

COMPARING THE PERFORMANCE OF DIFFERENT RADIOGRAPHIC VIEWS IN THE ASSESSMENT OF OA - HIP

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome	
Auleley G 1998 [1]	64	Cross-sectional	Standing AP of the pelvis vs supine AP of the pelvis	-	Comparison between JSW in the two projections	AP standing: average JSW 4.1% (sd 25.6%) greater than supine radiographs
Conrozier T 1997 [2]	58	Cross-sectional	AP weightbearing of the pelvis vs AP non weightbearing of the pelvis	-	JSW: differences between the two techniques	Mean JSW (mm) (sd): non weightbearing 2.53±0.85 vs 2.45±0.85 p>0.05 Max JSW (mm) (sd): non weightbearing 1.94±0.61 vs 1.81±0.54 p<0.05
Pessis E 1999 [3]	25	Cross-sectional	Standing AP of the pelvis vs supine AP of the pelvis	-	metric index of the hip	No significant difference of the metric index between supine and WB AP views of the hip (p > 0.2)
Maheu C 2005 [4]	50	RCT	AP of the pelvis vs PA of the hip vs oblique of the hip	3 years	mJSW: intra-reader reliability, inter-reader reliability	<ul style="list-style-type: none"> ▪ Intra-reader reliability (ICC, 95% CI): AP of the pelvis 0.96 (0.93–0.98); AP of the hip: 0.96 (0.93–0.98); oblique of the hip: 0.88 (0.80–0.93) ▪ Inter-reader reliability (ICC): AP of the pelvis 0.80; AP of the hip: 0.88; oblique of the hip: 0.72 ▪ Sensitivity to change(SRM 95%CI): AP of the pelvis -0.76 (-0.77 , -0.73); AP of the hip -0.72 (-0.74 , -0.70); oblique of the hip -0.76 (-0.79, -0.73)
Conrozier T 2009 [5]	50	RCT	AP of the pelvis vs AP of the hip vs oblique view of the hip	3 years	JSW: intra-reader and inter-reader reliability; sensitivity to change	<ul style="list-style-type: none"> ▪ Intra-reader reliability: no significant difference in relation to the view (P=0.51) ▪ Inter-reader reliability: mean difference (sd) between the two observers: AP of the pelvis 0.1 (0.32) mm; AP of the hip 0.04 (0.31) mm; oblique: 0.05 (0.38) ▪ Sensitivity to change: SRM: 0.60 AP of the pelvis; 0.67 AP of the hip, 0.64 oblique
<p>AP: anteroposterior; PA: posteroanterior; JSW: joint space width; sd: standard deviation; RCT: randomized controlled trial; SRM: standardized response mean; mJSW: minimal joint space width; ICC: interclass correlation</p>						

COMPARING THE PERFORMANCE OF DIFFERENT RADIOGRAPHIC VIEWS IN THE ASSESSMENT OF OA- KNEE

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome																
Chaisson C 2000 [6]	377	Cross-sectional	fluoroscopically guided PA weightbearing vs skyline vs lateral	-	<ul style="list-style-type: none"> Comparison of radiographic views for the diagnosis of OA: PA+lateral (index test) vs PA+skyline (reference standard) <p>PA+lateral for the diagnosis of OA:</p> <ul style="list-style-type: none"> Sensitivity (95% CI): 0.96(0.95,0.97) Specificity (95% CI): 0 (0,0.14) LR+ (95% CI): 0.97(0.95,0.98) 																
Cicuttini F 1996 [7]	250	Cross-sectional	AP full extension weightbearing vs lateral standing 30° of flexion vs skyline 45° of flexion	-	<ul style="list-style-type: none"> Intra and inter-reader reliability for JSN and osteophytes Correlation between radiographic findings and pain 	<table border="1"> <thead> <tr> <th>Kappa coefficients</th> <th>Intra-reader reliability</th> <th>Inter-reader reliability</th> </tr> </thead> <tbody> <tr> <td>AP lateral tibiofemoral</td> <td>JSN: 0.92 Osteophytes: 0.96</td> <td>JSN: 0.60 Osteophytes: 0.90</td> </tr> <tr> <td>AP medial tibiofemoral</td> <td>JSN: 0.88 Osteophytes: 0.94</td> <td>JSN: 0.72 Osteophytes: 0.88</td> </tr> <tr> <td>Lateral patellofemoral</td> <td>JSN: 0.60 Osteophytes: 0.84</td> <td>JSN: 0.60 Osteophytes: 0.80</td> </tr> <tr> <td>Skyline patellofemoral</td> <td>JSN: 0.80 Osteophytes: 0.90</td> <td>JSN: 0.80 Osteophytes: 0.90</td> </tr> </tbody> </table>	Kappa coefficients	Intra-reader reliability	Inter-reader reliability	AP lateral tibiofemoral	JSN: 0.92 Osteophytes: 0.96	JSN: 0.60 Osteophytes: 0.90	AP medial tibiofemoral	JSN: 0.88 Osteophytes: 0.94	JSN: 0.72 Osteophytes: 0.88	Lateral patellofemoral	JSN: 0.60 Osteophytes: 0.84	JSN: 0.60 Osteophytes: 0.80	Skyline patellofemoral	JSN: 0.80 Osteophytes: 0.90	JSN: 0.80 Osteophytes: 0.90
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OR (95% CI) of pain in case of radiographic abnormalities: AP 3.99(2.0-7.97); lateral 2.69 (1.36-5.30); skyline 5.84 (3.01-11.33)																					
Cline A 2006 [8]	85 + 112	RCT	Fluoroscopically guided semi-flexed vs fixed flexion vs semiflexed MTP	12 months	<p>JSW: progression</p> <p>Change in JSW (mean,sd): Fluoroscopically guided -0.12 (0.41), fixed flexion 0.07(0.63), semiflexed MTP 0 (0.53).</p>																
Dervin G 2001 [9]	152	Cross-sectional	3-foot standing AP vs 45° of flexion standing PA	-	JSN: accuracy to identify arthroscopically assessed cartilage damage	<table border="1"> <thead> <tr> <th></th> <th>Sensitivity</th> <th>Specificity</th> </tr> </thead> <tbody> <tr> <td>3-foot standing</td> <td>0.73</td> <td>0.82</td> </tr> <tr> <td>45° of flexion</td> <td>0.78</td> <td>0.76</td> </tr> </tbody> </table>		Sensitivity	Specificity	3-foot standing	0.73	0.82	45° of flexion	0.78	0.76						
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45° of flexion	0.78	0.76																			
<p>PA: posteroanterior; OA: osteoarthritis; 95% CI: 95% confidence interval; LR+: positive likelihood ratio; AP: anteroposterior; JSN: joint space narrowing; OR: Odds ratio; RCT: randomized controlled trial; MTP: metatarsophalangeal; JSW: joint space width.</p>																					

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome					
					JSW (mean in mm, sd)	AP weightbearing	Stress			
Eriksson K 2010 [10]	60	Cross-sectional	AP full-extension weightbearing vs varus and valgus stress (extended and 30° of flexion)	-	JSW					
						Medial compartment (varus stress)	1.3 (1.39)	0.5 (1.01) p<0.001	0.9 (1.33) p<0.01	
						Lateral compartment (valgus stress)	1.3 (1.53)	0.8 (1.13) p>0.05	0.1 (0.27) p<0.01	
Hellio Le Graverand M 2008 [11]	161	cohort	Fixed flexion vs Lyon-Schuss	12 months	mJSW: difference between the views, intra-reader and inter-reader reliability, sensitivity to change	<ul style="list-style-type: none"> Baseline mJSW: LS 4.01 (0.84) vs FF 3.89 (0.77) (p=0.001). Mean difference between the 2 views at 12 months 0.22 (p=0.001). Intra-reader reliability (ICC): LS 0.99 Inter-reader reliability (ICC): LS 0.99; FF 0.99 Sensitivity to change(SRM 95%CI): LS 0.65, FF 0.01 				
Hing C 2007 [12]	240	Cross-sectional	tunnel view (flexion 60° non weightbearing) vs AP full-extension weightbearing + lateral weightbearing + skyline	-	Medial JSW (correlation between views)	Kappa (95% CI) 0.53 (0.48–0.58)				
Jones AC 1993 [13]	30	Cross-sectional	standing AP vs lateral 30°flexion vs skyline 30° flexion	-	JSN, osteophytes, sclerosis, cysts, attrition: intra-reader reliability	kappa	Lateral TF	Medial TF	Lateral patellar facet	Medial patellar facet
						JSN	0.34 AP	0.46 AP	0.34 Lat 0.68 skyline	0.33 skyline
						Osteophytes	0.41 AP	0.36 AP	0.46 Lat 0.132 skyline	0.16 skyline
						Sclerosis	-0.46 AP	0.26 AP	-0.17 Lat 0.13 skyline	0.06 skyline
						Cysts	0.11 AP	0.16 AP	0.13 Lat 0.22 skyline	0.18 skyline
						Attrition	0.15 AP	0.68 AP	0.46 Lat 0.47 skyline	-
AP: anteroposterior; JSW: joint space width; ext: extended; flex: flexion; mJSW: minimal joint space width; LS: Lyon Schuss; FF: fixed flexion; ICC: interclass correlation; SRM: standardized response mean; JSN: joint space narrowing; TF: tibiofemoral; 95% CI: 95% confidence interval										

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Lanyon P 1996 [14]	54	cohort	skyline view 30° of flexion vs lateral standing	31 months (mean)	Patellar JSN, femoral and patellar osteophytes, sclerosis, subluxation, mJSW: inter-reader reliability, sensitivity to change	kappa	Lateral	Skyline lateral	Skyline medial
						JSN	0.68	0.88	0.96
						Superior patellar osteophyte	0.55	0.55 Patellar	0.55 Patellar
						Inferior patellar osteophyte	0.8	-	-
						Femoral osteophyte	0.43	0.56	0.74
						Sclerosis	-	1.0	1.0
						Subluxation	-	0.65	1.0
Mean change (95% CI) of mJSW	LATERAL -0.2(+0.1,-0.5); SKYLINE lateral facet -0.4(-0.2,-0.6) medial facet -0.5(-0.1,-0.8)								
Lanyon P 1998 [15]	452	Case-control	AP weightbearing vs skyline (Laurin modality)	-	Osteophytes and JSN (grading 0-3): Inter-reader reliability	kappa values >0.7 for all sites (lateral and medial tibiofemoral compartments, lateral and medial patellar surface)			
La Valley M 2005 [16]	355 knees	Cohort	Buckland Wright fluo positioned flex standing PA vs lateral view weightbearing 30° of flexion	30 months	JSN; OARSI atlas 0-3; mJSW intrareader reliability, sensitivity to change	<ul style="list-style-type: none"> Test-retest reading medial TF JSW -0.01 ± 0.43 Reliability of assessing progression was the same (kappa=0.73, P < 0.001) for PA and lateral views. Knees with change only on the fluoroscopically positioned PA view:: 23% Knees with change change only on the lateral view: 34% 			
Hellio Le Graverand 2006 [17]	240	RCT	Fixed flexion vs MTP PA vs fluoroscopically positioned AP semiflexed	12-36 months	reproducibility (IMD, alignment, rotation)		FF	MTP	Semiflexed AP
						IMD (%reproduced ±1.4 mm)	86	92	93
						Rotation (%reproduced ±1.4 mm)	-	53	66
						Femorotibial angle	the femorotibial angle was more frequently reproduced in serial FF radiographs than in serial MTP or semiflexed AP radiographs		

JSN: joint space narrowing; mJSW: minimal joint space width; 95% CI: 95% confidence interval; AP: anteroposterior; TF: tibiofemoral; PA: posteroanterior; MTP: metatarsophalangeal; IMD: intermargin distance; FF: fixed flexion

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome				
Mazzuca S 2003 [18]	43	Cohort	MTP vs fluoroscopically assisted semiflexed AP	14 months	JSW: sensitivity to change change in JSW: MTP -0.09 ± 0.66 $p=0.33$; semiflexed -0.09 ± 0.31 $p=0.1$				
Mazzuca S 2008 [19]	74	Cohort	Lyon Schuss vs fixed flexion	12 months	JSN and MTP alignment: reproducibility and sensitivity to change		LS	FF	
						Reproducibility (mean change, mm)	IMD	0.96 \pm 0.73	FF 1.94 \pm 1.45 ($p<0.001$)
							JSN	0.16 \pm 0.37	-0.01 \pm 0.51 ($p=0.007$)
Sensitivity to change (SRM)	IMD	-	-						
	JSN	0.46	0.05						
Mc Donnell 2011 [20]	88	Cross-sectional	Skyline vs lateral	-	Accuracy of JSN to predict full-thickness cartilage damage at the PF joint (surgery)		Sensitivity	Specificity	
						Lateral	0.23	0.44	
						Skyline	0.90	0.73	
Merle Vincent F 2007 [21]	202	Cross-sectional	Lyon Schuss vs AP weightbearing full extension	-	Overall agreement as to the presence or absence of radiographic OA	k (95% CI)			
						KLG $< or \geq 2$		0.73 (0.69,0.76)	
						KLG		0.69 (0.66,0.71)	
						Medial tibial osteophytes		0.68 (0.62,0.74)	
						Lateral tibial osteophytes		0.72(0.65,0.79)	
						Medial femoral osteophytes		0.42 (0.28,0.56)	
						Lateral femoral osteophytes		0.62 (0.45,0.79)	
						Medial JSN		0.68(0.63,0.74)	
Lateral JSN		0.65 (0.54,0.76)							
Nelson 2010 [22]	1664	Cross-sectional	AP full extension vs fixed flexion	-	KLG, JSN, osteophytes grade	Kappa (95%CI)			
						KLG $< or \geq 2$		0.73 (0.69,0.76)	
						KLG		0.69 (0.66,0.71)	
						medial tibial osteophytes		0.68 (0.62,0.74)	
						lateral tibial osteophytes		0.72(0.65,0.79)	
						medial femoral osteophytes		0.42 (0.28,0.56)	
						lateral femoral osteophytes		0.62 (0.45,0.79)	
						medial JSN		0.68(0.63,0.74)	
lateral JSN		0.65 (0.54,0.76)							

MTP: metatarsophalangeal; AP: anteroposterior; JSW: joint space width; JSN: joint space narrowing; IMD: intermargin distance; FF: fixed flexion; SRM: standardized response mean; MTP: metatarsophalangeal; PF: patellofemoral; KLG: Kellgren and Lawrence; OA: osteoarthritis

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome							
Piperno M 1998 [23]	32	cohort	AP full extension vs AP standing on the homolateral knee vs Lyon Schuss	12 months	JSN graded (0-5) osteophytes (0-3)			JSN score medial OA	JSN score lateral OA			
						Schuss vs extended		+39.7% , P<0.001	+45.7%, P<0.02			
						Schuss vs standing on one foot		+63.2%, P<0.0001	+75.2%, P=0.001			
Tait M 2013 [24]	76	Cross-sectional	Rosenberg (45° flexion weightbearing PA) vs 20/10 radiographs	-	JSN	More JSN in the Rosenberg view: 23% of knees More JSN in the 20/10 view: 49% of knees Same JSN in both: 28%						
Takahashi T 2013 [25]	46	Cross-sectional	AP weightbearing full extension vs 15° flex vs 30° flex vs 45° flex	-	JSW and IMD		Mean (sd) JSW	P (vs full extension)	Mean (sd) IMD	P (vs full extension)	Intra-reader reliability JSW (ICC)	Intra-reader reliability IMD (ICC)
						full extension	4.18±1.07	-	1.88±1.47	-	0.87	0.89
						15° flexion	3.19±1.06	p<0.001	0.69±0.91	p<0.001	0.94	0.85
						30° flexion	3.25±1.00	p<0.0001	1.06±1.29	p<0.0001	0.95	0.89
						45° flexion	3.43±1.01	p<0.001	2.09±2.36	p>0.05	0.94	0.88
Vignon E 2003 [26]	58	cohort	AP full extension weightbearing fluoroscopically guided vs Lyon Schuss	24 months	mJSW, mean JSW, JSA of the lateral and medial TF compartment: intra-reader reliability, sensitivity to change			Intra-reader reliability ICC (mJSW)		Sensitivity to change (SRM)		
						AP		0.98		mJSW 0.23- meanJSW 0.17- JSA 0.18		
						LS		0.98		mJSW 0.48- meanJSW 0.45- JSA 0.42		
Waldstein W 2013 [27]	78	Cross-sectional	AP full extension vs valgus stress	-	Accuracy of JSN to detect cartilage damage (surgery)	In the assessment of lateral compartment cartilage, valgus stress radiographs provided no benefit in addition to AP standing radiographs						

JSN: joint space narrowing; AP: anteroposterior; IMD: intermargin distance; JSW: joint space width; mJSW: minimal joint space width; JSA: joint space area; ICC: interclass correlation; SRM: standardized response mean; MTP: metatarsophalangeal; LS: Lyon Schuss

Reference	No of subjects	Study design	Imaging modality	Follow up	Outcome			
						JSN	Osteophytes	
Wolfe F 2002 [28]	1105	Cross-sectional	AP weightbearing full extension vs MTP and Schuss tunnel	-	JSN and osteophytes (scored 0-3)			
						<i>MTP vs AP</i>	1.38 vs 1.19 p<0.0001	1.18 vs 1.20 p=0.11
						<i>MTP vs Schuss</i>	1.27 vs 1.26 p=0.377	1.08 vs 1.05 p=0.027
						<i>Schuss vs AP</i>	1.25 vs 1.14 p=0.015	1.18 vs 1.20 p=0.11
Buckland Wright JC 1994 [29]	90	Cross-sectional	MTP vs tunnel view	-	JSN	JSN was recorded only in the tunnel view (22%) vs only in standing view only (8%)		
Buckland Wright JC 1999 [30]	74	Cross-sectional	MTP vs AP full extension weightbearing vs Schuss	-	JSW (reproducibility)	<ul style="list-style-type: none"> ▪ Semiflexed view: significantly more accurately positioned in regard to knee flexion (p<0.0005) than in the schuss view, which in turn was better (p<0.014) than in the extended knee view. ▪ Joint repositioning was significantly more reproducible in the semiflexed (p<0.0001) than in the extended knee, which was better (p<0.013) than in the schuss position. ▪ JSW measurement was significantly more reproducible in the semiflexed (p<0.014) than both schuss and extended knee positions, which were not significantly different. 		
Buckland Wright JC 1995 [31]	25	Cross-sectional	AP full extension weightbearing vs standing semiflexed fluoroscopically guided	-	mJSW: reproducibility and accuracy	the standing semiflexed view significantly improved the precision of computerized measurements of JSW in the medial compartment of the lateral compartment of the OA group		

MTP: metatarsophalangeal; AP: anteroposterior; JSW: joint space width

COMPARISON OF IMAGING-GUIDED PROCEDURES VS BLIND PROCEDURES

Reference	No of subjects	Study design	Imaging modality	Follow up	Treatment and Outcome					
Bum Park Y 2012 [32]	99	RCT	US	-	accuracy defined by subsequent CR of single high molecular weight injection of hyaluronic acid in knee OA	48/50 US-guided; 41/49 blind p<0.05				
Cunnington J 2010 [33]	184	RCT	US	2 and 6 weeks	single corticosteroids (triamcinolone 40 mg): VAS pain, stiffness, HAQ, EuroQoL5, accuracy in knee of patients with IA		US guided (mean change, sd) or median change IQR	Blind (mean change, sd) or median change IQR	p	
						2 weeks	VAS pain	-40.3 (23.2)	-36.8 (24.3)	0.324
							HAQ	-0.25 (-1.3-0.5)	-0.25 (-1.1-0.8)	0.366
							EQoL	8.8 (15.7)	13.9(17.5)	0.039
						6 weeks	VAS pain	-38.2 (26.8)	-34.9 (27.1)	0.324
							HAQ	-0.13 (-1.6-0.6)	-0.13 (-0.9-0.5)	0.466
							EQoL	7.7 (21.4)	7.3(21.7)	0.897
Accuracy		76/92 (83%)	61/92 (66%)	0.01						
Curtiss HM 2011 [34]	20 cadaveric specimen	Cross-sectional	US	-	Accuracy: accurate - partially accurate-inaccurate	US: accurate 100% (95% CI 89-100); blind accurate 78% (62-88) p=0.04				
Im SH 2009 [35]	84	RCT	US	-	accuracy defined by subsequent CR	43/45 (95.6%) US; 34/44 blind (77.3%) p=0.01				
Sibbitt 2011 [36]	94	RCT	US	2 weeks and 6 months	VAS pain, VAS pain related to the procedure; responder and non responder rate; time to next injection; referral to surgery after injection of triamcinolone in patients with knee OA		US	Blind	p	
						VAS pain related to the injection (mean, sd)	2.3 (2.4)	4.4 (2.9)	0.0003	
						VAS pain (2 weeks)	2.4 (2.1)	1.4 (2.1)	0.025	
						VAS pain (6 months)	6.3 (2.6)	6.3 (2.9)	>0.05	
						Responders rate	67%	33%	0.0004	
Cost per year (USD)	460(207)	173 (81)	0.0001							
RCT: randomized controlled trial; US: ultrasonography; CR: conventional radiography; OA: osteoarthritis; VAS: visual analogue scale; HAQ: Health Assessment Questionnaire; IQR: interquartile range;EQoL: European Quality of Life Questionnaire; OA: osteoarthritis; USD: US dollars										

Reference	No of subjects	Study design	Imaging modality	Follow up	Treatment and Outcome				
Luz K 2008 [37]	60	RCT	US	12 weeks	VAS pain and oedema, HAQ, Hand questionnaire for adverse events of corticosteroid injections in the wrists of patients with inflammatory arthritis	Mean (SD)	US	blind	p
						VAS pain	2.31 (2.32)	3.03 (2.76)	0.27
						VAS oedema	1.93 (2.23)	3.07 (2.33)	0.122
						HAQ	1.05 (0.57)	1.21 (0.70)	0.609
Sibbitt 2009 [38]	150	RCT	US	2 weeks	VAS pain, significant pain related to the procedure, percentage of responders and non responders (intra-articular corticosteroids in inflammatory arthritis)		Blind	US	p
						VAS pain (% reduction from baseline)	60.9 ± 30.5	83.1 ± 34.1	0.0005
						Pain related to the procedure (significant)	39/74	16/74	0.0005
						Responders	53/74	66/74	0.038
						Non responders	21/74	8/74	0.038
Balint P 200 [39]	61	Cross-sectional	US	-	Joint aspiration (different sites), inflammatory arthritis: success compared to blind procedure		Blind	US	
						Knee	4/10	18/19	
						Hip	0/0	1/1	
						Ankle	1/5	1/1	

RCT: randomized controlled trial; US: ultrasonography; VAS: visual analogue scale; HAQ: Health Assessment Questionnaire

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