Ultrasonographic atlas for scoring of B-mode (BM) synovitis in patients with juvenile idiopathic arthritis 5-8 years

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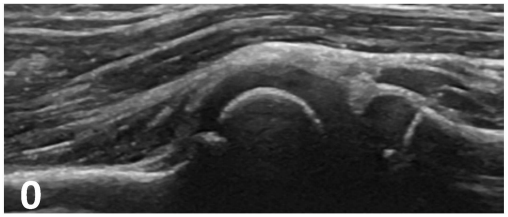
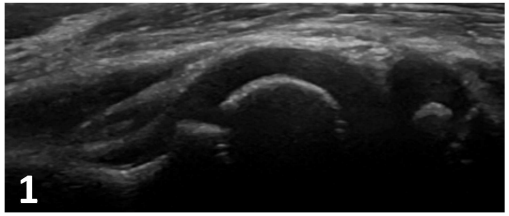
Included joint regions

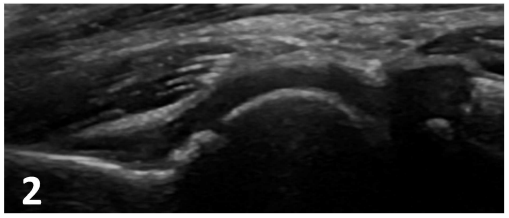
- Anterior elbow
- Posterior elbow
- Wrist (radiocarpal and midcarpal)
- Metacarpophalangeal (MCP) 2-3 dorsal
- Proximal interphalangeal (PIP) 2-3 dorsal
- Proximal interphalangeal (PIP) 2-3 volar
- Hip
- Knee, suprapatellar recess
- Knee, lateral parapatellar recess
- Tibiotalar
- Talonavicular
- Anterior subtalar
- Posterior subtalar
- Metatarsophalangeal (MTP) 2-3 dorsal

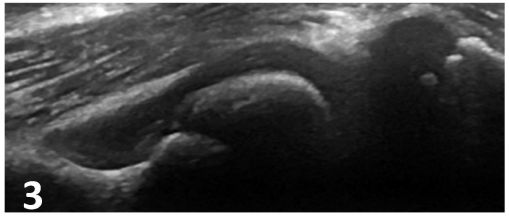
Anterior elbow

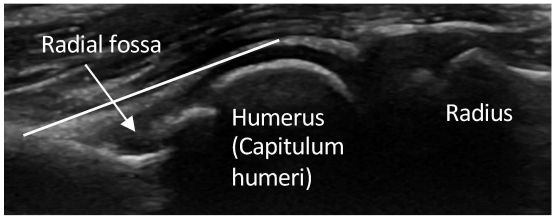
The subject will be in a supine position, but the scanning can also be done with the subject on the parents' lap. The elbow should be in full extension and supination of the lower arm. A longitudinal anterior scan of the elbow (humeroradial) joint. ***Landmarks:*** 1) the distal humerus and 2) the radius.











BM scoring for the anterior elbow, the humeroradial joint

0: No or minimal synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion
2: Moderate synovial hypertrophy/effusion up to, but not beyond the imaginary line*
3: Severe synovial hypertrophy/effusion beyond the imaginary line* and/or a clearly convex shape

** The line above the radial fossa; between the proximal end of the fossa to the top of the cartilage over the capitulum humeri*

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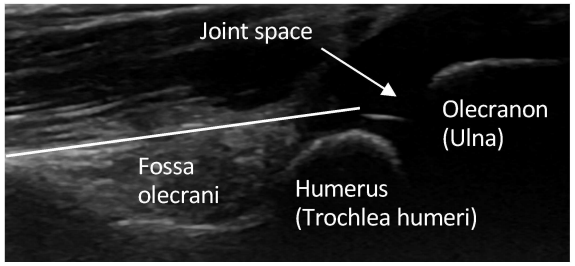
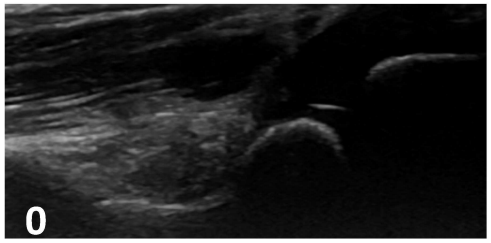
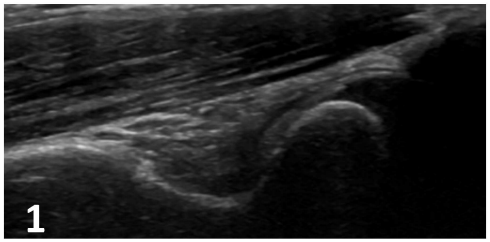
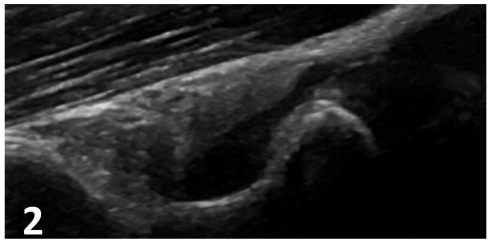
Posterior elbow

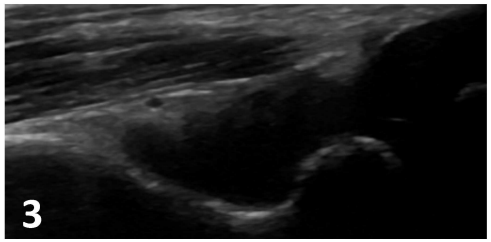
The subject will be in a supine position, but the scanning can also be done with the subject on the parents' lap. The elbow should be flexed at 90 degrees with the forearm resting on the stomach. A longitudinal posterior scan of the elbow (humeroulnar) joint. ***Landmarks:*** 1) the distal humerus and 2) the olecranon (ulna).











BM scoring for the posterior elbow, the humeroulnar joint

0: No or minimal synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion filling up to 25% of the fossa
2: Moderate synovial hypertrophy/effusion filling up to 50% of the fossa, but not beyond the imaginary line*
3: Severe synovial hypertrophy/effusion filling more than 50% of the fossa and/or extending beyond the imaginary line*

** The line above the fossa olecrani; between the proximal top of the fossa to the top of the cartilage of the trochlea humeri*

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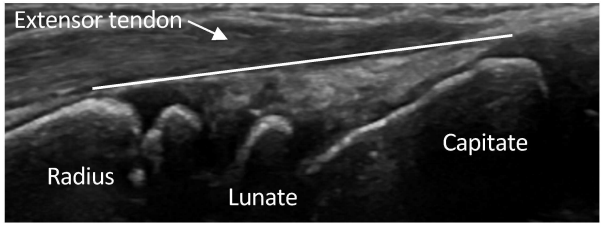
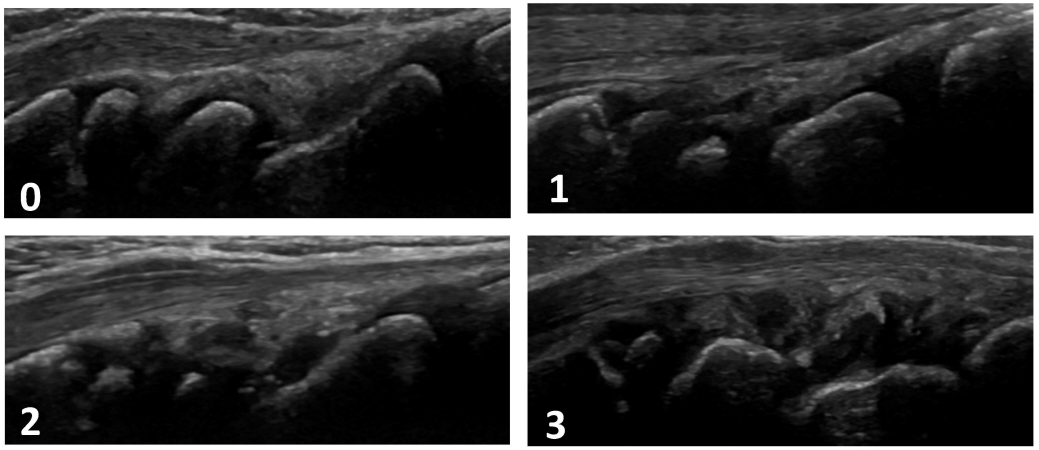
Radiocarpal and midcarpal

The subject will be in a sitting position, the hands palm-side down in a neutral position on an examination table and resting the elbow on the table. A longitudinal dorsal scan of the radiocarpal and midcarpal joints at the sagittal midline of the wrist, including the distal radius, the lunate and the capitate bone.
Landmarks: 1) the distal end of diaphysis and epiphyseal cartilage of radius and 2) the dorsal recess of the radiocarpal and midcarpal joints and over them 3) a compartment of the extensor tendons according to the area imaged.
(Collado et al. 2016)





BM scoring for the radiocarpal and midcarpal joints

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion
2: Moderate synovial hypertrophy/effusion up to, but not beyond the imaginary line*
3: Severe synovial hypertrophy/effusion with a convex shape extending beyond the imaginary line* and can push up the extensor tendons

** The line between the top of the cartilage of the distal end of the radius to the top of the cartilage of the capitate*

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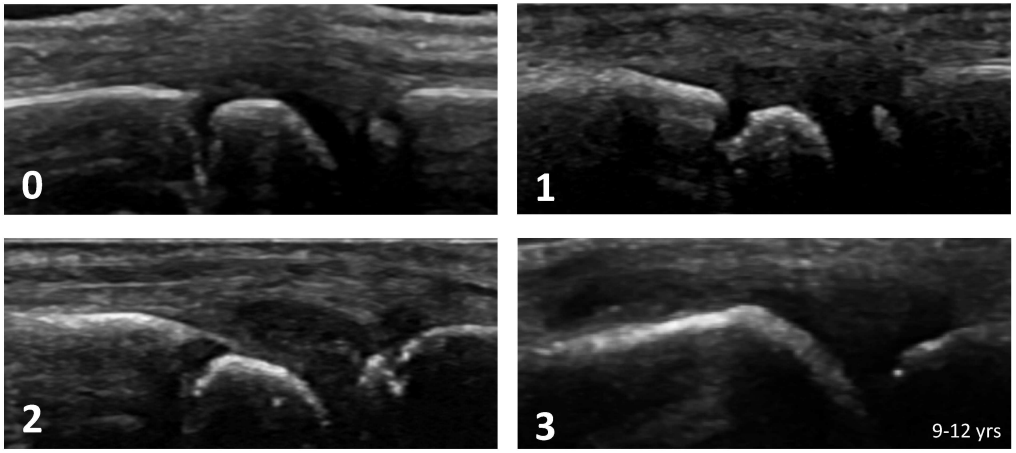
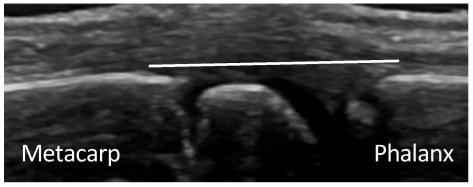
MCP2 - MCP3 dorsal



The subject will be in a sitting position with the hands palm-side down in a neutral position on an examination table.
A longitudinal dorsal scan of the MCP2 and MCP3 joints.
Landmarks: 1) the head of the metacarpal bone (2/3 of the image) and 2) the base of the proximal phalanx (1/3 of the image).



BM scoring for the MCP2 and MCP3 joints, dorsal

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion but not beyond the imaginary line*
2: Moderate synovial hypertrophy/effusion extending beyond the imaginary line*, but without overall convex shape
3: Severe synovial hypertrophy/effusion extending beyond the imaginary line* with a clearly convex shape

**The line between the top of the cartilage of the distal end of the metacarp to the top of the cartilage of the proximal end of the phalanx*

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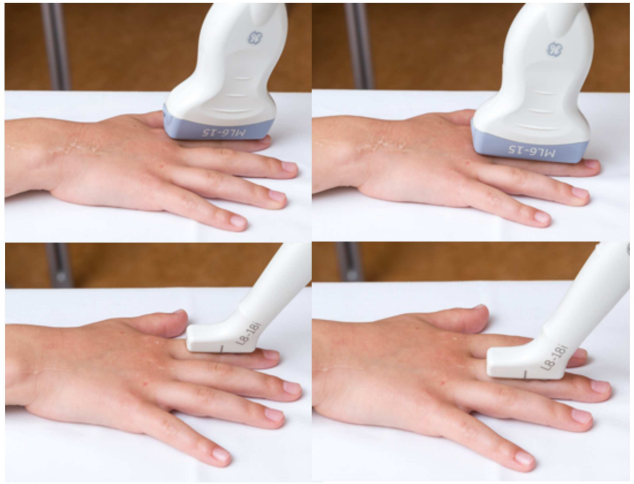
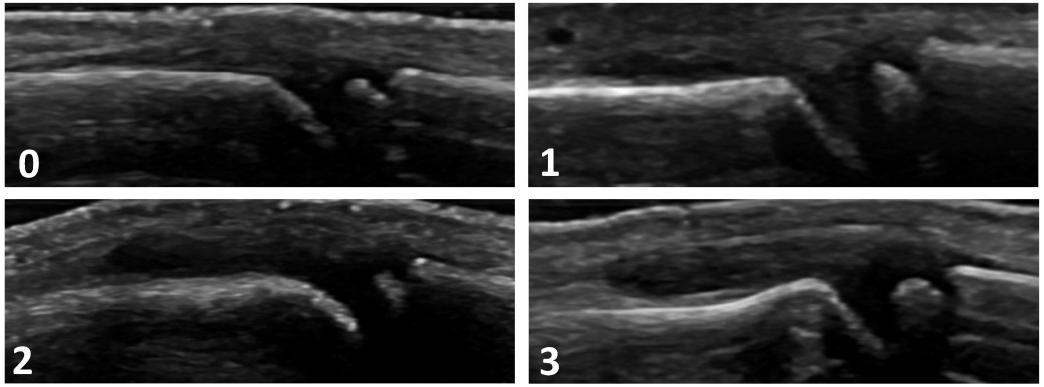
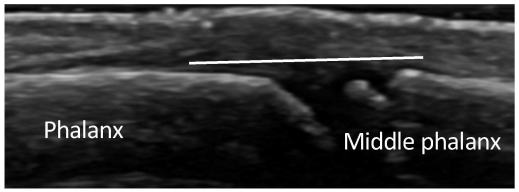
PIP2 - PIP3 dorsal





The subject will be in a sitting position with the hands palm-side down in a neutral position on an examination table.
A longitudinal dorsal scan of the PIP2 and PIP3 joints.
Landmarks: 1) the head of the proximal phalanx (2/3 of the image) and 2) the base of the middle phalanx (1/3 of the image).



BM scoring for the PIP2 and PIP3 joints, dorsal

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion but not beyond the imaginary line*
2: Moderate synovial hypertrophy/effusion extending beyond the imaginary line*, but without overall convex shape
3: Severe synovial hypertrophy/effusion extending beyond the imaginary line* with a clearly convex shape

**The line between the top of the cartilage of the distal end of the proximal phalanx to the top of the cartilage of the proximal end of the middle phalanx*

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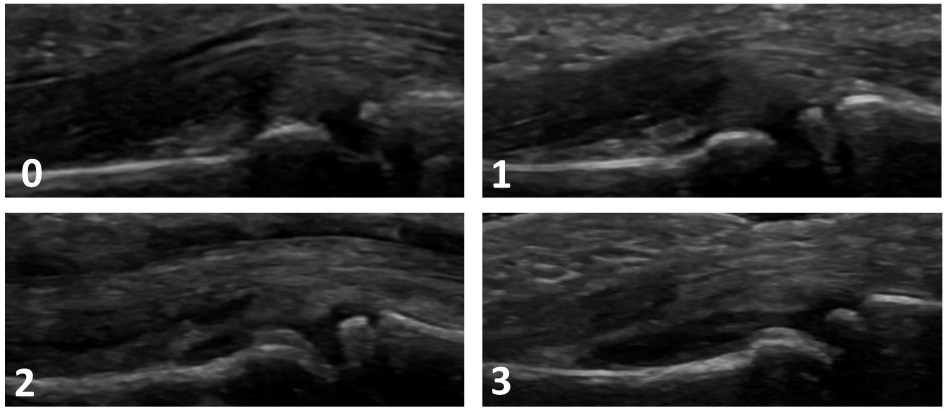
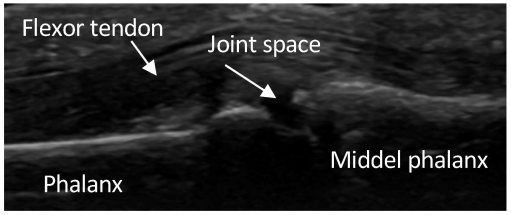
PIP2 - PIP3 volar



The subject will be in a sitting position with the hands palm-side up in a neutral position on an examination table. A longitudinal volar scan of the PIP2 and PIP3 joints.
Landmarks: 1) the head of the proximal phalanx and 2) the base of the middle phalanx and 3) the flexor tendon.



BM scoring for the PIP2 and PIP3 joints, volar

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion, possible to extend proximally but without convex shape
2: Moderate synovial hypertrophy/effusion extending over the proximal phalanx with convex shape, but not filling the joint space between proximal and middle phalanx
3: Severe synovial hypertrophy/effusion extending over the proximal phalanx and filling the joint space between proximal and middle phalanx with an overall convex shape

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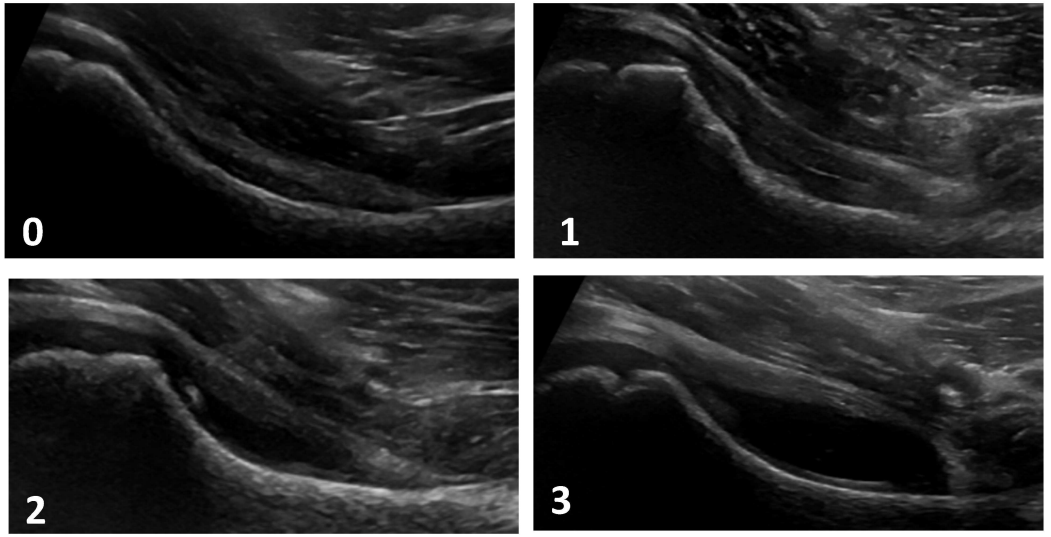
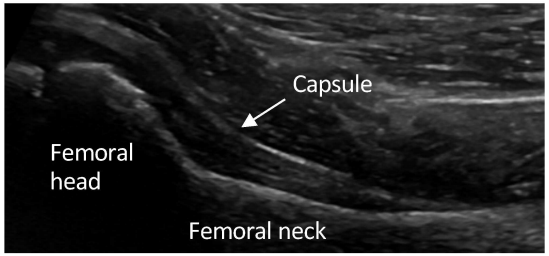
Hip

The subject will be in a supine position with the hip in a neutral position, slightly externally rotated. A longitudinal anterior scan parallel to the femoral neck of the hip joint.
Landmarks: 1) the femoral head and 2) the femoral neck.





BM scoring for the hip joint

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion, but just a "slit" of fluid between the two layers of the capsule
2: Moderate synovial hypertrophy/effusion leading to a straight line/minimal convex shape of the capsule
3: Severe synovial hypertrophy/effusion with a clearly convex shape, the effusion can also extend proximally over the femoral head

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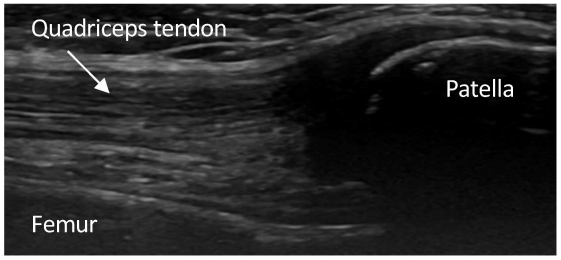
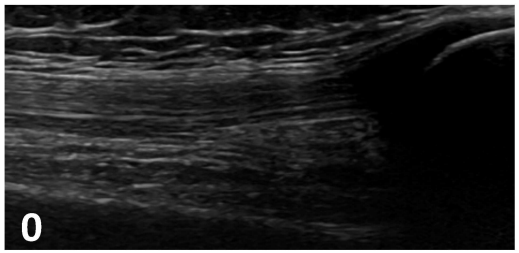
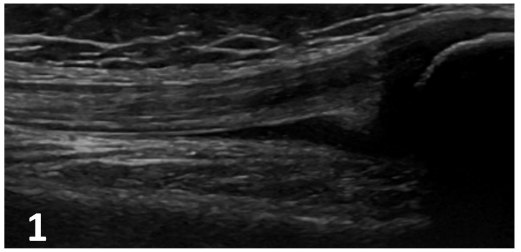
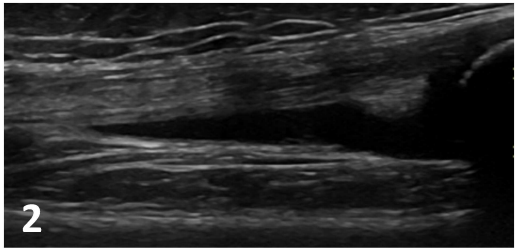
Knee, suprapatellar recess

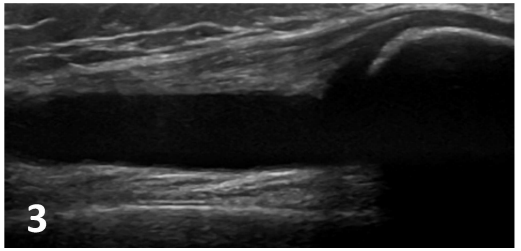
The subject will be in a supine position. The knee should be flexed at 30 degrees, and images taken after the subject completes flexion and extension three times. A longitudinal scan of the suprapatellar joint space. For the youngest subjects, the patella should be 1/3 of the image to compensate for the relatively shorter femur.
Landmarks: 1) the proximal third of the patella and 2) a clearly visualized quadriceps tendon.
(Ting et al. 2019)











BM scoring for the knee, suprapatellar recess

0: "Slit" of fluid/synovium without elevation of the pre-patellar fat pad but with only minimal extension beyond the prepatellar fat pad
1: Mild synovial hypertrophy/effusion with elevation of the prepatellar fat pad and extension proximally <50% of the visualized portion of the quadriceps tendon
2: Moderate synovial hypertrophy/effusion elevating the pre-patellar fat pad with extension proximally > 50% of the visualized portion of the quadriceps tendon
3: Significant distension of the suprapatellar recess throughout the image, and with the most proximal portion of the synovial recess being > 50% of the maximum distension of the recess
(Ting et al. 2019)

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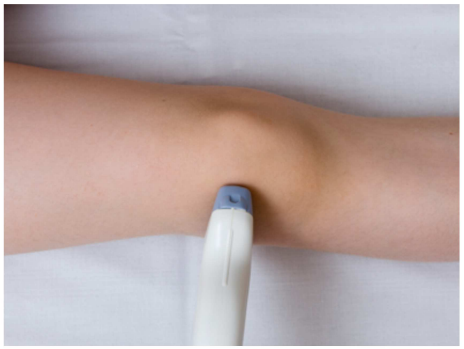
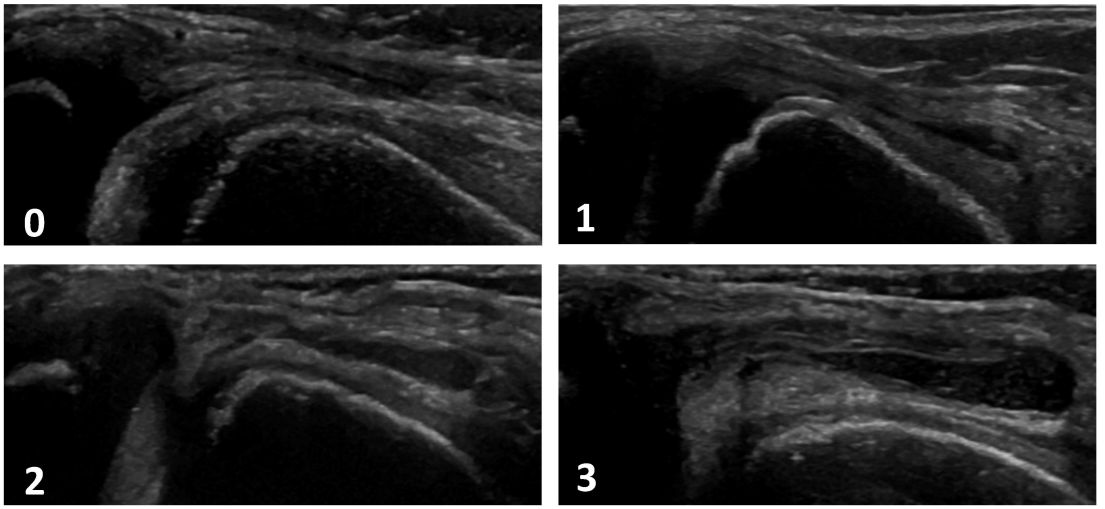
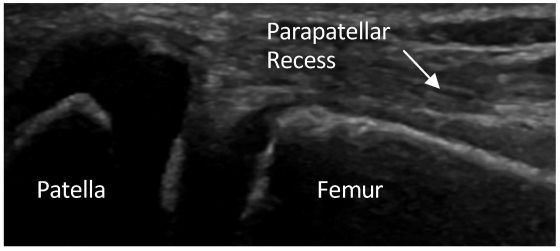
Knee, lateral parapatellar recess



The subject will be in a supine position. The knee should be flexed at 30 degrees. For the lateral parapatellar recess the image will be obtained with the probe in transverse position over the mid-patella with both the patella and femur in view. ***Landmarks:*** 1) the superior edge of the patella and 2) the femoral condyle.
(Ting et al. 2019)





BM scoring for the knee, lateral parapatellar recess

0: Empty parapatellar recess but a minimal bulge of synovial hypertrophy/effusion may be found extending to the patellofemoral joint line
1: Synovial hypertrophy/effusion filling < 1/3 of the full area of the parapatellar recess
2: Synovial hypertrophy/effusion filing between one to two thirds of the full area of the parapatellar recess
3: Synovial hypertrophy/effusion that fills >2/3 of the full area of the parapatellar recess and clearly pushing up the retinaculum
(Ting et al. 2019)

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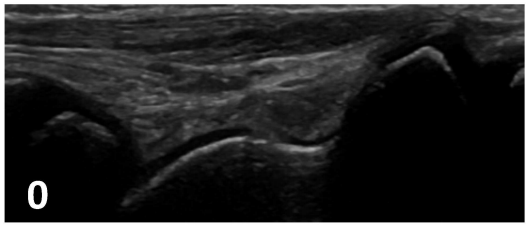
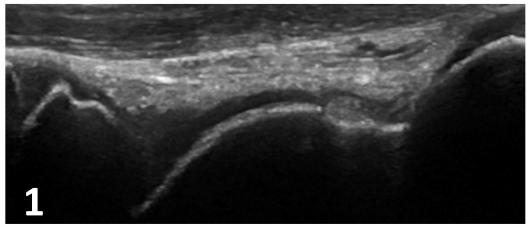
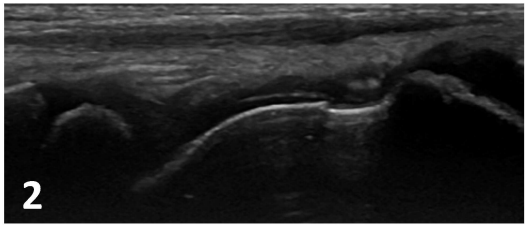
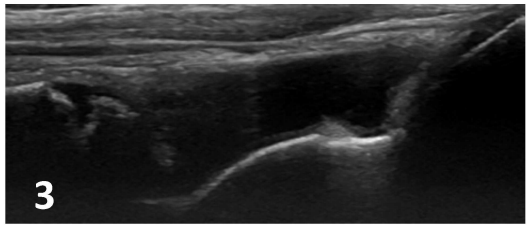
Tibiotalar

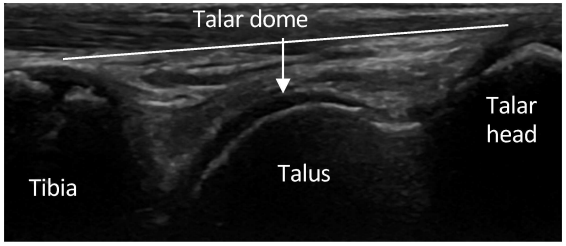
The subject will be in a supine position with the knee at 90 degrees flexion and the foot sole-side down.
A longitudinal scan of the tibiotalar joint.
Landmarks: 1) the distal end of the tibia and 2) the talus.











BM scoring for the tibiotalar joint

0: No sign of synovial hypertrophy/effusion in the tibiotalar joint, but possible to have a minimal amount of fluid in the concave neck of the talus
1: Mild synovial hypertrophy/effusion filling the gap between the tibia and the talus and in the concave neck of the talus, but not continuously over the talus
2: Moderate synovial hypertrophy/effusion filling up to 50% of the area between the tibia, the talus and the imaginary line* and continuously over the talus
3: Severe synovial hypertrophy/effusion filling more than 50% of the area between the tibia, the talus and the imaginary line*, or beyond the imaginary line*

**The line between the top of the cartilage of the distal end of the tibia and the top of the cartilage of the talar head*

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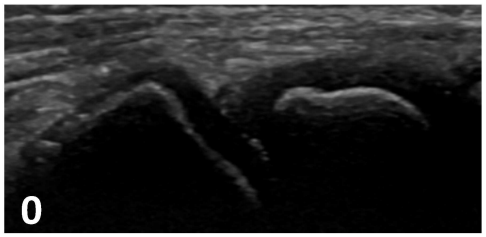
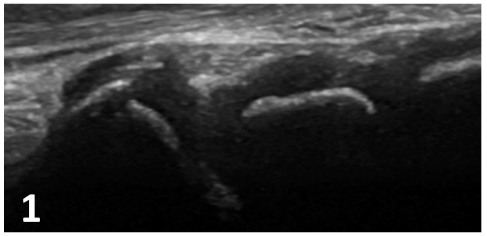
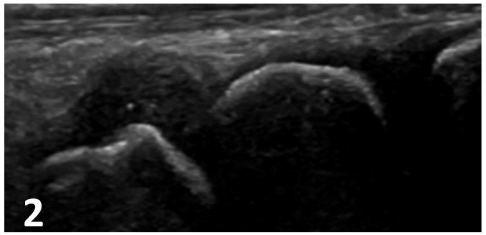
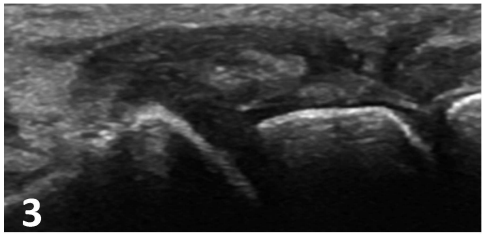
Talonavicular

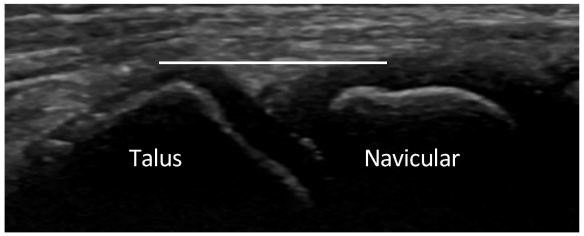
The subject will be in a supine position with the knee at 90 degrees flexion and the foot sole-side down.
A longitudinal scan of the talonavicular joint.
Landmarks: 1) the talus and 2) the navicular bone.











BM scoring for the talonavicular joint

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion but not beyond the imaginary line*
2: Moderate synovial hypertrophy/effusion extending beyond the imaginary line* and proximal with a concave or straight shape
3: Severe synovial hypertrophy/effusion extending beyond the imaginary line* and over the talus with a convex shape clearly pushing up the joint capsule

** The line between the top of the cartilage of the head of the talus to the top of the cartilage of the navicular bone*

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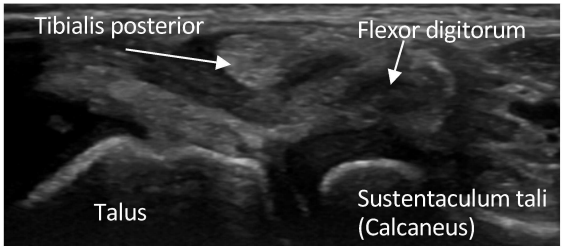
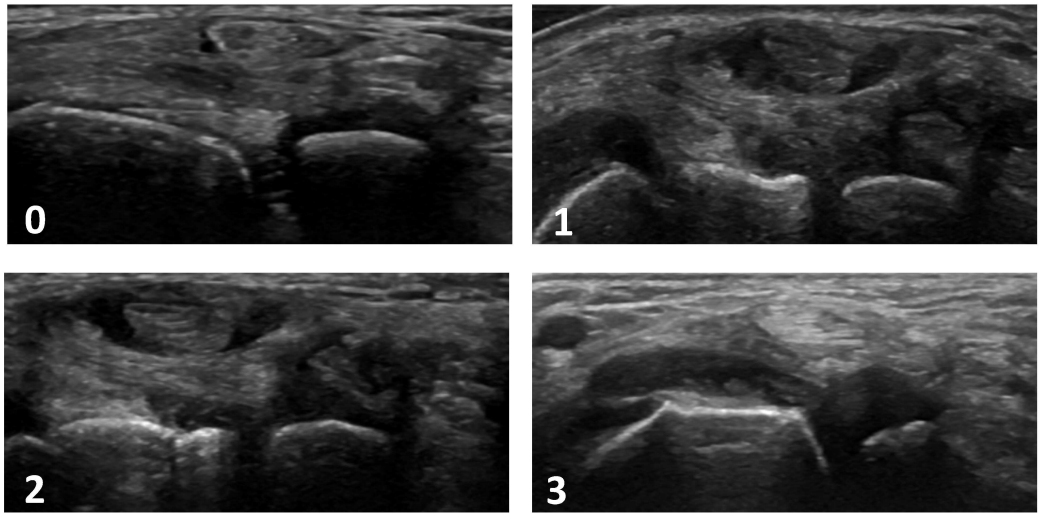
Anterior subtalar

The subject will be in a supine position with the leg straight and the forefoot/ankle in slight eversion. The probe will be positioned at 45 degrees pointing to the heel and then moved proximally and distally. A medial scan of the anterior subtalar joint.
Landmarks: 1) the talus and 2) the sustentaculum tali (calcaneus).





BM scoring for the anterior subtalar joint

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion covering up to 25% of the straight part of the talus
2: Moderate synovial hypertrophy/effusion covering up to 50% of the straight part of the talus
3: Severe synovial hypertrophy/effusion covering more than 50% of the straight part of the talus

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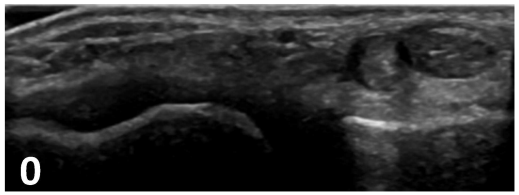
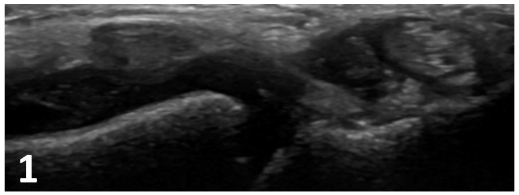
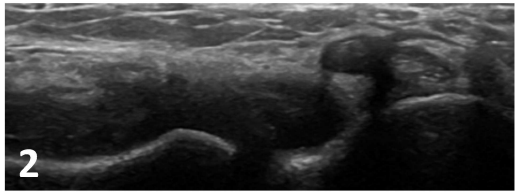
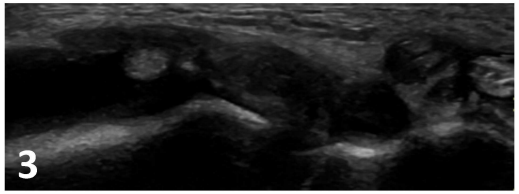
Posterior subtalar

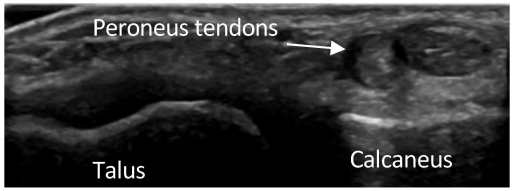








The subject will be in a supine position with the leg straight and the forefoot/ankle in slight inversion. The probe will be positioned along the sinus tarsi perpendicular to the sole, and then moved posteriorly. If no distension is seen, the image will be taken visualizing the joint with the peroneus tendons. A lateral scan of the posterior subtalar joint.
Landmarks: 1) the talus and 2) the calcaneus.



BM scoring for the posterior subtalar joint

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion filling the gap between the talus and the calcaneus
2: Moderate synovial hypertrophy/effusion extending beyond the talus and the calcaneus but not with a convex shape
3: Severe synovial hypertrophy/effusion extending beyond the talus and the calcaneus with a convex shape

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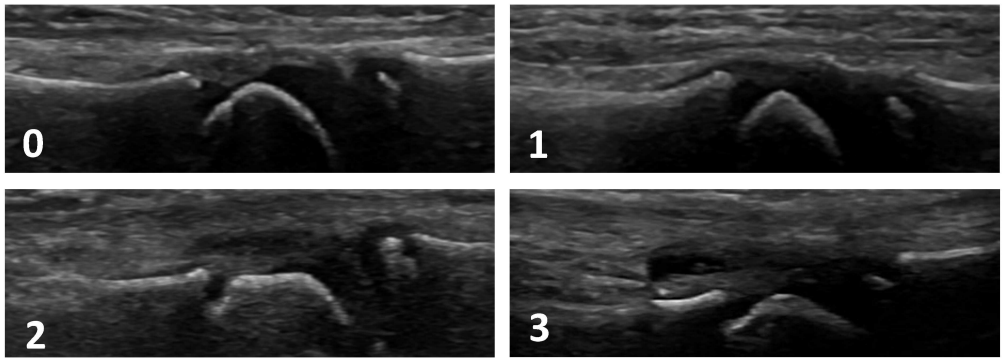
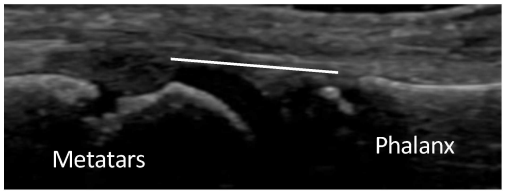
MTP2 - MTP3 dorsal



The subject will be in a supine position with the knee at 90 degrees flexion and the foot sole-side down. A longitudinal dorsal scan of the MTP2 and MTP3 joints.
***Landmarks*:** 1) the head of the metatarsal bone (2/3 of the image) and 2) the base of the proximal phalanx (1/3 of the image).



BM scoring for the MTP2 and MTP3 joints, dorsal

0: No sign of synovial hypertrophy/effusion
1: Mild synovial hypertrophy/effusion but not beyond the imaginary line*
2: Moderate synovial hypertrophy/effusion extending beyond the imaginary line*, but without overall convex shape
3: Severe synovial hypertrophy/effusion extending beyond the imaginary line* with a clearly convex shape

** The line between the top of the cartilage of the distal end of the metatars to the top of the cartilage of the proximal end of the phalanx*

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