cartilage loss vs radiographic JSN for monitoring cartilage loss		**Se**	**Sp**	
						JSN medial compartment WORMS	0.86 (0.76,0.93)	0.42 (0.23,0.63)	
						JSN medial compartment BLOKS	0.87 (0.78,0.93)	0.42 (0.23,0.63)	
						JSN lateral compartment WORMS	0.96 (0.90,0.98)	0.50 (0.12,0.87)	
						JSN lateral compartment BLOKS	0.90 (0.83,0.95)	0.50 (0.12,0.87)	
Crema MD 2014 [233]	148	Cohort	MRI (dGEMRIC)	2 years	Correlation between dGEMRIC and changes in cartilage thickness	KL grade 0 and 1 and 3: no significant associations KL grade 2: significant association at the central medial femur between the decrease in dGEMRIC indices and the increase in cartilage thickness			
Kornaat P 2007 [234]	182	Cohort	MRI	2 years	Change in BMLs/change in symptoms, function and increase in cystic lesions		**WOMAC pain**	**WOMAC function**	
						unchanged BML	2 (-8, 12)	−2 (12, 8)	
						increasing BML	2 (-8 ,11)	−4 (13, 6)	
						decreasing BML	1 (-11 ,12)	-4 (15, 8)	
						change in size of an adjacent cyst or BML	OR 95% CI=6.2 (3.2,12.3)		
Phan C 2006 [235]	34	Cohort	MRI	1 year-2 years	Cartilage and BMLs/WOMAC	**r**	**Baseline (cartilage/BMLs)**	**12 months (cartilage/BMLs)**	**24 months (cartilage/BMLs)**
						WOMAC pain	n.s./ n.s.	0.42/0.42	n.s./0.45
						WOMAC stiffness	n.s./ n.s.	0.54/0.51	n.s./ n.s.
						WOMAC function	n.s./ n.s.	0.51/0.45	0.63 /n.s.

MRI: magnetic resonance imaging; BMLs: bone marrow lesions; dGEMRCI: delayed gadolinium enhanced magnetic resonance imaging; WOMAC: Western Ontario McMAster Universities osteoarthritis index; r: correlation coefficient; KLG: Kellgran and Lawrence grade; PF: patellofemoral; n.s. not significant; HA: hyaluronic acid; cMF: central medial femur; ThCtAb: mean cartilage thickness over the bone area; BMLs: bone marrow lesions; BME: bone marrow edema; sd: standard deviation; JSN: joint space narrowing; Se: sensitivity; Sp: specificity; WORMS: whole organ magnetic resonance imaging score; BLOKS: Boston Leeds osteoarthritis knee score

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Cubukcu D 2005 [236]	40	RCT	MRI	8 weeks	PF cartilage changes	no significant change in PF cartilage in the saline group (p>0.05), but statistically significant improvement in the HA group (p<0.05)
Stahl R 2007 [237]	8	Cohort	MRI	1 year	Sensitivity to change of cartilage volume and cartilage thickness	SRM cartilage volume: - 1.17 SRM cartilage thickness: -0.33
Stahl R 2011 [238]	30	Cohort	MRI	1 year	Prevalence of progression in cartilage lesions and BMLs	• Using the WORMS 3.8% of the cartilage lesions in OA patients increased, while 96.2% of the lesions remained unchanged. BMEP decreased in 3.4% and increased in 4.9% of the lesions in the OA patients.
Wirth W 2009 [239]	156	Cohort	MRI	1 year	Sensitivity to change of cartilage thickness	MFTC.ThCtAB -0.24 (-0.30,-0.17)
Wirth W 2011 [240]	346	Cohort	MRI	2 years	Change in cartilage thickness	Change of ThCtAB TFJ: baseline-year 1 -0.32; year 1- year 2 -0.28; baseline year 2: -0.44
Wirth W 2011 [241]	290	Cohort	MRI	1 year	Sensitivity to change of cartilage thickness	MFTC (mcm) no JSN: SRM -0.12; JSN: -0.31; LFTC (mcm) JSN: -0.09 ; no JSN:-0.23
Wirth W 2010 [242]	80	Cohort	MRI	1 year	Sensitivity to change of cartilage thickness	SRM -0.29

MRI: magnetic resonance imaging; SRM: standardized response mean; WORMS: whole organ magnetic resonance imaging score; MFTC: medialfemorotibial compartment; ThCtAb: mean cartilage thickness over the bone area; TFJ: tibiofemoral joint; MFTC: medial femorotibial compartment; JSN: joint space narrowing; LFTC: lateral femorotibial compartment

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Zhang Y 2011 [243]	651	Cohort	MRI	3 months	Change in pain status according to change in BML and effusion/synovitis score	**PAIN** (OR 95%CI)	**Absent/present**	**Present/absent**
						BMLS 0	1	0.3 (0.1–0.9)
						BMLS 1	1.1 (0.6–2.3)	0.3 (0.1–1.0)
						BMLS 2	0.7 (0.3–1.6)	0.3 (0.1–1.1)
						BMLS 3	0.3 (0.3–1.5)	0.5 (0.2–1.6)
						BMLS 4	0.9 (0.3–2.3)	1.0 (0.3–3.4)
						BMLS 5-6	1.3 (0.5–3.4)	0.7 (0.3–1.8)
						BMLS 7-18	1.3 (0.5–3.6)	1
						Synovitis 0	1	0.4 (0.1–1.4)
						Synovitis 1	1.2 (0.7–2.3)	1.0 (0.3–2.8)
						Synovitis 2	2.1 (0.9–5.1)	0.6 (0.2–1.8)
						Synovitis 3-6	**4.4 (1.4–14.0)**	1
						Effusion 0	1	**3.0 (1.1–8.2)**
						Effusion 1	1.4 (0.8–2.6)	0.8 (0.4–1.5)
						Effusion 2-3	2.3 (1.0–5.3)	1
Creamer P 1994 [244]	12	RCT	MRI radioisotope scan	6 weeks	Sensitivity to change	No differences between baseline and follow up in Tc 99 scan MRI: non consistent differences between pre and post images		

MRI: magnetic resonance imaging; BMLs; bone marrow lesions; Tc: technetium; OR 95%CI: odds ratio and 95% confidence interval

US: all outcomes

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Hall M 2014 [245]	243	Case-control	US	3 months	Sensitivity to change of effusion, synovial hypertrophy, popliteal cysts	**Mean (sd)**	**baseline**	**3 months**	**p**
						Effusion	8.6 (4.6)	8.6 (4.9)	0.96
						Synovial hypertrophy	7.1 (4.0)	5.7 (4.3)	0.003
						Popliteal cysts	0 (0-14.3)	1.15 (0-13.4)	0.45
						no correlation between change in pain and change in US measures for either group			
Acebes JC 2006 [246]	30	Cohort	US	4 weeks	Change in popliteal cyst sagittal area/ROM	r=0.380, p<0.05			
Bandinelli F 2012 [247]	40	Cohort	US	8 weeks	Change in popliteal cyst measures after steroid injection	**Mean(sd)**	**baseline**	**2 weeks**	**4 weeks**	**8 weeks**
						Longitudinal diameter	4.84 (1.42)	1.8 (1.22)*	1.69 (1.1)*	1.8 (1.22)*
						Transverse diameter	2.18 (0.8)	0.56 (0.51)*	0.75 (0.59)*	0.94 (0.68)*
						Thickness	1.53 (0.57)	0.41 (0.53)*	0.66 (0.66)*	0.76 (0.69)*
										*p<0.05
Hall M 2014 [248]	25	RCT	US		Sensitivity to change of effusion and synovial hypertrophy	Synovial hypertrophy: SRM -0.40 Effusion: SRM –0.04				
Jan M 2006 [249]	44	Cohort	US	1 year	Change in synovial thickness	the synovial thickness in both treatment groups decreased to 81% to 84% of the initial thickness; after 30 treatment sessions, it was 67% to 72% of the initial thickness				

US: ultrasonography; sd: standard deviation; ROM: range of motion; r: correlation coefficient; SRM: standardized response mean

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Kawaguchi K 2012 [250]	58	Cohort	US	1 year	Change in meniscal radial displacement	The MRD values in the standing position were significantly increased during the followup period, except for the KL grade 4 knees		
Song IH 2009 [251]	41	RCT	US (CEUS) MRI	16 weeks	Sensitivity to change of effusion, synovial hypertrophy, CEUS slope, MRI effusion	**SRM**	**Superior recess**	**Lateral recess**
						effusion	0.09	0.09
						synovitis	0.06	0.03
						CEUS slope	0.18	
						MRI effusion	0.05	0.003
Keen HI 2011 [252]		SLR	US					

US: ultrasonography; CEUS: contrast enhanced ultrasonography; MRD: meniscal radial displacement; KL: Kellgren and Lawrence; SRM: standardize response mean; MRI: magnetic resonance imaging; SLR: systematic literature review

TREATMENT OF OA - KNEE

Q9: What is the value of imaging-guided interventions in OA with respect to accuracy, therapeutic response, clinical and imaging outcome?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Bum Park Y 2012 [253]	99	RCT	US		Accuracy of HA injection vs blind injection	OR (95%CI)= 4.68 (0.94,23.30)			
Im SH 2006 [254]	99	RCT	US		Accuracy of HA injection vs blind injection	Accuracy: 95.5% (US) vs 77.2% (blind) p 0.01			
Jang SH 2013 [255]	126	RCT	US		US guided in plain injection vs US guided out of plane vs blind Triamcinolone exhacetonide	Accuracy: US guided in plain 95.1%; US guided out of plain 97.7%; Blind 78% P<0.05 blind vs remaining procedures			
Sibbitt W 2011 [256]	92	RCT	US	2 weeks – 6 months	US guided vs blind trimacinolone		**US**	**blind**	**p**
						VAS pain	-42 (-78,-5) p=0.025	-0 (-18,+18) p=1.0	-
						Reinjection	24/46	34/46	0.03
						VAS pain related to the injection	2.3 (2.4)	4.4 (2.9)	0.0003
						Cost per year ($)	460 ± 207	173±81	0.0001
Maricar N 2013 [257]		SLR	US			No quantitative synthesis, references reviewed			

US: ultrasonography; VAS: visual analogue scale

MAKING A DIAGNOSIS OF OSTEOARTHRITIS – FOOT

Q1: What is the added value of imaging to the diagnosis of OA?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome	
Matsos M 2009 [258]	62	Cross-sectional	US	Clinical diagnosis	Certainty pre-US vs certainty post-US	primary OA: 29 (46.8) vs 45 (73.0) p=0.002; inflammatory OA 29 (46.8) vs 54 (87.1) p<0.001

CR: conventional radiography, US: ultrasonography

Q2: What is the accuracy of different imaging modalities for detecting OA features (soft tissues and bone involvement)?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome			
Moon J 2010 [259]	83	Cross-sectional	CR	surgery	concordance between radiographic scores and cartilage damage	KLG 0.53 (0.38,0.66) Takakura 0.42 (0.24,0.57) van Dijk 0.42 (0.25,0.57)		
Tol J 2004 [260]	60	**Surgery**	CR	surgery	Accuracy of CR to detect osteophytes		**Se**	**Sp**
						Tibial OP	0.85	0.45
						Talar OP	0.73	0.68

CR: conventional radiography; Se: sensitivity; Sp: specificity; OP: osteophytes; KLG: Kellgran and Lawrence grade

PROGNOSIS OF OA- FOOT

Q5: What is the prognostic (prediction of outcome) value of imaging in OA?

Reference	No of subjects	Study design	Imaging modality	Outcome			
Bouaicha S 2010 [261]	198	Case-control	CR		**Hallux rigidus**	**Hallux valgus**	**p**
				MPE (mean 95% CI)	+5.2 mm(4.7, 5.7)	+2.8 mm (2.2, 3.4)	< 0.0001
				DFA	9° (8.10)	14° (13, 16)	p < 0.0001
Iagnocco A 2011 [262]	100	Cross-sectional	US	US abnormalities/joint tenderness and swelling			**OR (95% CI)**
					US abnormalities midfoot		16.75 (6.21,45.15)
					US abnormalities forefoot		4.28 (1.73,10.60)
Keen HI 2011 [263]	53	Case-control	US	GS, PD, Osteophytes and JSN at MTPs/ VAS pain and foot function index	**p**	**VAS pain**	**Foot function index**
					GS	0.55	0.40
					PD	0.43	0.03
					osteophytes	0.04	0.03
					JSN	0.47 (neg)	0.01
McDaniel G 2011[58]	138	Cross-sectional	CR	JSN, osteophytes and KLG in the tibiotalar and subtalar joint/		**Gait velocity**	**Standing balance**
					JSN tibiotalar	r=-0.06 p=0.45	r=-0.15 p>0.05
					JSN subtalar	r= -0.13 p=0.12	r= -0.29 p=0.0006
					Osteophytes tibiotalar	r= 0.03 p=0.69	r= -0.03 p=0.72
					Osteophytes subtalar	r= -0.03 p=0.74	r= -0.10 p=0.23
					KLG tibiotalar	r= -0.10 p=0.27	r= -0.19 p=0.02
					KLG subtalar	r= -0.15 p=0.08	-
Menz HB 2009 [264]	197	Cross-sectional	CR	CR/symptoms			**OR (95% CI)**
					OA at MTP1		1.2 (0.7,2.2)
					OA at 1st CMJ		1.1 (0.5,2.2)
					OA at 1st CJ		2.4 (1.3,4.3)
					OA at TNJ		0.8 (0.4,1.6)
					OA at 2nd CMj		2.2 (1.2,4.3)

CR: conventional radiography; US: ultrasonography; MPE: metatarsus primum elevatum; DFA: metatarsophalangeal dorsiflexion angle; OR (95% CI) ratio with 95% confidence interval; VAS: visual analogue scale; JSN: joint space narrowing; GS: grey scale; PD: power Doppler; KLG: Kellgren and Lawrence grade; MTP: metatarsophalangeal; CMJ: cuneiform-metatarsal joint; CJ: 1st navicular-cuneiform joint; TNJ: talonavicular joint; r: correlation coefficient

Q6: What is the prognostic (prediction of therapeutic response) value of imaging in OA?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Drakonaki E 2011 [265]	51	Cohort	US CR	12 months		**US degenerative signs**	**US and CR degenerative signs**	**p**
					Positive therapeutic response (i.a. methylprednisolone)	76.9%	75%	1
Han SH 2014 [266]	40	Cohort	CR	12 months	Response to intraarticular HA (VAS pain)	**OR (95%CI)**	**Early stage 1-2 vs 3-4**	
						3 months	11.00 (2.24,53.86)	
						6 months	10.55 (1.90,58.55)	
						12 months	5.00 (0.92,27.08)	
Sun S 2011[267]	46	Cohort	CR		KLG 2 and 3/AOS, AOFAS scores and	no significant difference in the AOS, AOFAS, or clinical balance test scores between KLG and 3 at any time point		

CR: conventional radiography; US: ultrasonography; OR (95% CI) ratio with 95% confidence interval; HA: hyaluronic acid; VAS: visual analogue scale; KLG: Kellgren and Lawrence scale, AOFAS: America Orthopedic ankle and foot society score; AOS: foot and ankle outcome score

MAKING A DIAGNOSIS OF OSTEOARTHRITIS – HAND

Q1: What is the added value of imaging to the diagnosis of OA?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome	
Matsos M 2009 [258]	62	Cross-sectional	US	Clinical diagnosis	n (%) Certainty pre-US vs certainty post-US	primary OA: 29 (46.8) vs 45 (73.0) p=0.002; inflammatory OA 29 (46.8) vs 54 (87.1) p<0.001

CR: conventional radiography; US: ultrasonography; Se: sensitivity; Sp: specificity; LR+: positive likelihood ratio; LR-: negative likelihood ratio; AUC: area under the curve

Q2: What is the accuracy of different imaging modalities for detecting OA features (soft tissues and bone involvement)?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome				
Cicuttini F 1998 [268]	6590 DIP	Cross-sectional	CR DIP	Physical examination	osteophytes	**Se**	**Sp**	**LR+**	**LR-**
						0.49 (0.46,0.53)	0.88 (0.88,0.89)	4.51 (4.08,4.98)	0.565 (0.53,0.60)
Grainger A 2007 [269]	120 joints	Cross-sectional	MRI DIP PIP	CR	erosions	**Se**	**Sp**	**LR+**	**LR-**
						1 (0.66,1)	0.74 (0.65,0.82)	3.96 (2.88,5.46)	0
Haims AH 2004 [270]	85	Cross-sectional	MRI wrist	Surgery	cartilage		**Se**	**Sp**	
						Distal radius	0.27	0.91	
						Scaphoid	0.31	0.90	
						Lunate	0.41	0.75	
						Triquetrum	0.18	0.93	
Haugen IK 2012 [271]	106	Cross-sectional	MRI DIP PIP	CR	Osteophytes Central erosions Marginal erosions JSN Cysts		**Se**	**Sp**	
						Osteophytes	1	0.22	
						Central erosions	0.78	0.72	
						Marginal erosions	0.83	0.94	
						JSN	0.95	0.63	
						Cysts	0.16	0.96	
Mutimer J 2008 [272]	20	Cross-sectional	MRI	Surgery	cartilage	**Se**	**Sp**	**LR+**	**LR-**
						0.71 (0.58,0.82)	0.77 (0.61,0.89)	3.19 (1.75,5.78)	0.37 (0.24,0.57)
Keen HI 2008 [273]	37	Cross-sectional	US	CR	JSN osteophytes		**Se**	**Sp**	**LR+**	**LR-**
						JSN	0.82 (0.77,0.86)	0.72 (0.69,0.75)	2.92 (2.62,3.35)	0.25 (0.19,0.32)
						osteophytes	0.83 (0.78,0.87)	0.75 (0.72,0.78)	3.42 (2.99,3.90)	0.22 (0.17,0.28)
Koutroumpas AC 2010 [274]	18	Cross-sectional	US DIP PIP	Physical examination	synovitis	PD as reference standard for inflammation: Se of clinical assessment = 0.15, Sp = 0.96			

CR: conventional radiography; US: ultrasonography; Se: sensitivity; Sp: specificity; LR+: positive likelihood ratio; LR-: negative likelihood ratio; DIP: distal interphalangeal joints: PIP: proximal interphalangeal joints; JSN: joint space narrowing

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome					
Mathiessen A 2013 [275]	127	Cross-sectional	US DIP PIP MCP CMC	Physical examination CR MRI	osteophytes		**Se**	**Sp**	**LR+**	**LR-**
						US vs MRI	0.95 (0.93,0.96)	0.86 (0.81,0.90)	7.08 (5.04,9.93)	0.05 (0.04,0.08)
						US vs CR	0.04 (0.029,0.05)	0.35 (0.33,0.36)	0.06 (0.05,0.08)	2.74 (2.59,2.90
						US vs PE	0.89 (0.87,0.91)	0.68 (0.67,0.70)	2.89 (2.71,3.08)	0.15 (0.13,0.18)
Vlychou M 2013 [276]	20	Cross-sectional	US DIP PIP MCP CMC	MRI	Osteophytes Erosions Cysts Synovitis Tenosynovitis Effusion		**Se**		**Sp**	
						osteophytes	0.9 (0.84,0.94)		0.95 (0.85,0.99)	
						erosions	0.88 (0.81,0.93)		0.96 (0.89,0.98)	
						cysts	0.87 (0.75,0.94)		0.97 (0.92,0.99)	
						synovitis	0.84 (0.75,0.90)		0.96 (0.91,0.99)	
						tenosynovitis	0.8 (0.57,0.94)		0.99 (0.96,1)	
						effusion	0.92 (0.73,0.99)		0.98 (0.95,0.99)	
Wittoek R 2010 [277]	38	Cross-sectional	US DIP PIP IP1	CR	Erosions	**Se**	**Sp**	**LR+**	**LR-**	
						0.94(0.86,0.98)	0.90 (0.87,0.93)	10.20 (7.68,13.55)	0.06 (0.02,0.16)	
Iagnocco A 2005 [278]	110	Cross-sectional	US DIP PIP	CR	Erosions	**Se**	**Sp**	**LR+**	**LR-**	
						0.72 (0.49,0.89)	1 (0.95,1)	-	0.27 (0.14,0.54)	
Vlychou M 2009 [279]	22	Cross-sectional	US DIP PIP MCP CMC	CR	Erosions osteophytes	• Erosions were detected in 231/660 (35%) small joints by US imaging, and in 115/660 (17.4%) small joints with conventional radiographs [P<0.05]. • Osteophytes were detected in 360/660 (54.5%) small joints by US imaging and in 310/660 (47%) small joints with conventional radiographs [P<0.05]				
Wittoek R 2011 [280]	14	Cross-sectional	US DIP PIP IP1	MRI	Erosions	**Se**	**Sp**	**LR+**	**LR-**	
						0.65 (0.50,0.79)	0.90 (0.80,0.96)	7.15 (3.24,15.74)	0.38 (0.25,0.56)	
Iagnocco A 2000 [281]	57	Cross-sectional	US	Synovial fluid aspiration	Effusion	Successful synovial fluid aspiration in patients with US effusion: 18/18, Se=1 Visualization of effusion in healthy controls in which saline solution was injected: 3/3, Se=1				

CR: conventional radiography; US: ultrasonography; MRI: magnetic resonance imaging; Se: sensitivity; Sp: specificity; LR+: positive likelihood ratio; LR-: negative likelihood ratio; DIP: distal interphalangeal joints: PIP: proximal interphalangeal joints; MCP: metacarpophalangeal joints; CMC: carpometacarpal joints; IP1: first interaphalangeal joint; PE: physical examination

PROGNOSIS OF OA - HAND

Q5: What is the prognostic (prediction of outcome) value of imaging in OA?

Cross- sectional studies

Reference	No of subjects	Study design	Imaging modality	Outcome				
Jones G 2001 [282]	522	Cross-sectional	CR CMC DIP	Altman score/AUSCAN	Beta coefficient, p	**CMC score**	**DIP score**	
					AUSCAN pain	+0.14 (0.024)	+0.17 (0.003)	
					AUSCAN function	+0.19 (<0.001)	+0.15 (0.012)	
					Grip strenght	−0.09 (0.010)	−0.12 (0.012)	
Bijsterbosch J 2010 [283]	236	Cross-sectional	CR	Erosions/pain function and QoL	Mean, sd	**Erosive OA**	**Non erosive OA**	**p**
					AUSCAN pain (0–20)	9.0±4.8	7.0±4.8	0.016
					MHQ pain (0–100)	47.1±18.1	37.9±22.8	0.016
					Number of painful joints (0–30)	11.3±6.8	7.9±7.8	0.009
					Pain intensity (0–90)	8.7±7.2	6.6±7.0	0.082
					AUSCAN function (0–36)	17.3±8.7	13.2±8.7	0.006
					MHQ overall function (0–100)	53.5±14.8	61.2±15.6	0.004
					MHQ ADL (0–100)	73.2±19.4	79.3±17.8	0.049
					MHQ work performance (0–100)	65.2±24.5	71.1±25.9	0.182
					Grip strength (kg)	19.7±8.4	21.7±10.7	0.241
					Pinch grip (kg)	3.2±1.8	3.2±1.5	0.872
					HAMIS (0–27)	5.7±4.0	3.7±2.6	<0.001
					Fingertip to palm distance (mm)	54.0±52.1	15.1±27.3	<0.001

CR: conventional radiography: CMC: carpometacarpal joint; DIP: distal interphalangeal joint; AUSCAN: Australian Canadian OA hand index; MHQ: Michigan hand questionnaire; ADL: activities of daily living; HAMIS: hand mobility in scleroderma; QoL: quality of life

Reference	No of subjects	Study design	Imaging modality	Outcome						
Kortekaas M 2011 [284]	55	Cross-sectional	CR US CMC MCP DIP PIP IP1	US and CR osteophytes and JSN/pain			**OR 95% CI**			
					US osteophytes	**Grade 1 vs 0**	1.6 (1.2, 2.3)			
						Grade 2 vs 0	2.7 (1.8, 4.1)			
						Grade 3 vs 0	4.8 (3.1, 7.5)			
					CR osteophytes	**Grade 1 vs 0**	2.0 (1.5, 2.7)			
						Grade 2 vs 0	3.2 (2.1, 4.8)			
						Grade 3 vs 0	4.1 (2.4, 7.1)			
					CR JSN	**Grade 1 vs 0**	1.8 (1.3, 2.4)			
						Grade 2 vs 0	4.3 (2.6, 7.2)			
						Grade 3 vs 0	4.2 (2.0, 9.0)			
Kwok YK 2013[285]	80	Cross-sectional	CR DIP PIP MCP CMC ST IP1	Erosions/pain and function			**Erosive vs non erosive (mean difference 95% CI)**			
					AUSCAN pain		1.3 (0.3, 2.3)			
					AIMS2 pain subscale		0.8 (0.3, 1.4)			
					AUSCAN function		2.3 (0.4, 4.2)			
					AIMS2 hand finger subscale		0.8 (0.2, 1.3)			
					Grip strenght		-3.0 (-7.1,3.4)			
Marshall M 2009 [286]	592	Cross-sectional	CR DIP PIP MCP CMC ST IP1	OA location/pain and function	Mean	**Non OA**	**Finger OA**	**Thumb OA**	**Finger+ thumb OA**	**p**
					AUSCAN pain	8.3 (6.7-9.8)	8.2 (6.3-10.1)	8.6 (6.9-10.3)	10.5 (9.6-11.4)	0.0018
					AUSCAN function	5.4 (4.6-6.2)	5.7 (4.7-6.8)	5.8 (4.9-6.7)	6.5 (6.1-7.0)	0.07
Wittoek R 2012 [287]	349	Cross-sectional	CR DIP PIP CMC	number of remodeled joints and CMC involvement/pain and function	Beta coefficient, p		**No of remodeled joints**		**CMC involvement**	
					VAS pain		0.99 p<0.001		-3.31 p>0.05	
					AUSCAN pain		0.25 p<0.001		-2.72 p>0.05	
					AUSCAN function		2.01 p<0.01		-2.72 p>0.05	
					FIHOA		3.51 p<0.01		1.59 p>0.05	

CR: conventional radiography; US: ultrasonography; CMC: carpometacarpal joint; DIP: distal interphalangeal joint; MCP: metacarpophalangeal joints; DIP: distal interphalangeal joints; PIP: proximal interphalangeal joints; IP1: 1st interphalangeal joint; JSN: joint space narrowing; OR (95%CI): odds ratio with 95% confidence intervals; AUSCAN: Australian Canadian OA hand index; AIMS: arthritis impact measurement scale; VAS: visual analogue scale; FIHOA: functional index for hand OA.

Reference	No of subjects	Study design	Imaging modality	Outcome			
Keen HI 2008 [288]	67	Case-control	US CMC MCP DIP PIP IP1	Osteophytes, PD, effusion and synovial thickening/pain and tenderness	Painful and tender joints were significantly more likely to have osteophytes, JSN, synovitis or PD		
Kortekaas M 2010 [289]	55	Cross-sectional	US CMC MCP DIP PIP IP1	GS and PD/ tenderness			**OR (95%CI)**
					GS	1vs0	2.1 (1.5, 2.8)
						2vs0	4.7 (2.8, 7.8)
						3vs0	4.0 (1.9, 8.2)
					Effusion	1vs0	2.0 (1.5, 2.6)
						2vs0	3.8 (2.3, 6.1)
						3vs0	3.7 (1.8, 7.6)
					Synovial thickeninkg	1vs0	1.3 (0.7, 2.4)
						2-3 vs 0	2.6 (1.1, 6.3)
					PD	1vs0	1.4 (1.0, 2.1)
						2-3 vs 0	2.0 (0.8, 4.9)
Jonsson H 1999 [290]	297	Cross-sectional	Radioisotope scan	Uptake/symptoms	"Hand symptoms were related to distal interphalangeal (DIP) and CMC1 uptake, thumb symptoms with first metacarpophalangeal joint (MCP1) CMC1 uptake, and knee symptoms with the subchondral knee uptake pattern."		
Dahaghin s 2006 [291]		SLR					
Kwok WY 2013 [292]		SLR					

US: ultrasonography; CMC: carpometacarpal joint; DIP: distal interphalangeal joint; MCP: metacarpophalangeal joints; DIP: distal interphalangeal joints; PIP: proximal interphalangeal joints; IP1: 1st interphalangeal joint; PD: power Doppler; GS: grey scale; OR (95% CI): odds ratio with 95% confidence interval; SLR: systematic literature review

Reference	No of subjects	Study design	Imaging modality	Outcome				
Haugen I 2012 [293]	85	Cross-sectional	CR MRI DIP PIP	CR and MRI/pain and function		**Tenderness (OR 95% CI)**	**FIHOA B (beta coefficients)**	**Grip strength (beta coefficients)**
					Synovitis	2.4, (1.5,3.6)	0.45 (0.01,0.89)	-
					BMLs	1.6 (1.0, 2.5)	-	-
					Osteophytes	1.4 (0.9, 2.1)	0.23 (0.07, 0.39)	−0.39 (−0.58, −0.21)
					Bone attrition	2.5 (1.5, 4.1)	0.58 (0.18,0.97)	−0.87 (−1.34, −0.39)
					Flexor tenosynovitis	1.5 (1.0,2.3)	-	
					Erosions	-	-	−0.43 (−0.69,−0.16)
					JSN	-	0.28 (0.01, 0.54)	−0.53 (−0.84,−0.23)
Wenham C 2012 [294]	65	RCT	MRI	Synovitis and effusion/pain and tenderness	Tenderness: OR (95%CI) 4.7 (2.8, 7.9) Pain: OR (95%CI) 3.7 (95% CI 2.2, 6.2)			
CR: conventional radiography; MRI: magnetic resonance imaging; DIP: distal interphalangeal joints; PIP: proximal interphalangeal joints; OR (95% CI): odds ratio with 95% confidence interval; FIHOA: functional index for hand OA; BMLs: bone marrow lesions								

Longitudinal studies

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Haugen IK 2013 [295]	190	Cohort	CR DIP PIP MCP CMC	7 years	KLG/tenderness	Joint tenderness increases with the severity of KLG. In multivariate model significant association with osteophytes, malalignement and erosions		
Ding H 2011 [296]	436	Cohort	CR DIP PIP MCP IP1	5 years	KLG≥2/incident pain	**Fingers 1-3 right**	RR= 1.76 (1.16,2.69)	
						Fingers 1-3 left	RR= 3.0 (1.97,4.58)	
						Fingers 4-5 right	RR= 2.30 (1.38,3.82)	
						Fingers 4-5 left	RR= 1.93 (1.06,3.53)	
Bijsterbosch J 2011 [297]	236	Cohort	CR	6 years	Osteophytes and JSN/erosive progression	Osteophyte grade 2-3 OR (95% CI) 0.7 (0.3,2.0) JSN grade 2-3 8.9 OR (95% CI) (4.8,16.4)		
Dahaghin S 2005 [298]	1235	Cohort	CR	6.6 years	Hand OA/incident knee or hip OA	OR= 2.2 (1.5,3.3) for incident hip/knee OA in case of hand OA		
Filkova M 2009 [299]	88	Cohort	CR	2 years	Erosions/Kallman score progression		**Erosive OA**	**Non erosive OA**	**p**
						Kallman score progression (mean, sd)	2.41(3.06)	0.57 (1.07)	0.002
Balblanc J 1995 [300]	15	Cohort	Radioisotope scan	4 years	Abnormal scan/incident OA in previously normal joints	OR (95% CI)= 5.95 (1.51,23.44)		
Hutton CW 1986 [301]	14	Cohort	Radioisotope scan	5 years	Abnormal scan/structural progression	OR 95% CI= 7.22 (4.28, 12.17)		
McCarthy M 1994 [302]	67	Cohort	Radioisotope scan	5-6 years	Abnormal scan/structural progression	OR (95% CI= 14.53 (9.25,22.82)		

CR: conventional radiography; CMC: carpometacarpal joint; MCP: metacarpophalangeal joints; DIP: distal interphalangeal joints; PIP: proximal interphalangeal joints; IP1: 1st interphalangeal joint; KLG: Kellgren and Lawrence grade; OR (95% CI): odds ratio with 95% confidence interval; RR: risk ratio; sd: standard deviation; JSN: joint space narrowing

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Kortekaas M 2014 [303]	25	Cohort	US	3 months	Synovial thicknening, effusion and PD/incident pain	synovial thicknening OR (95%CI) 2.0 (1.1, 3.9) effusion OR (95%CI) 4.8 (2.2, 10.5) PD OR (95%CI) 3.8 (2.7, 5.4)
Zhang W 2008 [304]		Case-control	CR		Hand finger pattern/incident hip or knee OA	Development of OA in case of type 3 finger pattern (OR 95% CI) Knee OA: OA 1.94 (1.54–2.44) Hip OA: 1.37 (1.13–1.67) IP nodes: 0.99 (0.83–1.18) IP nodes+ hip or knee OA 1.69 (1.33–2.16)

US: ultrasonography; CR: conventional radiography; DIP: distal interphalangeal joints; PIP: proximal interphalangeal joints; PD: power Doppler; JSN: joint space narrowing; OR (95% CI): odds ratio with 95% confidence interval

Q6: What is the prognostic (prediction of therapeutic response) value of imaging in OA?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Mallinson P 2013 [305]	31	Cohort	US CR	6 weeks	CR and US/ response to intraarticular triamcinolone	No significant association between treatment response and grades for osteophytes (p =0.148), joint-space narrowing (p = 0.850), and capsule thickness (grade or size; p =0.918, p =0.235)
Wenham C 2012 [294]	65	RCT	MRI	12 weeks	MRI/response to prednisolone 5 mg	The baseline number of joints with definite synovitis or effusion did not correlate with OARSI response at 4 weeks.

US: ultrasonography; CR: conventional radiography; MRI: magnetic resonance imaging; OARSI: osteoarthritis research society international

Q7: When, how often and under what clinical circumstance should imaging be used in the follow-up of osteoarthritic joints?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Bijsterbosch J 2011 [297]	172	Cohort	CR	2-6 years	Proportion of joints progressing according to KLG, VV grade or OARSI atlas	(%)	**KLG**	**VV**	**OARSI**
						2 years	18.9-56.2	13.3-52.2	6.7-37.8
						6 years	50.6-79.8	26.7-65.6	33.3-74.4
Botha Scheepers S 2009 [306]	90	Cohort	CR	2 years	Sensitivity to change of JSN and osteophytes	JSN: SRM= 0.35 Osteophytes: SRM= 0.34			
Botha-Scheepers S 2005 [307]	20	Cohort	CR	2 years	Sensitivity to change of JSN and osteophytes	JSN: SRM= 0.38 Osteophytes: SRM= 0.41			
Haugen IK 2013 [295]	190	Cohort	CR	7 years	Radiographic progression/incident tenderness	joints with progression had higher odds of tenderness, joints with incident KL 3 or 4 had higher odds of tenderness			
Maheu EC 2007 [308]	105	RCT	CR	12 months	Sensitivity to change of VV score, OA global score, Kallman score and KLG	KLG: SRM= 0.17 Kallman: SRM= 0.26 Verbrueggen: SRM= 0.18 Global score: SRM= 0.17			
Macfarlane DG 1991 [309]	32	Cohort	CR Radioisotope scan	1 year	Sensitivity to change of osteophytes detected by CR and radioisotope scan	Radioisotope scan SRM=0.21 CR SRM=0.20			

CR: conventional radiography; KLG: Kellgren and Lawrence grade; VV: Verbruggen-Veys score; OARSI: osteoarthritis research society international; JSN: joint space narrowing; SRM: standardized response mean; DIP: distal interphalangeal joints; MCP: metacarpophalangeal joints

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Jans L 2013 [310]	9	Cohort	MRI (DCE)	1 year	Change of DCE parameters during 1 year	**Mean**	**baseline**	**12 months**	**p**
						Synovium maximum upslope	19.8	3.1	0.002
						Synovium enhancement curve	2.31	0.76	0.01
						Absolute enhancement	5.9	3.1	0.002
Keen HI 2011 [311]	36	Cohort	US	12 weeks	Correlation between GS and PD synovitis and decrease in pain after i.m. methylprednisolone	No significant association between changes in GS and PD at 4 and 12 weeks and response			
Klauser AS 2012 [312]	33	Cohort	US	4 weeks	Correlation between joint thickening and PD and VAS pain after intraarticular HA	decrease VAS pain statistically significantly correlated with the decrease of joint thickening ($p < 0.001$; $r = 0.7$) and PDUS score ($p < 0.001$; $r = 0.8$)			
Kortekaas MC 2014 [303]	25	Cohort	US	3 months	Change in scores for synovial thickening, effusion and PD		**baseline**	**3 months**	
						synovial thickening	5(0-23)	4 (0-19)	
						effusion	6(0-25)	8 (0-27)	
						PD	3(0-11)	2 (0-14)	
Saltzherr 2014 [313]		SLR	US						

MRI: magnetic resonance imaging; US: ultrasonography; OR (95% CI): odds ratio with 95% confidence interval; BMLs: bone marrow lesions; DCE: dynamic contrast enhanced; GS: grey scale; PD: power Doppler; i.m.: intramuscular; VAS: visual analogue scale; HA: hyaluroinic acid: PDUS: power Doppler ultrasound; SLR: systematic literature review

Q9: What is the value of imaging-guided interventions in OA with respect to accuracy, therapeutic response, clinical and imaging outcome?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Karalezli N 2007 [314]	16	Cohort	CR	1 month	Fluoroscopy-guided vs blind injections of HA in TM	VAS pain related to the procedure: Fluoroscopic guide: 4.1 (range 3–6) Anatomic guide 5.6 (range 3–7) p<0.005 Safety (guided vs blind) 1.00 (0.017, 56.46)
US: ultrasonography; CR: conventional radiography; HA: hyaluronic acid; TM: trapeziometacarpal; VAS: visual analogue scale; sd: standard deviation						

MAKING A DIAGNOSIS OF OSTEOARTHRITIS – HIP

Q2: What is the accuracy of different imaging modalities for detecting OA features (soft tissues and bone involvement)?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome					
Leydet-Quilici H 2010 [315]	23	Cross-sectional	MRI	surgery	BMLs/histology	**Se**	**Sp**			
						0.80	0.95			
Taljanovic M 2008 [316]	19	Cross-sectional	MRI	Surgery	BMLs/histology	number of microfractures and focal signal/intensity ratio (r=−0.48, P<0.05). No statistically significant correlation between the calculated MRI values and other histopathologic findings, including the amount of BME					
Xu L 2013 [317]	44	Cross-sectional	CR	MRI	CR vs MRI		**Se**	**Sp**	**LR+**	**LR-**	**AUC**
						JSN	0.64	0.88	0.90	0.58	0.75
						osteophytes	0.84	0.71	0.94	0.45	0.77
						subchondral cysts	0.44	0.89	0.58	0.94	0.66
						bone attrition	0.78	0.86	0.58	0.94	0.81

CR: conventional radiography; MRI: magnetic resonance imaging; BMLs: bone marrow lesions; Se: sensitivity; Sp: specificity; LR+: positive likelihood ratio; LR-: negative likelihood ratio; AUC: area under the curve; r: correlation coefficient; JSN: joint space narrowing;

MANAGEMENT OF OA - HIP

Q4: In people with OA do imaging have an impact on management?

Reference	No of subjects	Study design	Imaging modality	Comparator	Outcome	
Dolin SJ 2003 [318]	72	Cross-sectional	CR	surgery	Priority of THR assignment based on radiographic severity graded 0-15	Relative Risk (95%CI) for priority assignment: CR grading>9/15, RR (95% CI) 1.98 (1.23, 3.19)

CR: conventional radiography; THR: total hip replacement; RR (95%CI): risk ratio with 95% confidence interval

PROGNOSIS OF OA - HIP

Q5: What is the prognostic (prediction of outcome) value of imaging in OA?

Cross-sectional studies

Reference	No of subjects	Study design	Imaging modality	Outcome			
Taljanovic M 2008 [316]	19	Cross-sectional	MRI	BMLs/symptoms	the total signal/intesity ration of BML was significantly correlated with symptoms: pain : r −0.46 p<0.05		
Iagnocco A 2012 [319]	75	Cross-sectional	US	effusion synovitis osteophytes/pain		**Previous hip pain**	**Current hip pain**
					Joint effusion	93.3% vs 73.7% p<0.001	93.3% 57.9% p<0.0001
					Synovial hypertrophy	90% vs 82.7% p>0.05	90% vs 72.4% p>0.05
					osteophytes	82.5% vs 100% p>0.05	82.5% vs 100% p>0.05
Recnik G 2009 [320]	54	Cross-sectional	CR	Measure of centre-edge angle/age at THR	β coefficient for linear regression was 0.271 (r2 = 0.073; P = 0.024) for the correlation between centre-edge angle and age at THR, with lower angles associated to yaunger age		
Lievense A 2002 [321]		SLR					
Wright AA 2009 [322]		SLR					
Holla JF 2011 [57]	497	Cross-sectional	CR	CR/function	Beta coefficient (95% CI)	**Internal hip rotation**	**External hip rotation**
					severe JSN superior	-12.20 (-16.00,-8.40) p<0.0001	-5.39 (-9.00, -1.78) p=0.004
					severe JSN medial	-3.47 (-7.08, 0.14) p=0.14	-3.49 (-6.60, -0.37) p=0.03
					moderate/severe osteophytes superior	-6.48 (-9.13,-3.48) p<0.0001	-1.22 (-3.67, 1.23) p=0.33
					moderate/severe osteophytes inferior	-16.54 (-21.93,-11.15) p<0.0001	-4.95 (-9.83, -0.07) p=0.05
					subchondral sclerosis	-6.71 (-11.04, -2.38) p=0.002	-3.36 (-7.27, 0.56) p=0.09
					flattening of the femoral head	-0.69 (-3.60, 2.23) p=0.64	-4.52 (-7.07, -1.96) p=0.001
					femoral buttressing	-1.46 (-3.75, 0.82) p=0.21	-4.41 (-6.44, -2.39) p<0.0001

CR: conventional radiography; MRI: magnetic resonance imaging; US: ultrasonography; BMLs: bone marrow lesions; r: correlation coefficient; JSN: joint space narrowing

Longitudinal studies

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Agricola R 2013 [323]	720	Cohort	CR	5 years	amount of acetabular coverage/ VAS pain, function	No significant prediction of 5-years incident pain Lateral pincer deformity resulted in decreased internal rotation (29.87° vs 30.82°, P = 0.035)			
Agricola R 2013 [324]	723	Cohort	CR	5 years	active shape modeling of proximal femur and pelvis/pain, ACR criteria	• mode 9 associated with VAS pain • no modes predicted the fulfillment of the ACR criteria • mode 7 predicted internal rotation<15°			
Arden NK 2009 [325]	5839	Cohort	CR	5 years	CR/pain and THR	**OR (95%CI)**	**pain**	**Change in lower limb disability**	**THR**
						osteophyte grade≥2	4.1 (2.4,6.9)	1.0 (0.8–1.4)	9.9 (6.0,16.3)
						JSN grade ≤2 lateral OR JSN grade ≤3 medial	4.8 (2.3,8.0)	2.2 (1.7–2.8)	8.2 (4.6,14.6)
						MJS ≤1.5	5.2 (3.0,9.1)	1.9 (1.5–2.5)	10.3 (6.0,17.8)
						MJS ≤2.0	3.2 (1.9,5.5)	1.7 (1.3,2.1)	6.4 (3.8,11.0)
						MJS ≤2.5	2.4 (1.5,3.9)	1.4 (1.1,1.7)	3.9 (2.3,6.7)
						KLG≥2	5.7 (3.2,9.8)	1.1 (0.8,1.5)	13.8 (8.3,23.0)
Gossec L 2009 [326]	1404	Cohort, RCT	CR	3 years	KLG, OARSI JSN, JSW/pain, function and THR	**OR (95% CI)**	**Symptoms (cross-sectional**	**Structural progression**	**THR**
						KLG 2 vs 1	0.87 (0.33,2.28)	1.31 (0.50,3.43)	
						KLG 3 vs 1	0.88 (0.33,2.39)	1.73 (0.64,4.68)	KLG 3 vs 2 2.62(1.67,4.13)
						KLG 4 vs 1	0.25 (0.01,4.66)	1.45 (0.10,21.07)	
						OARSI 2 vs 1	1.09 (0.77,1.54)	1.14 (0.81,1.62)	
						OARSI 3 vs 1	0.85 (0.45,1.61)	0.96 (0.51,1.82)	4.47 (1.98,10.05)
						JSW 1 vs 0	0.92 (0.55,1.53)	0.77 (0.46,1.29)	
						JSW 2 vs 0	1.14 (0.72,1.82)	1.47 (0.92,2.36)	
						JSW 3 vs 0	1.00 (0.60,1.68)	1.21 (0.72,2.03)	4.02 (1.88,8.56)

CR: conventional radiography; VAS: visual analogue scale; ACR: American college of Rheumatology; THR: total hip replacement; OR 95% CI: odds ratio with 95% confidence interval; JSN: joint space narrowing; mJS: medial joint space; KLG: Kellgren and Lawrence grade

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Gossec L 2005 [327]	505	Cohort	CR	2 years	KLG and pattern of migration of the femoral head/THR	OR (95% CI) of 2 year THR: KLG 3 vs 2: 3.3 (1.7,6.4); KLG 4 vs 2: 5.3 (2.6,10.8)		
Lievense A 2007 [328]	224	Cohort	CR	6 years	KLG, JSW<2.5 mm, osteophytes/THR		**3 years THR (OR, p)**	**6 years THR (OR, p)**
						KLG≥2	13.0 p<0.01	17.8 p<0.01
						osteophytes	3.3 p=0.01	3.1 p<0.01
						JSW<2.5	6.6 p<0.01	7.1 p<0.01
Maillefert JF 2002 [329]	422	Cohort	CR	5 years	mJSW at 1 and 2 years follow up/THR	Thresholds of -0.2 mm and -15%, i.e. a decrease in JSW of at least 0.2 mm (15%), were the most relevant, with sensitivity of 75 and 68% (20.2 mm) and 74 and 78% (215%) respectively.		
Lane NE 2004 [330]	745	Cohort	CR	8 years	CR/structural progression THR	**OR (95% CI)**	**Radiographic progression**	**THR**
						osteophytes	2.1 (1.0, 4.3)	3.8 (2.1, 7.1)
						cysts	0.6 (0.3, 1.0)	3.5 (1.8, 6.8)
						sclerosis	1.2 (0.9, 1.8)	5.1 (1.8, 14.6)
						JSN concentric	0.5 (0.2, 1.1)	9.2 (3.8, 22.5)
						JSN superolateral	0.5 (0.2, 1.1)	3.0 (1.4, 6.3)
						JSN superomedial	0.6 (0.3, 0.9)	5.1 (2.2, 11.9)
Ledingham J 1993 [331]	252	Cohort	CR	27 months	KLG and pattern of migration of the femoral head/THR, rapid, slow or no progression	**Rapid progression:** superior migration 9.0 (1.24, 183.52); **NO progression:** %medial/axial migration 3.71(1.09,13.83); intermediate migration 11.41 (2.47,72.79) **THR:** OR 95% CI any joint progression 2.19 (1.18, 4.08); rapid joint progression 5.83 (1.90,19.11)		
Conrozier T 1998 [332]	367	Cohort	CR	1 year	JSW/JSW progression	the mean JSW at 12 months was correlated with baseline JSW (r=0.66, p=0.01)		
Reijman M 2005 [333]	1904	Cohort	CR	1 year	KLG and baseline JSW/radiographic progression		**OR (95%CI)**	
						KLG≥2	5.8 (4.0, 8.4)	
						Baseline JSW≤2.5 mm	1.9 (1.2,2.9)	

CR: conventional radiography; KLG: Kellgren and Lawrence grade; OARSI: osteoarthritis research society international; JSN: joint space narrowing; THR: total hip replacement; OR 95% CI: odds ratio with 95% confidence interval; JSW: joint space width; mJSW: minimal joint space width

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome		
Barr RJ 2012 [334]	195	Cohort	CR	5 years	active shape modeling/symptoms and function	• correlation between mode 2 and baseline pain duration: r=-0.26 (p=0.005) • mode 4 vs baseline WOMAC function r=-0.19 (p=0.034) • mode 2 OR=0.54 (0.29, 0.99) for 5 years THR	
Agricola R 2013 [335]	865	Cohort	CR	5 years	α angle/incident OA	OR (95% CI)=2.42 (1.15,5.06) for incident OA. OR (95% CI)=9.66 (4.78,19.78) for end stage OA	
Dougados M 1996 [336]	508	Cohort	CR	1 year	pattern of migration of the femoral head, KLG and JSW/change in JSW		**OR (95%CI)**
						Superolateral migration	4.25 (2.26,8.01)
						Baseline JSW≤2 mm	2.11 (1.30,3.44)
Ahedi H 2014 [337]	198	Cohort	MRI		BMLs/cross sectional and incident pain	Cross-sectional hip pain: OR (95%CI)= 4.43 (1.46, 13.2)	Incident hip pain: BMLs resolving vs absent MD (sd) −0.95 (−2.85 to +1.04) Incident vs absent +2.08 (+0.22 to +3.94). knee pain BMLs resolving vs absent MD (sd) −1.81 (−3.82 to +0.21); Incident vs absent −0.75 (−2.34 to +0.82)
Zhang W 2008 [304]		Case-control	CR		Hand finger pattern/incident hip or knee OA	Development of OA in case of type 3 finger pattern: Knee OA: OA 1.94 (1.54–2.44) Hip OA: 1.37 (1.13–1.67) IP nodes: 0.99 (0.83–1.18) IP nodes+ hip or knee OA 1.69 (1.33–2.16)	

CR: conventional radiography; MRI: magnetic resonance imaging; KLG: Kellgren and Lawrence grade; THR: total hip replacement; OR (95% CI): odds ratio with 95% confidence interval; JSW: joint space width; BMLs: bone marrow lesions; MD: mean difference; IP: interphalangeal

Q6: What is the prognostic (prediction of therapeutic response) value of imaging in OA?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
Atchia I 2011 [338]	77	RCT	US	16 weeks	Synovitis/response to methylprednisolone	OR 95% CI= 16.7 (1.4,204)		
Hirsch G 2013[170]		SLR						
Keurentjes J 2013 [164]	723	Cohort	CR	5 years	KLG/QoL after THA or TKA	SF36 subscales	**Mean difference (95%CI) KLG0-2 vs 3-4**	
						Physical functioning	8.93 (2.14,15.7) p=0.01	
						Role physical	6.39 (25.89,18.7) p=0.31	
						Bodily pain	0.88 (26.08,7.84) p=0.80	
						General Health	20.66 (25.66, 4.34) p=0.79	
						Vitality	23.53 (29.03,1.97) p=0.21	
						Social functioning		
						Role emotional	3.11 (28.22,14.4) p=0.59	
						Mental health	21.80 (26.13,2.50) p=0.41	
						PCS	1.94 (20.57–4.44) p=0.13	
						MCS	22.03 (24.46,0.39) p=0.10	
						NRS satisfaction	0.3 (20.2–0.9) p=0.19	
Lequesne M 2002 [339]	163	RCT	CR	2 years	JSW/structural progression	In patients with initial smaller JSW treated with avocado soybean, the reduction of JSW was half than in the placebo group; no differences among treatment and placebo in patients with more JSW		
Rennesson- Rey B 2008 [340]	55	Cohort	US CR	6 months	Effusion and KLG/OARSI response to HA	**OARSI response**	**KLG 1-2**	**KLG 3-4**	**p**
						1 month	50%	22%	0.06
						3 months	58%		0.15
						6 months	10%	18%	
						effusion	No significant difference		

CR: conventional radiography; US: ultrasonography; OR (95%CI): odds ratio with 95% confidence interval; KLG: Kellgren and Lawrence grade; QoL: quality of life; THA: total hip replacement; TKA: total knee replacement; SF39: short form 36; PCS: physical component score; MCS: mental component score; JSW: joint space width; OARSI: osteoarthritis research society international; HA: hyaluronic acid

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Rozendaal RM 2009 [341]	222	RCT	CR	2 years	KLG/WOMAC pain and function, JSN		**KLG 1**		**KLG 2**
						WOMAC pain	-1.4 (95% CI [-6.7, 3.8])		-1.4 (95% CI [-7.4, 4.7])
						WOMA C function	-0.09 mm (95% CI [-0.22, 0.04])		0.09 mm (95% CI [-0.07, 0.24]
						JSN	-1.5 (95% CI [-5.8, 2.9])		-2.1 (95% CI [-7.5, 3.3]
Hoeksma KL 2005 [342]	103	RCT	CR		KLG/Harris Hip score and range of motion in response to manual therapy vs exercise		**Low radiographic grade**	**High radiographic grade**	**p**
						HHS	MT -23.6 ET -10.36	MT -16.01 ET -3.56	p=0.52
						Hip function	MT 19.62 ET 5.07	MT 17.24 ET -4.39	0.17
						ROM	MT 1.28 ET -1.49	MT -0.38 ET -3.02	p=0.01
Deshmukh A 2011 [343]	220	Cohort	CR	2 weeks	KLG/pain relief after methylprednisolone injections		**Immediate pain relief**		**Delayed relief**
						KLG 2	2.16 p=0.03		1.14 (0.56,2.32)
						KLG 3-4	3.94 p=0.001		5.33 (2.04,13.93)
Robinson P 2007 [344]	120	Cohort	US CR	12 weeks	US osteophytes and capsular thickneing, KLG/WOMAC response	no baseline US or radiographic variable predictive of the outcome			

CR: conventional radiography; US: ultrasonography; KLG: Kellgren and Lawrence grade; WOMAC: Western Ontario McMaster Universities osteoarthritis index; JSN: joint space narrowing; HHS: Harris hip score; ROM: range of motion; MT: manual therapy; ET; exercise therapy; CS: corticosteroids

FOLLOW-UP OF OA - HIP

Q7: When, how often and under what clinical circumstance should imaging be used in the follow-up of osteoarthritic joints?

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Auleley G 2000 [345]	104	RCT	CR	3 years	Sensitivity to change of mJSW	SRM -0.70
Botha-Scheepers S 2008 [346]	115	Cohort	CR	2 years	Sensitivity to change of JSN score	SRM 0.43
Conrozier T 2009 [347]	50	RCT	CR	3 years	Sensitivity to change of JSN	SRM 2.05
Conrozier T 1998 [332]	61	Cohort	CR	81 months	Sensitivity to change of mean JSW, mJSW, JS area,	Mean JSW SRM 1 mJSW SRM 0.82 JS area 1.03
Conrozier T 1998 [348]	48	Cohort	CR	1 year	Sensitivity to change of JSW	SRM 1.15
Dougados M 2001 [349]	269	RCT	CR	3 years	Sensitivity to change of JSW	SRM 1
Gossec L 2009 [326]	1404	Cohort, RCT	CR	3 years	Sensitivity to change of JSW, KLG and OARSI	SRM: 0.77 JSW; 0.28 KLG; 0.35 OARSI
Maillefert JF 2002 [329]	25	Cohort	CR	3 years	Sensitivity to change of JSW (manual vs computer)	JSW: -0.77 (-1.03,-0.44) computer based mJSW -0.64 (-0.93,-0.29) computer based average JSW -0.61 (-0.9, -0.31)
Lequesne M 2002 [339]	95	RCT	CR	2 years	Sensitivity to change of JSW	mean (sd) JSW baseline 2.35 ±0.93 2 years 1.87 ± 1.10 in avocado soy/bean; baseline 2.50 ±0.94 2 years 1.90 ± 1.33
Maheu C 2005[350]	50	RCT	CR	3 years	Sensitivity to change of JSW	-0.76 (-0.77 , -0.73) (mean change)

CR: conventional radiography; mJSW: minimal joint space width; SRM: standardized response mean; JSW: joint space width; KLG: Kellgren and Lawrence grade; OARSI: osteoarthritis research society international

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Maillefert JF 2002 [351]	25	Cohort	CR	5 years	Sensitivity to change of mJSW	Manual measure: –0.77 (–1.03, –0.44) Computer measure: –0.64 (–0.93, –0.29)
Papaloucas CD 2005 [352]	14	Cohort	CR	18 months	Sensitivity to change of mJSW	SRM=0.24
Pavelka K 2000 [353]	117	RCT	CR	5 years	Sensitivity to change of mJSW	mean change (SEM) 0-5 years: −0.21±0.08 treatment; −0.22±0.08 placebo
Ratzlaff C 2014 [354]	54	Case-control	CR	2 years	Sensitivity to change of mJSW	SRM 1.00
Jaremko J L 2014 [355]		SLR	CR			
Dougados M 1996 [336]	508	Cohort	CR	1 year	Sensitivity to change of mJSW	SRM 0.62
Lane NE 2004 [330]	745	Cohort	CR	8 years	Sensitivity to change of JSN	SRM 0.69

CR: conventional radiography; mJSW: minimal joint space width; SRM: standardized response mean; SEM: standard error; JSN: joint space narrowing

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