

**METHODS****Patients**

The representativeness of the 141 study participants consecutively recruited among the 471 PsA patients fulfilling the CASPAR criteria and visiting the outpatient clinic for ordinary follow-up during the inclusion period, was compared with the remaining 330 PsA patients not included in the study but visiting the outpatient clinic during the inclusion period. Apart from age, 28 tender joint count, DAS28, CDAI and current use of leflunomide and steroids, no statistically significant differences were seen between the patients at their last visit at the out-patient clinic during the study period (supplementary table S1).

**Supplementary table S1. Characteristics of psoriatic arthritis study participants and non-participants from the outpatient clinic.**

	Non-participants (n=330)	Study participants (n=141)	P-value
<b>Patient characteristics</b>			
Age (years), mean (SD)	56.4 (13.3)	52.4 (10.2)	<b>0.001</b>
Sex (female), n (%)	169 (51.2%)	71 (50.4%)	0.865
Currently smoking, n (%)	61 (18.5%)	26 (18.4%)	0.252
Education (years), mean (SD)	12.2 (3.5)	12.9 (3.5)	0.057
Disease duration (years), mean (SD)	10.1 (8.2)	9.2 (6.8)	0.269
BMI (kg/m <sup>2</sup> ), mean (SD)	29.8 (19.6)	28.2 (4.8)	0.155
<b>Disease activity</b>			
Swollen joint count 28, median (range)	0 (0-8)	0 (0-4)	0.367
Tender joint count 28, median (range)	0 (0-27)	0.50 (0.0-2.0)	<b>&lt;0.001</b>
ESR (mm/h), mean (SD)	10 (1-105)	12 (2-62)	0.312
CRP (mg/L), median (range)	2 (0-50)	2 (0-74)	0.856
DAS28 (ESR), median (range)	2.5 (0.1-5.4)	2.7 (0.8-5.7)	<b>0.008</b>
CDAI, median (range)	5.0 (0.0-33.1)	5.7 (0.0-26.9)	<b>0.030</b>
PGA (VAS, 0-100mm), median (range)	33 (0-100)	36 (0-100)	0.771
EGA (VAS, 0-100mm), median (range)	6 (0-48)	7 (0-42)	0.070
Pain (VAS, 0-100mm), median (range)	33 (0-96)	30 (0-99)	0.946
Fatigue, median (range)	41 (0-100)	47 (0-100)	0.218
Morning stiffness, median (range)	5 (0-6)	5 (0-6)	0.659
MHAQ, median (IQR)	0.38 (0.0-2.0)	0.38 (0.0-1.5)	0.350
<b>Medication</b>			
Current use of csDMARDs, n (%)	159 (48.2)	80 (56.7)	0.089
- Leflunomide, n (%)	39 (11.8)	28 (19.9)	<b>0.022</b>
- Methotrexate, n (%)	113 (34.2)	51 (36.2)	0.688
- Sulfasalazine, n (%)	7 (2.1)	1 (0.7)	0.277
Current use of bDMARDs, n (%)	84 (25.5)	48 (34.0)	0.057
- Adalimumab, n (%)	30 (9.1)	17 (12.1)	0.325
- Certolizumab, n (%)	3 (0.9)	1 (0.7)	0.829
- Etanercept, n (%)	22 (6.7)	16 (11.3)	0.888
- Golimumab, n (%)	18 (5.5)	9 (6.4)	0.691

- Infliximab, n (%)	5 (1.5)	5 (3.5)	0.161
- Ustekinumab, n (%)	3 (0.9)	0 (0)	0.256
- Abatacept, n (%)	3 (0.9)	0 (0)	0.256
Current use of steroids, n (%)	48 (14.5)	11 (7.8)	<b>0.043</b>

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The data between study participants and non-participants are compared for their last visit at the out-patient clinic during the study period. BMI, body mass index; ESR, Erythrocyte sedimentation rate; CRP, C-reactive protein; DAS28, Disease Assessment Score for 28 joints; PGA, Patient's Global Assessment, EGA, Evaluator's Global Assessment; MHAQ, Modified Health Assessment Questionnaire; csDMARD, conventional synthetic Disease Modifying Anti-Rheumatic Drugs; bDMARDs, biological Disease Modifying Anti-Rheumatic Drugs

**Supplementary table S2. Modified Composite Psoriatic Disease Activity Index<sup>1</sup> (CPDAI), Psoriatic Arthritis Disease Activity Score<sup>2</sup> (PASDAS) and Disease Activity for Psoriatic Arthritis<sup>3</sup> (DAPSA).**

<b>Modified Composite Psoriatic Disease Activity Index (CPDAI) (range 0-15)</b>				
<b>Domain</b>	<b>Not involved (Score=0)</b>	<b>Mild (Score=1)</b>	<b>Moderate (Score=2)</b>	<b>Severe (Score=3)</b>
Peripheral arthritis	-	1-4 SJ/TJ and MHAQ<0.5	1-4 SJ/TJ and MHAQ≥0.5 >4SJ/TJ and MHAQ<0.5	>4SJ/TJ and MHAQ≥0.5
Skin disease	-	PASI≤10 and DLQI≤10	PASI≤10 and DLQI>10 PASI>10 and DLQI≤10	PASI>10 and DLQI>10
Enthesitis	-	≤ 3 sites (MASES) and MHAQ<0.5	≤3 sites (MASES) and MHAQ≥0.5 >3 sites (MASES) and MHAQ<0.5	>3 sites (MASES) and MHAQ≥0.5
Dactylitis	-	≤3 Digits and MHAQ<0.5	≤3 Digits and MHAQ≥0.5 >3 Digits and MHAQ<0.5	>3 Digits and MHAQ≥0.5
Axial Disease	-	BASDAI≤4 and RAID<4	BASDAI≤4 and RAID≥4 BASDAI>4 and RAID<4	BASDAI >4 and RAID≥4

SJ, number of swollen joints using the 66 swollen joint count (range 0-66); TJ, number of tender joints using the 68 tender joint count (range 0-68); MHAQ, Modified Health Assessment Questionnaire (range 0-3) only counted if clinical involvement of domain (joint/entheses/dactylitis) present; PASI, Psoriatic Area Severity Index (range 0-72), DLQI, Dermatology Life Quality Index (range 0-30); MASES, Maastricht Ankylosing Spondylitis Enthesitis Score (range 0-13); BASDAI, Bath Ankylosing Spondylitis Disease Activity Index (range 0-10); RAID, Rheumatoid Arthritis Impact of Disease (score 0-10).

<b>Modified Psoriatic Arthritis Disease Activity Score (PASDAS)</b>
$\text{PASDAS} = ((0,18 \times \sqrt{\text{EGA}}) + (0.159 \times \sqrt{\text{PGA}}) - (0.253 \times \sqrt{\text{MHAQ}}) + (0.101 \times \log_{\text{nat}}(\text{SJC66} + 1)) + (0.048 \times \log_{\text{nat}}(\text{TJC68} + 1)) + (0.23 \times \log_{\text{nat}}(\text{MASES} + 1)) + (0.37 \times \log_{\text{nat}}(\text{tender dactylitis count} + 1)) + (0.102 \times \log_{\text{nat}}(\text{CRP} + 1)) + 2) \times 1.5$

EGA, evaluator's global assessment; PGA, patient global assessment: both on a 100mm VAS scale; MHAQ, Modified Health Assessment Questionnaire, SJC66, 66 swollen joint count, TJC68, 68 tender joint count, MASES, Maastricht Ankylosing Spondylitis Enthesitis Score; CRP, C-reactive protein in mg/L

<b>Disease Activity for Psoriatic Arthritis (DAPSA)</b>
DAPSA=SJC66+TJC68+PGA+pain+CRP

SJC66, 66 swollen joint count; TJC68, 68 tender joint count; PGA, patient global assessment; CRP, C-reactive protein in mg/dl. Visual analogue scale for PGA and pain are applied in cm.

## Ultrasonography protocol

US evaluation was performed by a rheumatologist with 5 years of experience in musculoskeletal US (APD) on the day of clinical examination. The duration of the US examination was approximately 45 minutes per patient. The nurse performing 66/68 tender/swollen joint count and MASES/enthesitis evaluation was unaware of the US findings. The sonographer was aware of the clinical results. Gray scale (GS) and power Doppler (PD) sonography were performed at: 34 mandatory joints (bilateral metacarpo-phalangeal (MCP) 1-5, radio-carpal, inter-carpal, radio-ulnar, knees, talo-crural, subtalar, talo-navicular, metatarso-phalangeal (MTP) 1-5) with the Norwegian ultrasonographic atlas<sup>4</sup> as reference and additional joints found to be swollen or tender by 66/68 joint count; 10 mandatory entheses (bilateral quadriceps, proximal and distal patellar tendons, Achilles, plantar fasciae) and additionally entheses found to be tender by clinical examination of 19 other entheses (1<sup>st</sup> and 7<sup>th</sup> costosternal joints, anterior superior iliac spine, iliac crest, 5<sup>th</sup> lumbar spinous process, posterior superior iliac spine, lateral and medial epicondyle, triceps, great trochanter); 30 mandatory tendons were examined for tenosynovitis (bilateral finger flexor digiti 1-5, flexor (digitorum superficialis and profundus) and extensor (compartment 1-6) groups in the wrists, medial, anterior and lateral tendon sheets in the ankle, flexor digiti pedis 1-5). See supplementary table S3 for details on US assessments and figure S1 for examples of characteristic US findings.

The US examinations were performed by use of two US devices (Siemens Medical Systems, S2000 and GE logic E) with two multifrequency linear transducers (6-18 MHz; small and medium sized joints, tendons and entheses and 4-10 MHz; large joints, deeply located entheses e.g. trochanter major), as it is standard practice in the clinic to share US machines between physicians. A head-to-head comparison of the two US devices was made for PD and GS synovitis, enthesitis and tenosynovitis in 25 joints, entheses and tendons with similar results; very good agreement of kappa with linear weighting was found for GS and PD synovitis (GS: 0.89, 95% CI 0.68-1.00; PD: 1.00, 95% CI 1.0-1.0), enthesitis (GS: 0.88, 95% CI 0.66-1.0; PD: 1.00, 95% CI 1.0-1.0) and tenosynovitis (GS=0.83, 95% CI 0.52-1.0; PD: 1.00, 95% CI 1.0-1.0).

Resolution of the images was improved by using the highest B-mode frequency of the probe still permitting favorable resolution in the depth. Imaging parameters were adjusted to optimize the contrast between examined structures. PD frequency of 9 MHz was used for small joints, tendons and entheses and 6 MHz for large joints, with a pulse repetition frequency (PRF) of 391 Hz. PD gain was optimized by increasing gain until artifacts appeared, then by reducing gain until artifacts disappeared. The window of the power Doppler box was restricted to the area examined. All structures were examined longitudinally and transversely in accordance with current guidelines.<sup>5,6</sup>

In joints GS (presence of synovitis and joint fluid) and PD signals (presence of vascularisation) were semi-quantitatively graded 0-3: 0= none, 1= minor, 2= moderate, 3= major.<sup>4,6-8</sup> In tendons GS (presence of hypoechoic/ anechoic thickened tissue/ fluid in tendon sheet) and PD signals (presence of vascularisation) were semi-quantitatively graded 0-3: 0= none, 1= minor, 2= moderate, 3= major.<sup>6,9</sup>

GS and PD sum scores for joints (both range 0-228) and tendons (both range 0-90) were calculated. Enthesitis was defined as the presence of gray scale structural pathology (graded absent/ present); increased thickness measured at the point of maximal thickness on the bony insertion, hypoechogenicity, fibrillar separation, calcifications, erosions (cortical breakage with a step down contour defect seen in 2 perpendicular planes at the insertion of the entheses to the bone), enthesophytes (bone spurs at the entheses insertion) and/or PD signals of enthesitis (defined as approximately <2mm from the bony cortex) in accordance with current guidelines.<sup>6, 10</sup> GS and PD pathology of entheses were both graded absent/ present, (range 0-29). Dactylitis was defined as flexor tendon tenosynovitis and soft-tissue swelling.<sup>11</sup> PD and GS sum scores of joints, entheses and tendons were calculated (both range 0-347). To date no US remission criteria in PsA have been established. We defined US remission as PD=0 at all examined joints, entheses and tendons, in accordance with the previously proposed US definition of remission in RA<sup>7, 12</sup> and PsA.<sup>13</sup>

**Supplementary table S3. Overview of ultrasound assessment.**

<b>Ultrasound examination joints</b>			
<b>Sites</b>	<b>Patient positioning</b>	<b>Examination</b>	<b>Grading</b>
Metacarpo-phalangeal (MCP) 1-5, proximal interphalangeal (PIP) 1-5, distal interphalangeal (DIP) 2-5	Sitting, hands rested on table, extended finger joints	Palmar and dorsal	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Radio-carpal, inter-carpal, radio-ulnar joints	Sitting, hands rested on table, wrist in neutral position	Dorsal	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Elbow	Sitting, extension of elbow (anterior scan), 90° flexion of elbow (posterior scan)	Anterior and posterior	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Shoulder	Sitting, hands supine and rested on the lap	Posterior	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Temporomandibular joint	Supine	Lateral	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Acromio-clavicular, sterno-clavicular joints	Supine, arms in neutral position	Anterior	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Knee	Supine, knee neutral/ 30° flexion	Suprapatellar, medial and lateral	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Hip	Supine, hip and knee neutral	Anterior	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Talo-crural, subtalar, talo-navicular joints	Supine, knee 60° flexion, foot rested on bench	Anterior, medial and lateral	Gray scale synovitis 0-3, power Doppler synovitis 0-3
Metatarso-phalangeal (MTP)1-5 joints	Supine, knee flexed 90° , foot rested on bench	Palmar and dorsal. Lateral for MTP 1+5.	Gray scale synovitis 0-3, power Doppler synovitis 0-3
<b>Ultrasound examination entheses</b>			
<b>Sites</b>	<b>Patient positioning</b>	<b>Examination</b>	<b>Grading</b>
Quadriceps, proximal and distal patellar tendons	Supine, knee extended	Anterior	Gray scale structural pathology absent/present. Power Doppler absent/present.
Achilles	Prone, ankle in 90° flexion, feet relaxed over edge of bench	Posterior	Gray scale structural pathology absent/present. Power Doppler absent/present.
Plantar fasciae	Prone, ankle in 90° flexion, feet relaxed over edge of bench	Plantar	Gray scale structural pathology absent/present. Power Doppler absent/present.
Entheses of 1 <sup>st</sup> and 7 <sup>th</sup> costo-sternal joints . Entheses of anterior superior iliac spine.	Supine, arms and legs in neutral position	Anterior	Gray scale structural pathology absent/present. Power Doppler absent/present.
Iliac crest, great trochanter	Supine, sideposition	Lateral	Gray scale structural pathology absent/present.

			Power Doppler absent/present.
5 <sup>th</sup> lumbar spinous process, posterior iliac spine	Prone, arms and legs in neutral position	Posterior	Gray scale structural pathology absent/present. Power Doppler absent/present.
Lateral and medial epicondyle, triceps	Sitting, elbow in 90° flexion	Lateral, posterior and medial	Gray scale structural pathology absent/present. Power Doppler absent/present.
<b>Mandatory ultrasound examination tendons</b>			
<b>Sites</b>	<b>Patient positioning</b>	<b>Examination</b>	<b>Grading</b>
Finger flexor digiti 1-5	Sitting, hands on table, extended finger joints	Palmar	Gray scale tenosynovitis 0-3, power Doppler tenosynovitis 0-3.
Flexor digitorum superficialis et profundus	Sitting, hands on table, wrist in neutral position	Palmar	Gray scale tenosynovitis 0-3, power Doppler tenosynovitis 0-3.
Extensor compartments 1-6 in the wrist	Sitting, hands on table, wrist in neutral position	Dorsal	Gray scale tenosynovitis 0-3, power Doppler tenosynovitis 0-3.
Medial, anterior and lateral tendon sheets in the ankle	Supine, knee 60° flexion	Medial, anterior and lateral	Gray scale tenosynovitis 0-3, power Doppler tenosynovitis 0-3.
Flexor digiti pedis 1-5	Prone, toes neutral	Plantar	Gray scale tenosynovitis 0-3, power Doppler tenosynovitis 0-3.

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