

Atlas of healthy joints by ultrasound in children aged 0 – 18 years

Additional material to:

STRUCTURAL ULTRASOUND OF JOINTS AND TENDONS IN HEALTHY CHILDREN: NORMATIVE DATA

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Content

I. Cartilage

- Femoral head
- Trochlea knee
- Talar dome
- Head of the 1st metatarsal bone
- Head of the 2nd metacarpal bone

II. Recesses

- Acetabulofemoral recess
- Suprapatellar recess
- Parapatellar recess
- Tibiotalar recess
- Recess of MTP1 joint

- Lateral radiohumeral recess
- Anterior radiohumeral recess
- Posterior fossa elbow
- Wrist: radio-lunate recess, lunate-capitate recess, capitate-metacarpal III recess
- Recess of MCP2 joint

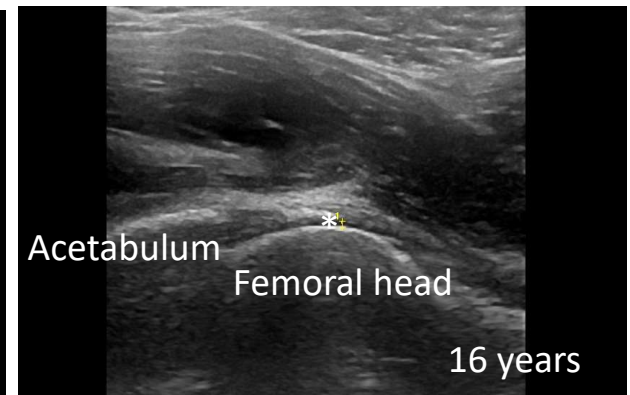
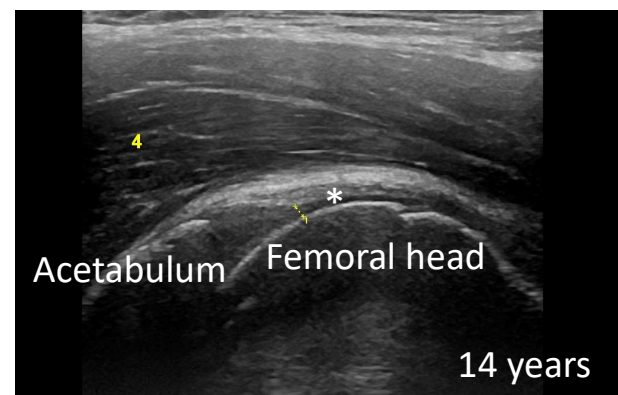
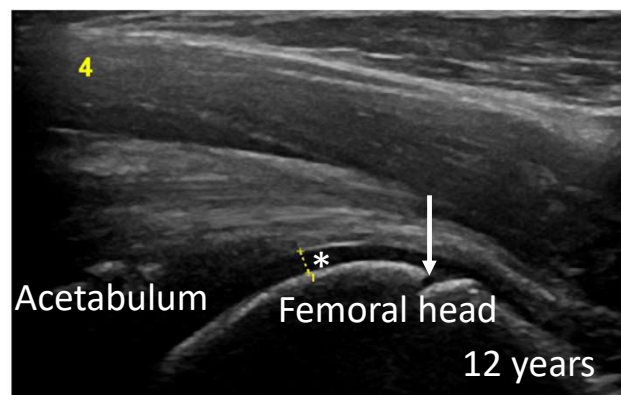
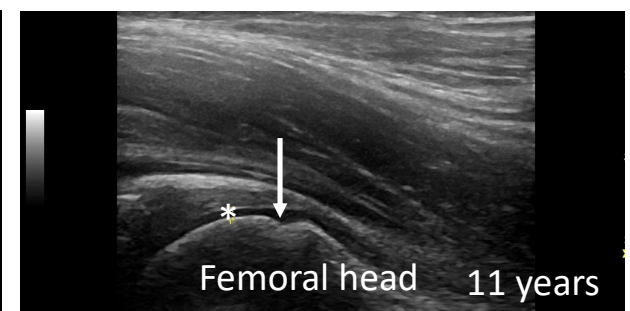
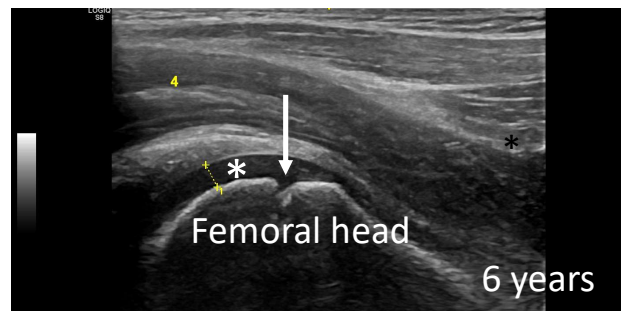
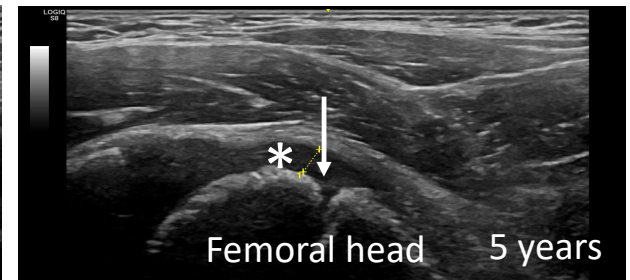
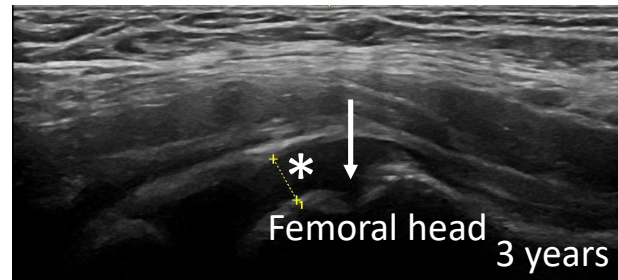
III. Tendons

- Biceps tendon
- Patellar tendon
- Extensor digitorum communis tendon
- Flexor digitorum (superficial and profound) tendon of the 2nd finger

- Cartilage thickness was measured as the greatest thickness of the cartilage layer, including the layer of hyaline cartilage, perpendicular to the bone cortex.
- The bone-capsule distance was measured as the maximal distance between the capsular layer and underlying bone cortex.
- Diameter of tendons was measured as the maximal diameter of the tendon in the transverse view, including the synovial sheet if present.
- Images belong to children from several age categories between 0 and 18 years. Specific age is explicated under the image.

I. Cartilage

Cartilage femoral head



Cartilage femoral head

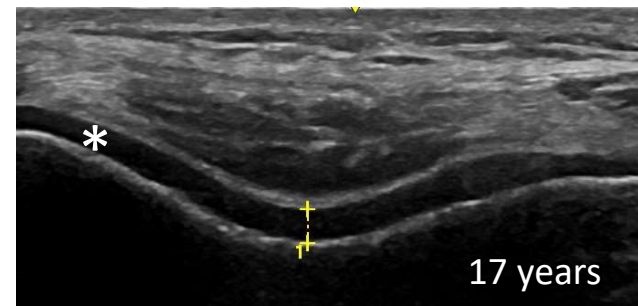
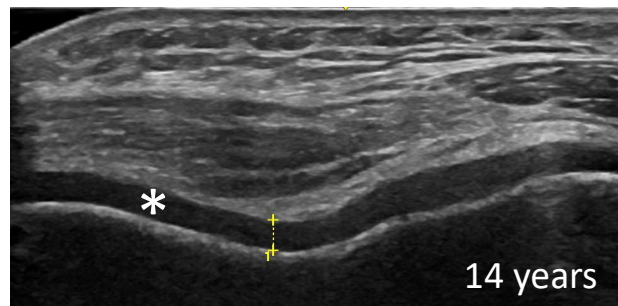
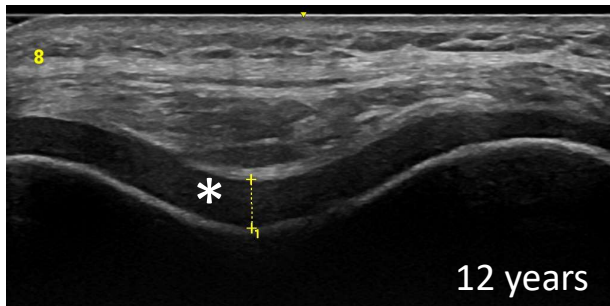
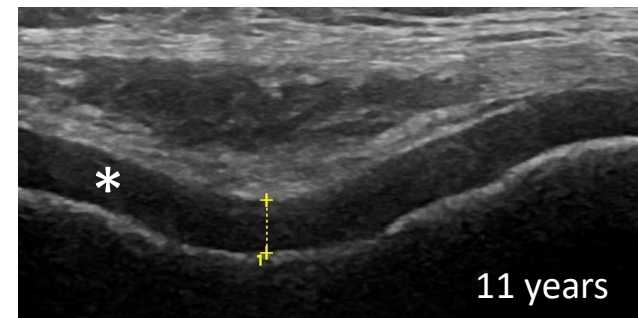
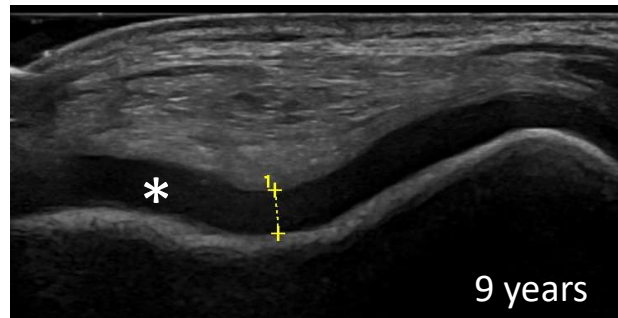
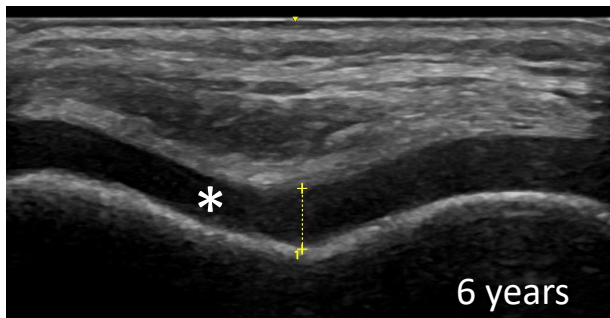
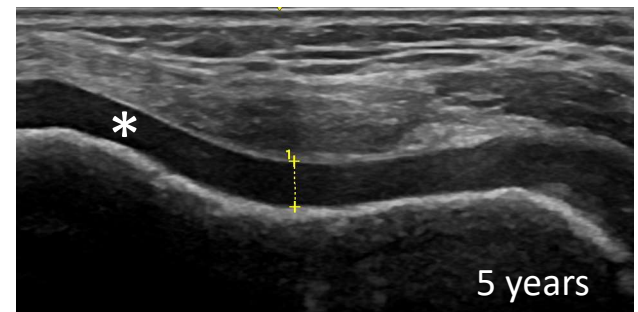
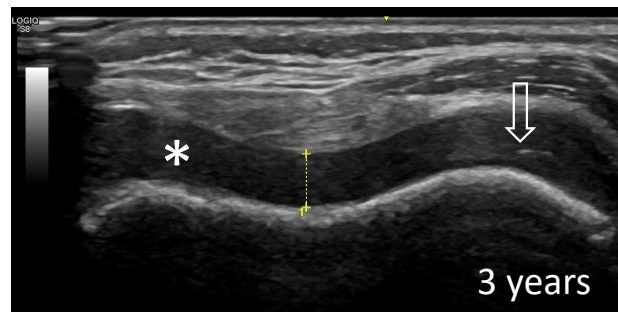
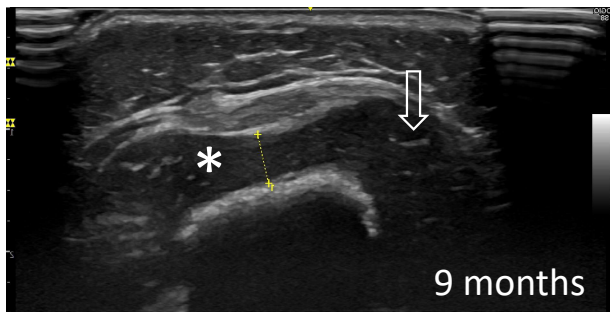
The femoral head in anterior longitudinal view: the femoral head of the children in the younger age groups is not well rounded due to the presence of the growth plate and the incomplete ossified epiphysis. This changes around the age of 10, when the head becomes more rounded. The growth plate disappears even a few years later.

Legend to images:

*: the black anechoic line represents cartilage

↓: the arrow marks the interruption of the bony cortex representing the growth plate

Cartilage trochlea of the knee



Cartilage trochlea of the knee

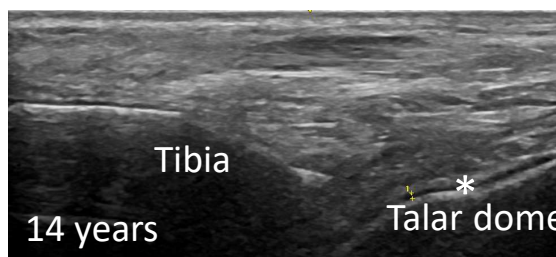
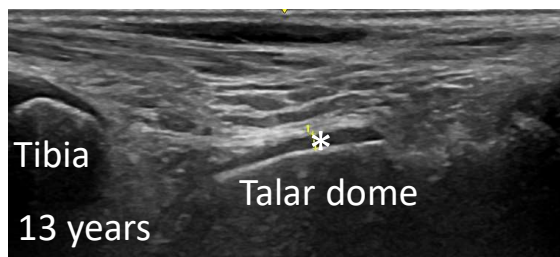
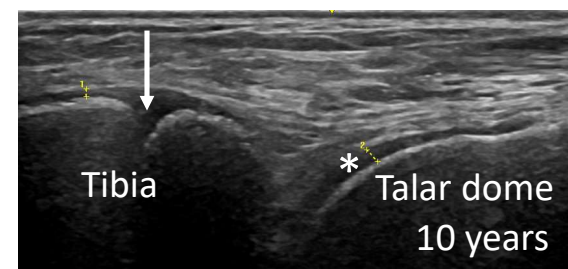
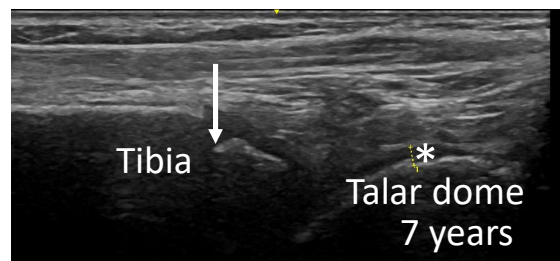
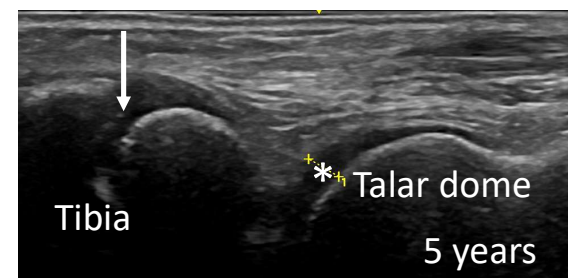
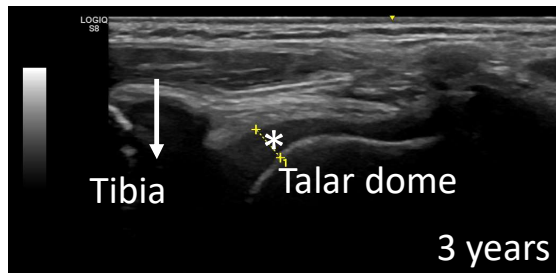
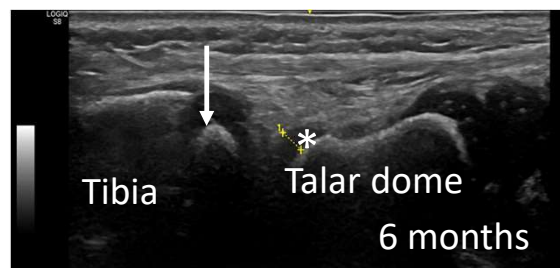
The cartilage overlying the trochlea of the knee in maximal flexion, in transverse view: a regular, symmetric anechoic layer is visible on the bone. In the children of the younger age groups, some hyperechoic spots are visible, representing vascular channels that close when growing.

Legend to images:

*: the black anechoic line represents cartilage

↓: vascular channels

Cartilage talar dome



Cartilage of the talar dome

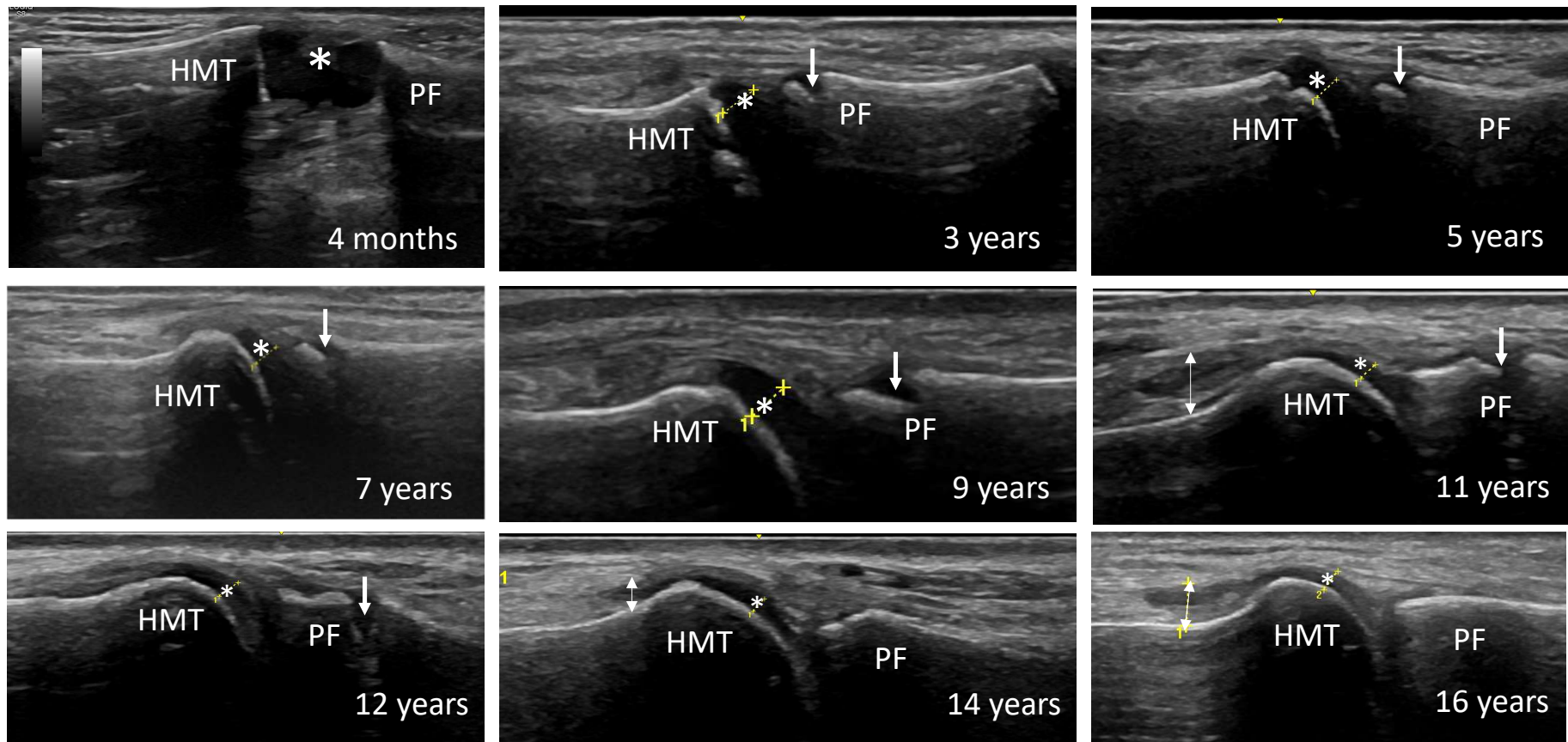
Cartilage at the talar dome in the ankle in anterior longitudinal view: presence of growth plate and incomplete ossified epiphysis at the distal tibia in the younger children.

Legend to images:

*: the black anechoic line represents cartilage

↓: the arrow marks the interruption of the bony cortex representing the growth plate

Cartilage of head of the 1st metatarsal bone



Cartilage of head of 1st metatarsal bone

Cartilage at the head of the 1st metatarsal bone in longitudinal midline view: presence of growth plate and incomplete ossified epiphysis at the proximal phalanx in the younger children.

Some fluid being present in the recess on the images of the children aged 11 years, 14 years and 16 years.

Legend to images:

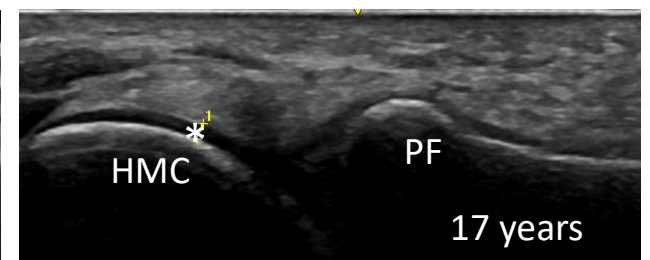
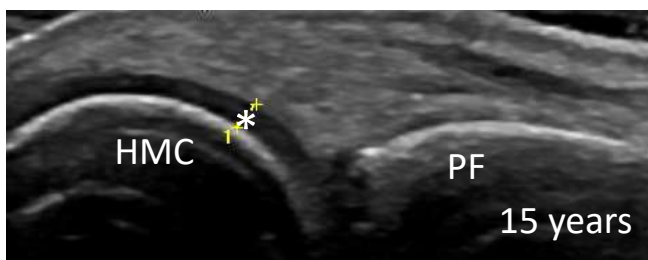
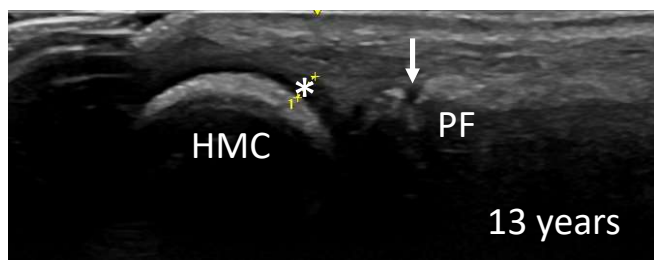
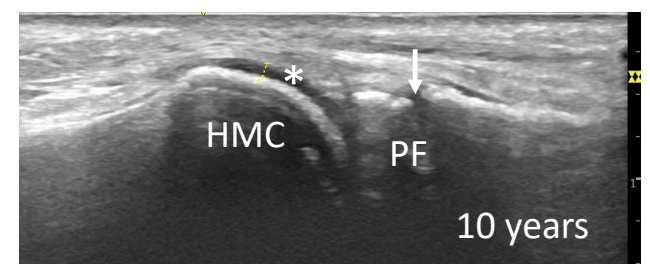
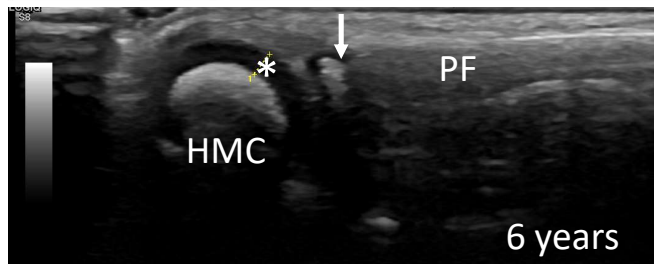
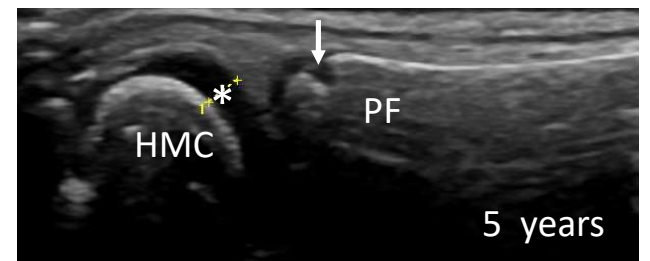
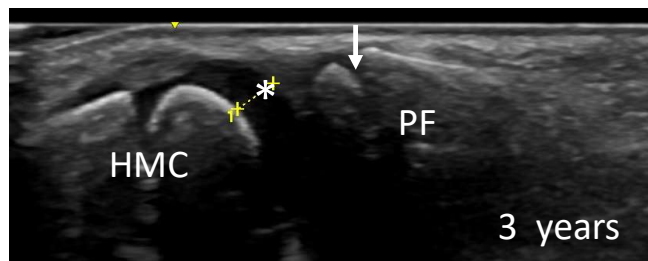
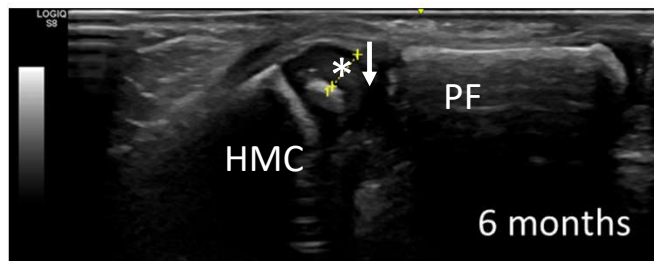
*: the black anechoic line represents cartilage

↓: the arrow marks the interruption of the bony cortex representing the growth plate

↑: some capsular distention in the recess is present

HMT: head of metatarsal bone; PF: proximal phalanx

Cartilage of head of the 2nd metacarpal bone



Cartilage of head of 2nd metacarpal bone

The cartilage, measured at the metacarpal head of the second finger with the MCP2 joint in maximal flexion, in longitudinal midline view: presence of growth plate and incomplete ossified epiphysis at the proximal phalanx in the younger children.

Legend to images:

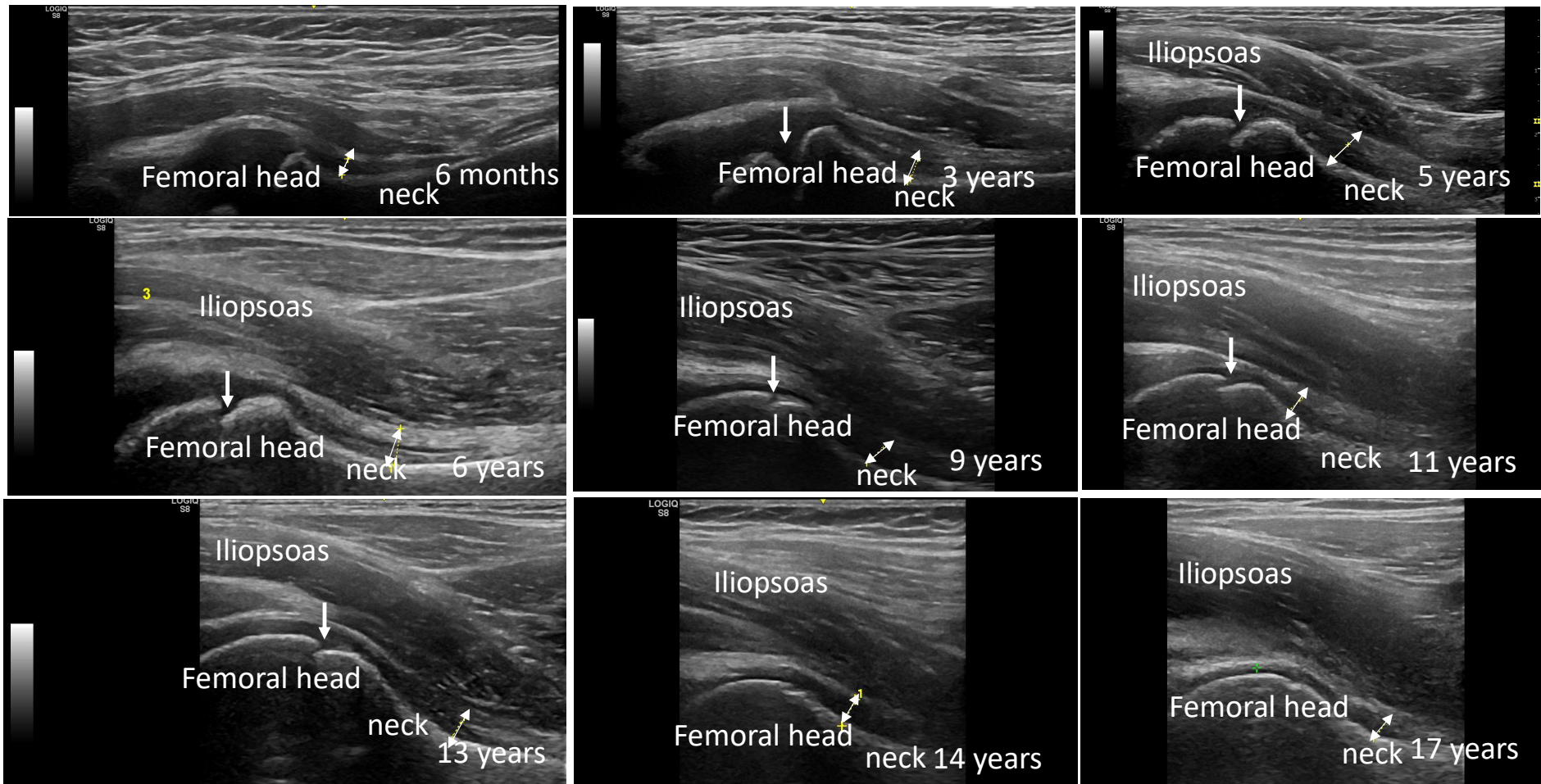
*: the black anechoic line represents cartilage

↓: the arrow marks the interruption of the bony cortex representing the growth plate

HMC: head of metacarpal bone; PF: proximal phalanx

II. Recesses

Acetabulofemoral recess



Acetabulofemoral recess

Anterior longitudinal view: the maximal distance between the underlying bone of the femoral neck and the overlying capsule was measured (defined as the bone-capsule distance). As shown, some distention is always present but this clearly does not reflect capsular bulging what would be present in case of synovitis.

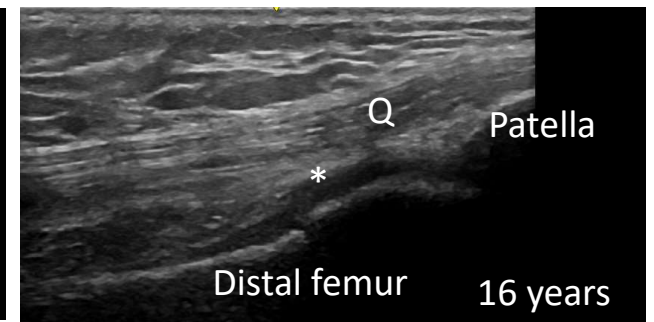
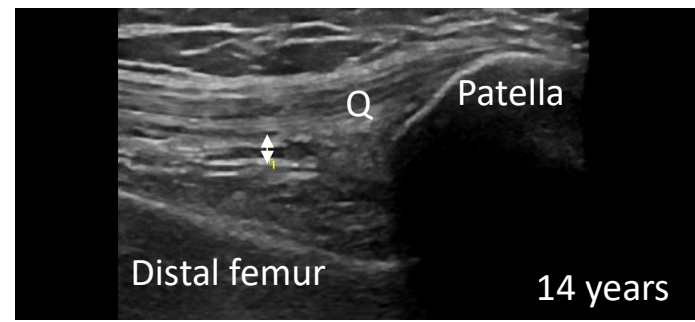
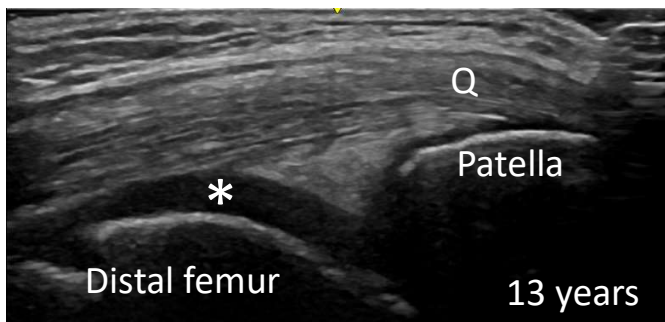
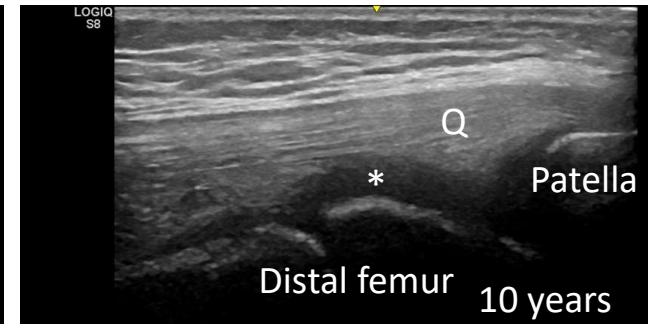
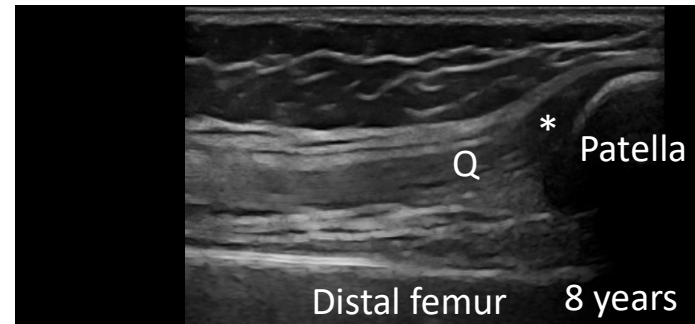
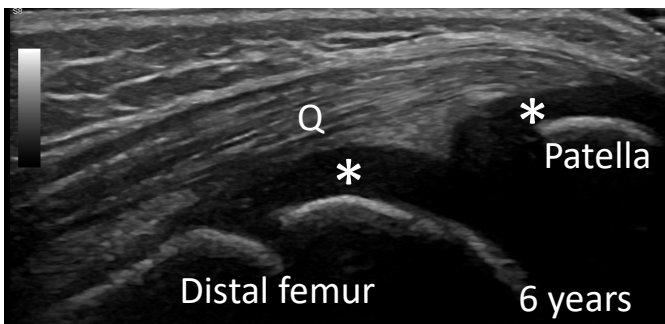
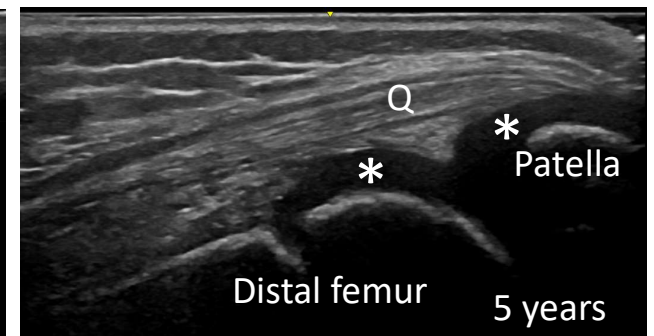
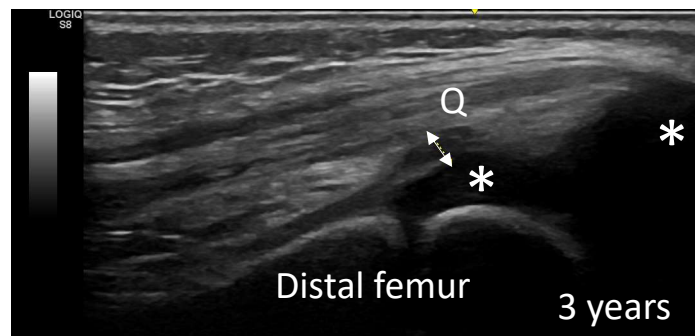
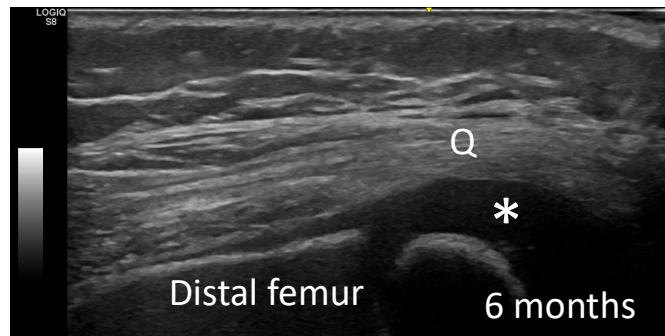
Also note to the presence of the growth plate and the incomplete ossified epiphysis at the femoral head. This closes around the age of 14 years.

Legend to images:

↕: bone to capsule distance

↓: the arrow marks the interruption of the bony cortex representing the growth plate

Suprapatellar recess



Suprapatellar recess

Longitudinal midline sagittal view of the knee with the knee in 30° flexion: effusion in the suprapatellar recess is often seen in healthy children (here, in the images of the 3-years and 14-years old children there is some effusion present). Note the large amounts of cartilage (anechoic signal) on the distal femur, not to be misinterpreted as effusion. In the youngest children, the patella is depicted as an unossified center anterior to the distal femur.

Legend to images:

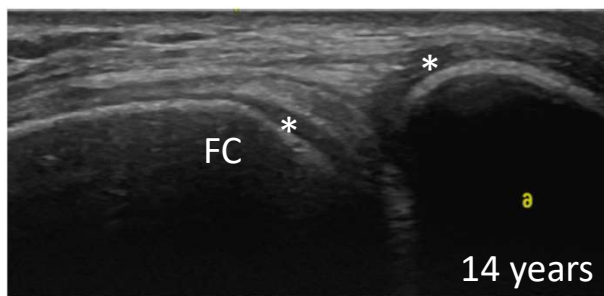
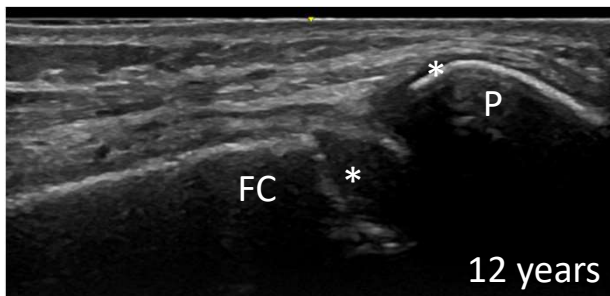
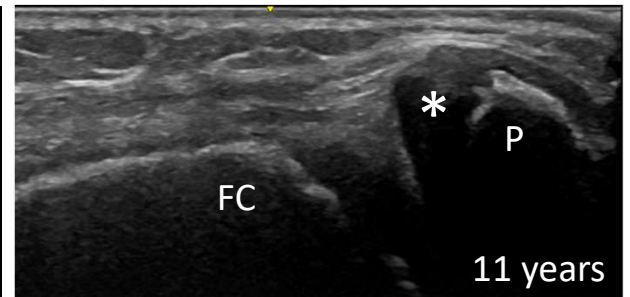
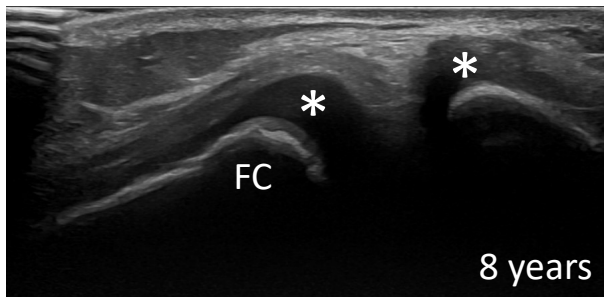
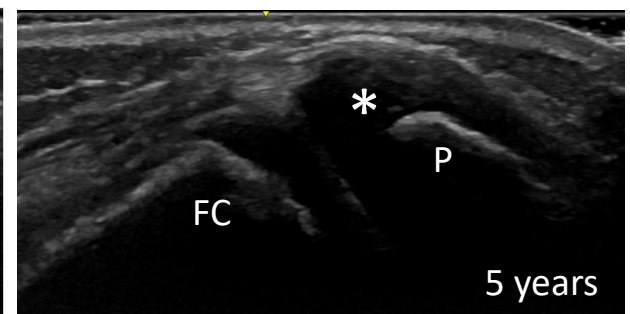
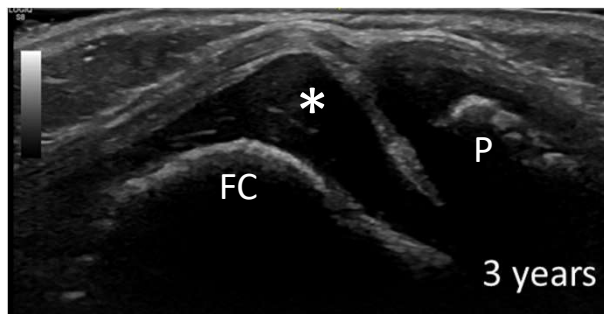
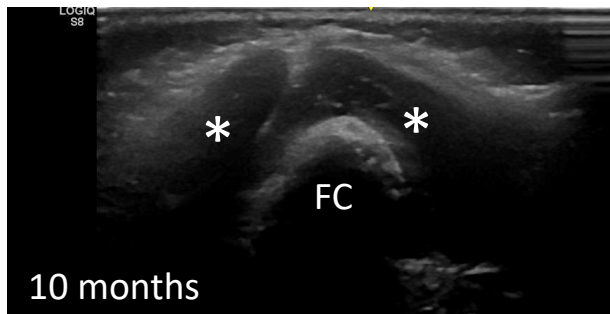
↕: bone to capsule distance

↓: the arrow marks the interruption of the bony cortex representing the growth plate

*: the anechoic signal represents cartilage

Q: quadriceps tendon

Parapatellar recess



Parapatellar recess

Transverse parapatellar (lateral) scan with the knee in maximal extension: some effusion in the parapatellar recess is seen in one quarter of healthy children. Large amounts of cartilage covers the patella and femoral condyles and decreases upon growing.

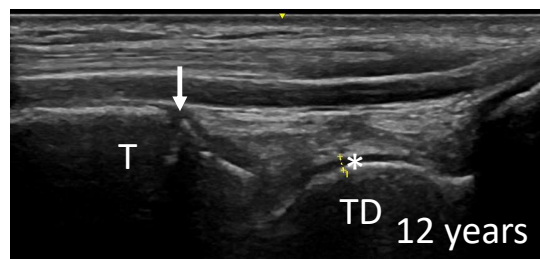
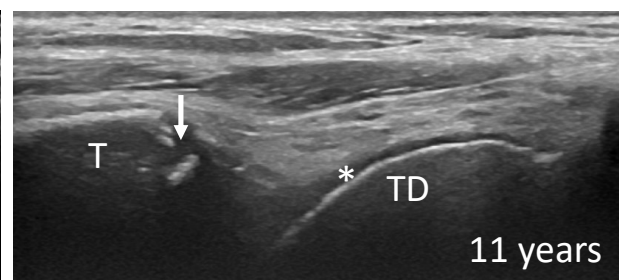
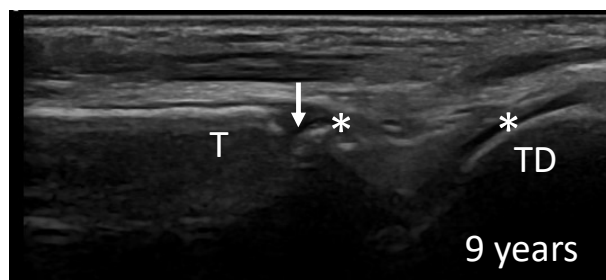
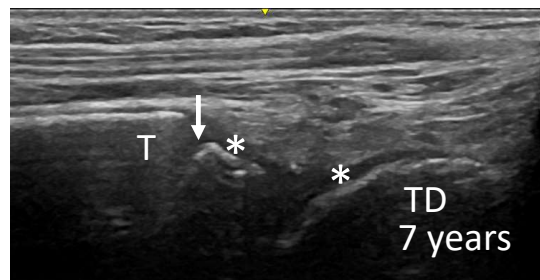
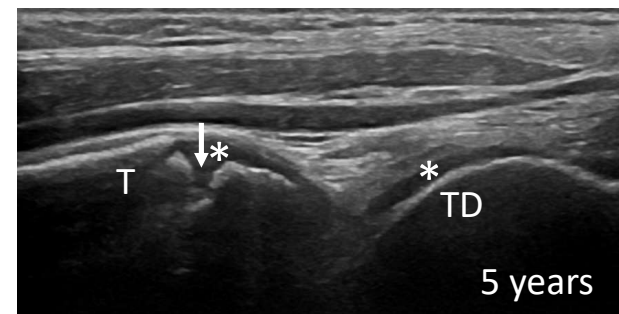
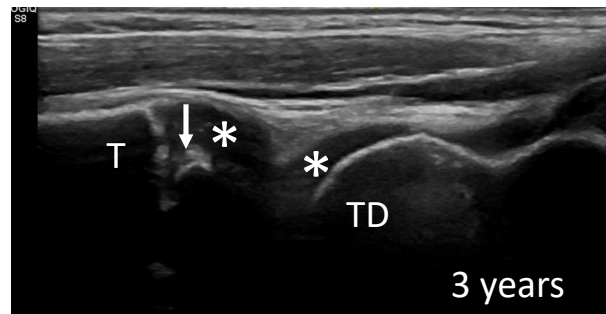
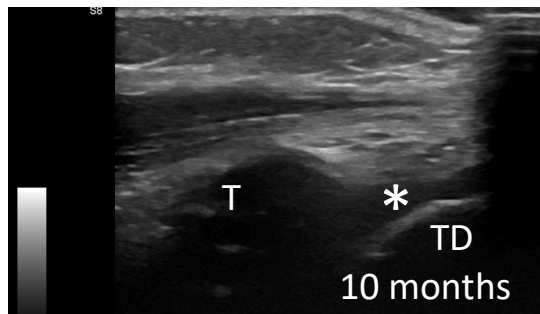
Legend to images:

↑↓: bone to capsule distance

*: the anechoic signal represents cartilage

FC: femoral lateral condyle; P: patella

Tibiotalar recess



Tibiotalar recess

Longitudinal sagittal midline view: effusion or any capsular distention of the tibiotalar recess is rare in healthy children. The cartilage on the talar dome and distal tibia is clearly decreasing upon growing.

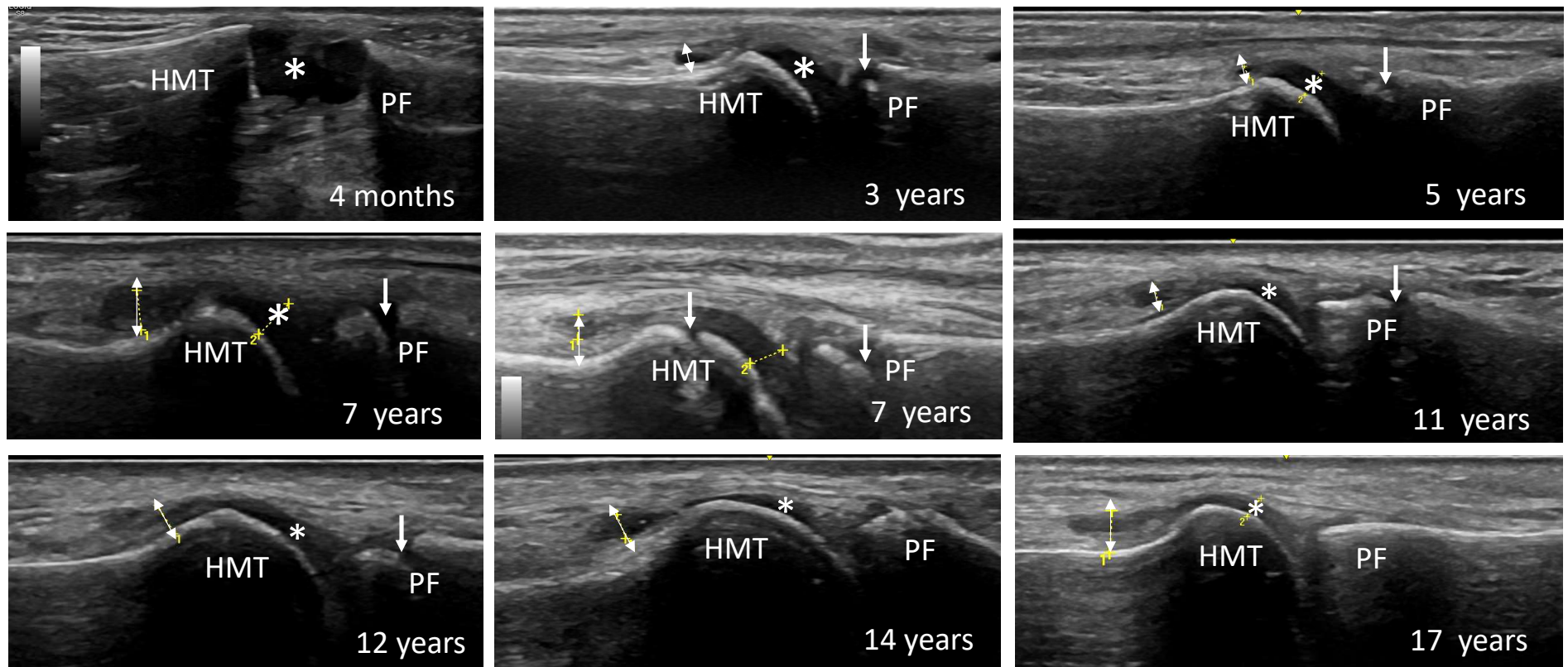
Legend to images:

*: the anechoic signal represents cartilage

↓: the arrow marks the interruption of the bony cortex representing the growth plate

TD: talar dome; T: tibia

Recess of MTP1



Recess of MTP1

Dorsal sagittal midline view: capsular distention (effusion and/or synovial hyperproliferation) is often seen in healthy children.

Legend to images:

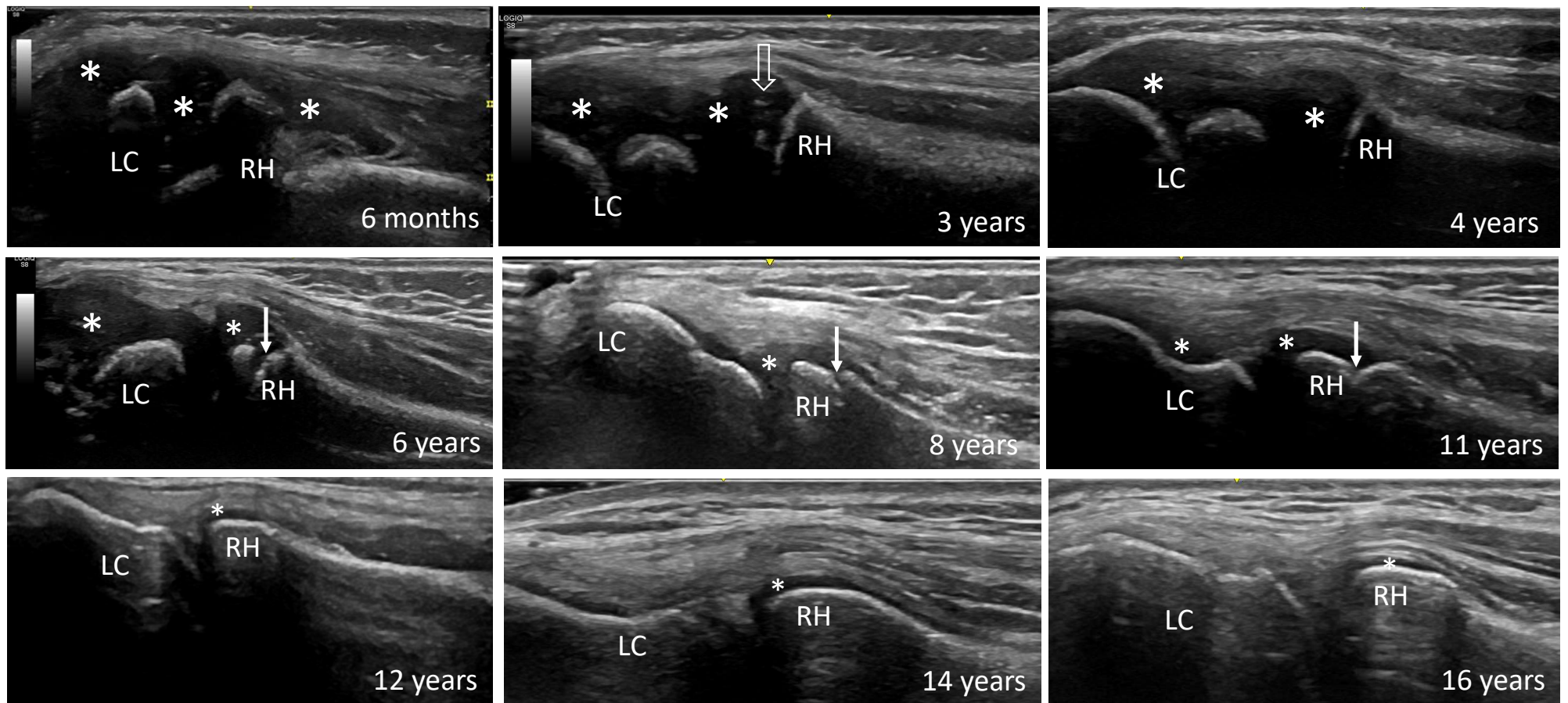
↕: some capsular distention in the recess is present

↓: the arrow marks the interruption of the bony cortex representing the growth plate

*: the black anechoic line represents cartilage

HMT: head of metatarsal bone; PF: proximal phalanx

Lateral radiohumeral recess



Lateral radiohumeral recess

Longitudinal radial view over radiohumeral joint, with elbow in 30° flexion: capsular distention of the lateral radiohumeral recess is rare in healthy children. The head of the radius of the children in the younger age groups is not well rounded due to the presence of the growth plate and the incomplete ossified epiphysis. This changes around the age of 12.

Legend to images:

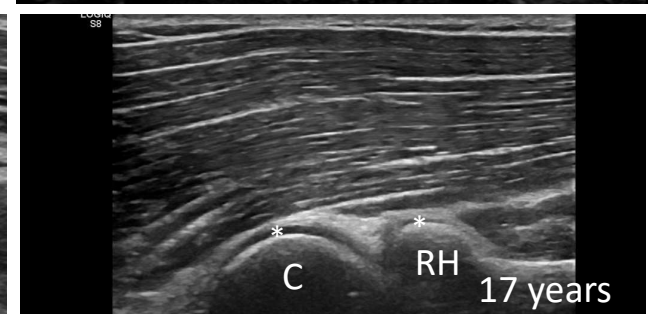
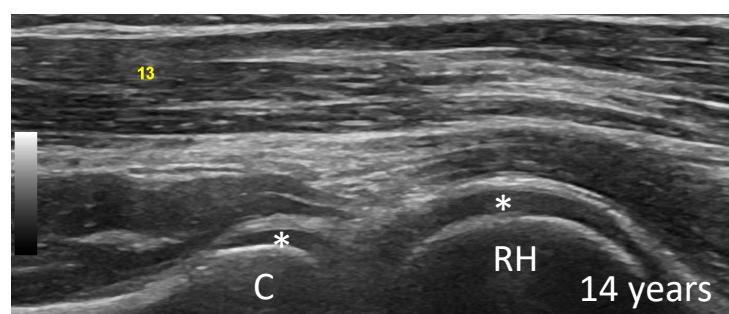
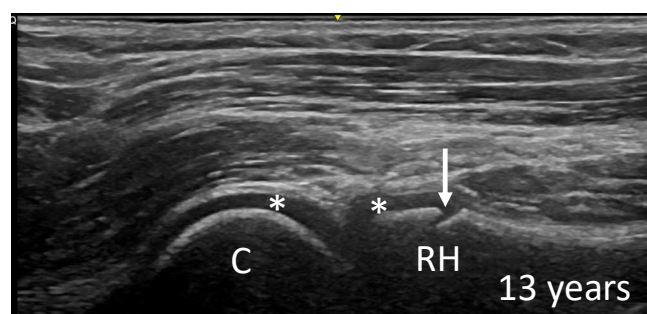
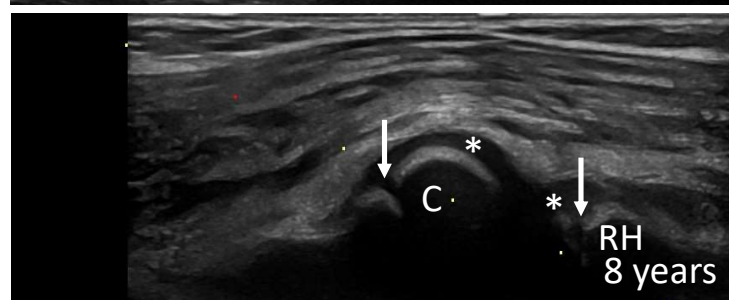
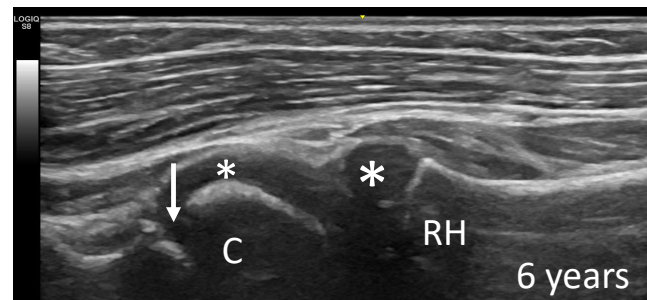
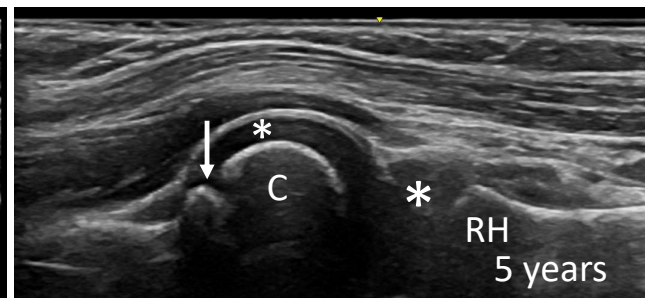
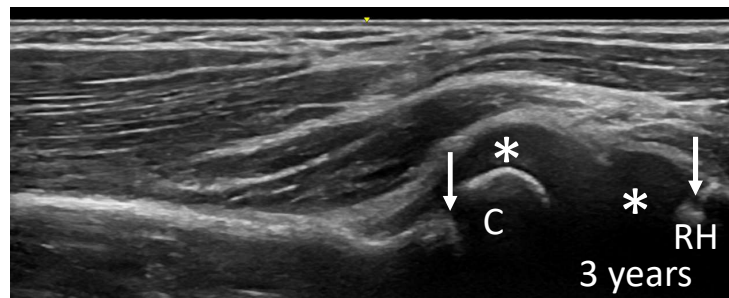
↓: the arrow marks the interruption of the bony cortex representing the growth plate

⇓: vascular channels

*: the black anechoic line represents cartilage

LC: lateral condyle of the humerus (capitulum); RH: radial head

Anterior radiohumeral recess



Anterior radiohumeral recess

Anterior sagittal view with the elbow in extension (not maximal since full extension will tend to force any fluid from the joint): some distention of the anterior radiohumeral recess was seen in 10% of the healthy children. Both the capitellum as radial head develop a more rounded shape upon growing.

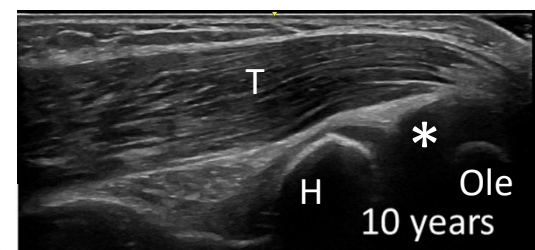
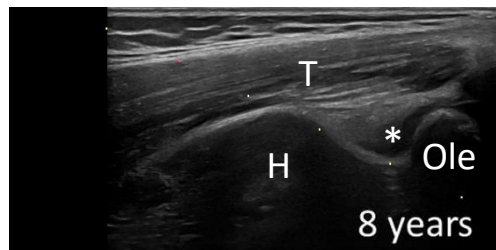
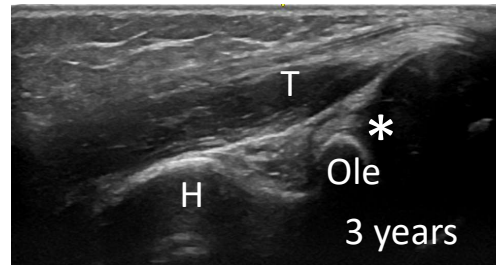
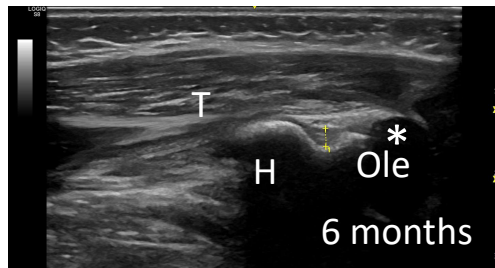
Legend to images:

↓: the arrow marks the interruption of the bony cortex representing the growth plate

*: the black anechoic line represents cartilage

C: capitellum (medial side) of the humerus; RH: radial head

Posterior fossa of the elbow



Posterior fossa of the elbow

Longitudinal view with elbow in 90° flexion: some effusion in the posterior fossa is often detected in healthy children in this position.

The black signal at the insertion of the triceps tendon represents anisotrophy.

Legend to images:

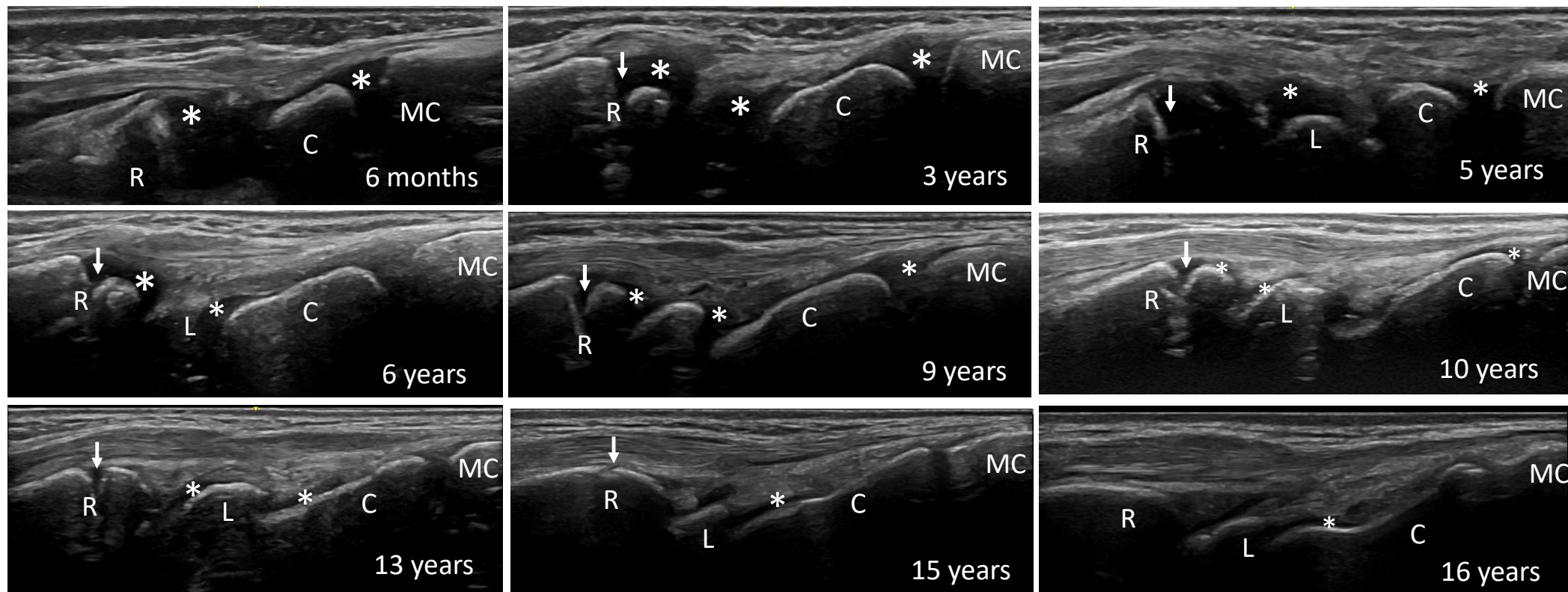
↕: some capsular distention in the recess is present

↓: the arrow marks the interruption of the bony cortex representing the growth plate

*: the black anechoic line represents cartilage

H: humerus; Ole: olecranon; T: triceps

Radiolunate – lunate-capitate – capitate-metacarpal 3 recesses



Radiolunate – lunate-capitate – capitate-metacarpal 3 recesses

Longitudinal sagittal view: effusion or capsular distention in the wrist recesses is almost not seen in healthy children. Note that the lunate bone is not yet visible in the youngest children (due to an unossified center). Growth plate at the distal radius closes around the age of 15 years.

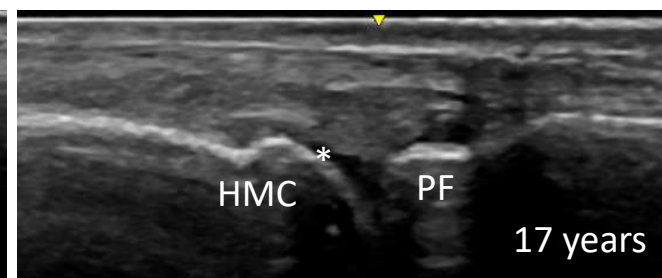
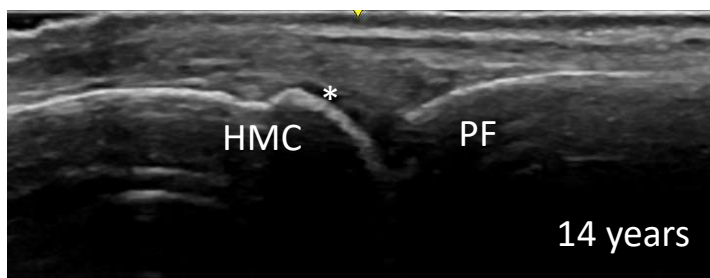
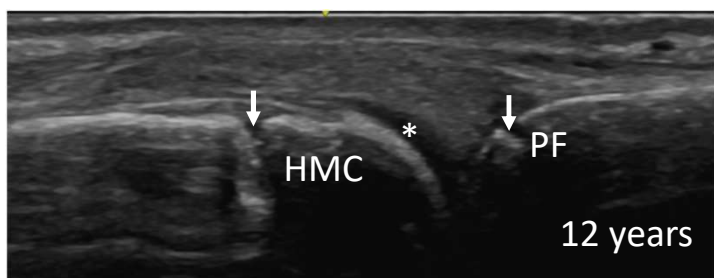
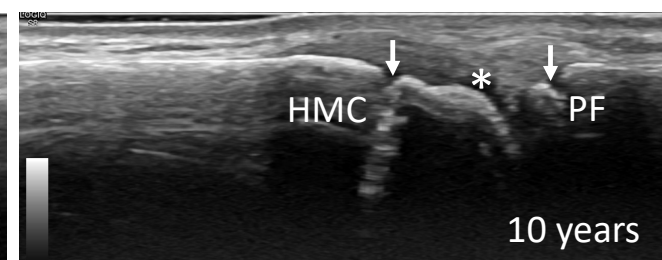
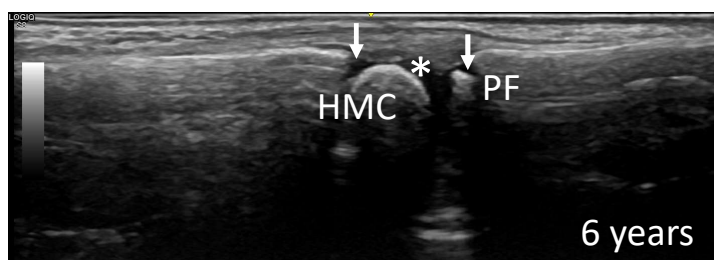
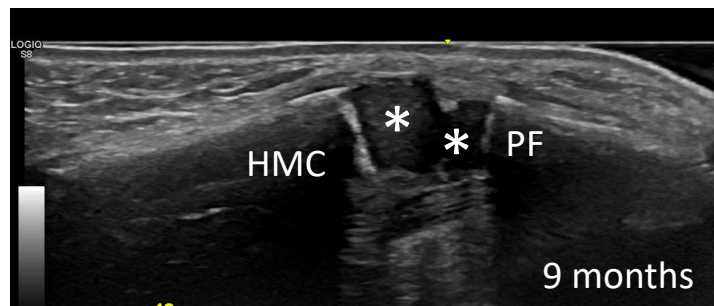
Legend to images:

↓: the arrow marks the interruption of the bony cortex representing the growth plate

*: the black anechoic line represents cartilage

R: distal radius; L: lunate bone; C: capitate bone; MC: base of the 3rd metacarpal bone

Recess of MCP2



Recess of MCP2

Longitudinal sagittal midline view (MCP joint in extension): effusion in the recess of MCP2 joint is very rare in healthy children. An abundance of cartilage is present in the MCP2 joint of little children. The cartilage is clearly decreasing while growing.

Epiphyseal growth is seen by closure of the epiphyses around the age of 14 years, both at the metacarpal head and at the base of the proximal phalanx.

Legend to images:

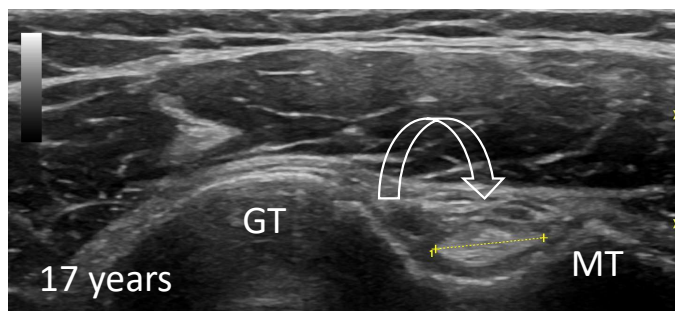
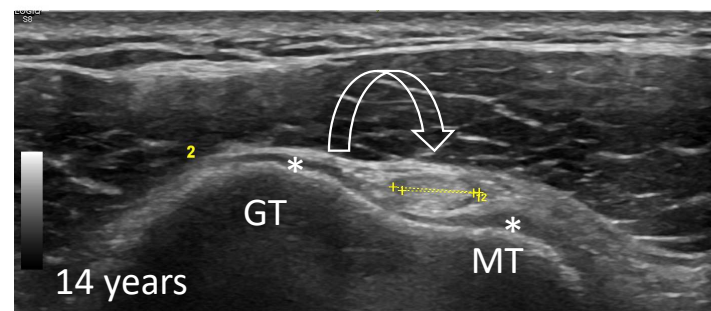
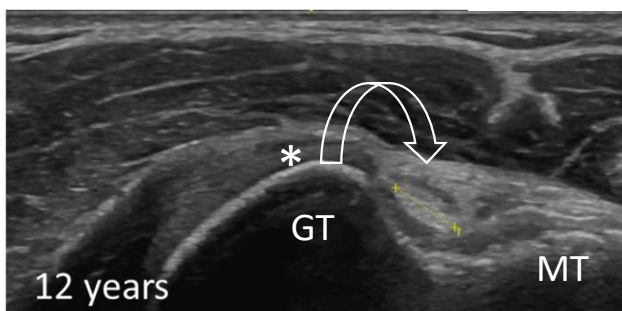
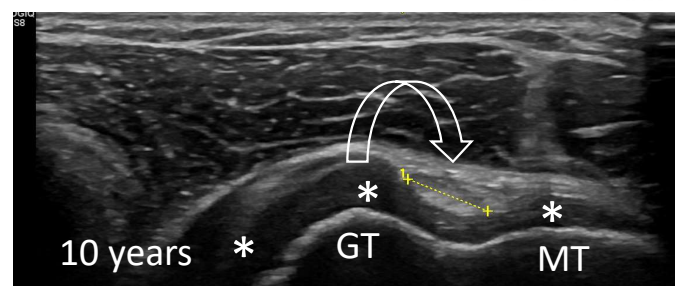
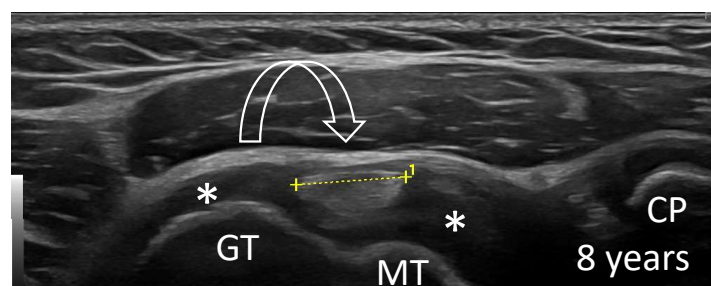
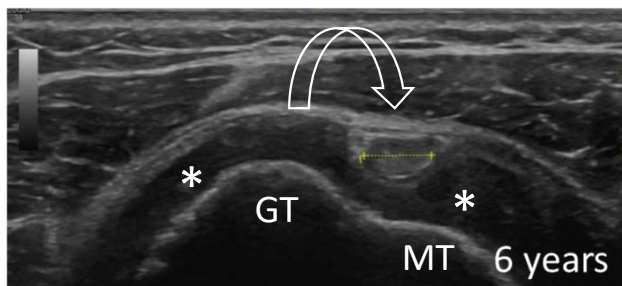
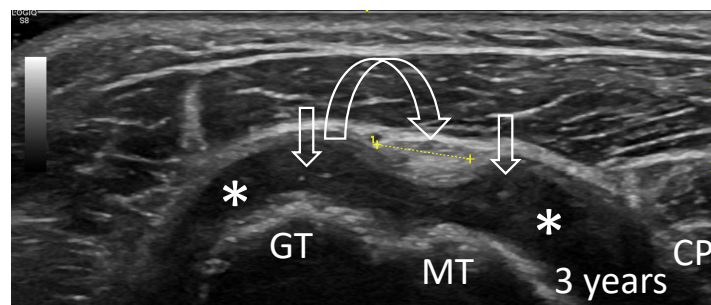
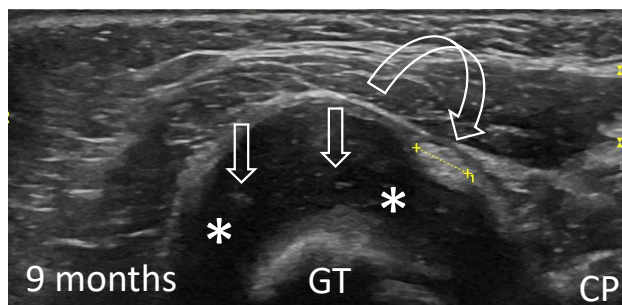
↓: the arrow marks the interruption of the bony cortex representing the growth plate

*: the black anechoic line represents cartilage

HMC: head of metacarpal bone; PF: proximal phalanx

III. Tendons

Biceps tendon



Biceps tendon

Transverse view: the biceps tendon lying in the bicipital recess, between the lesser tuberosity and the greater tuberosity. Note the large amount of cartilage (anechoic signal with some nutritional vessels creating hyperechoic spots) covering the underlying bone on the image of the younger children. This gradually decreases as children age.

Legend to images:

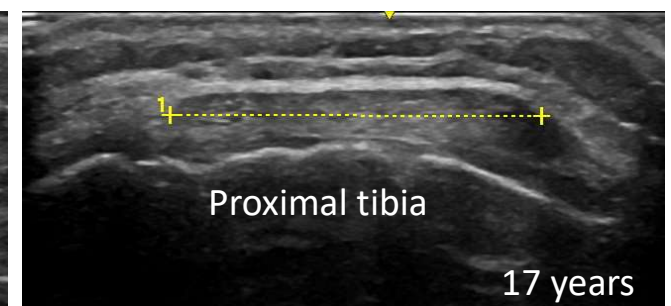
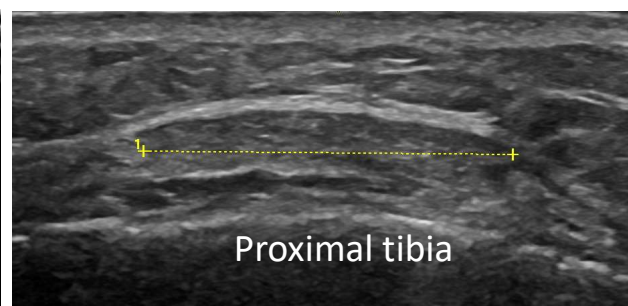
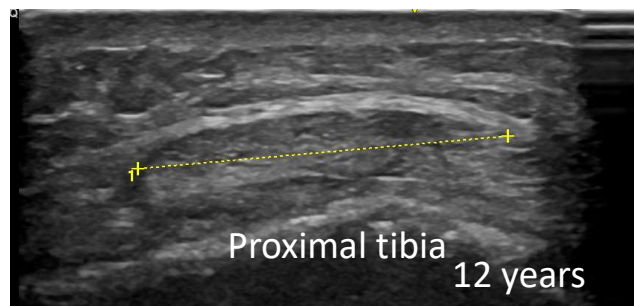
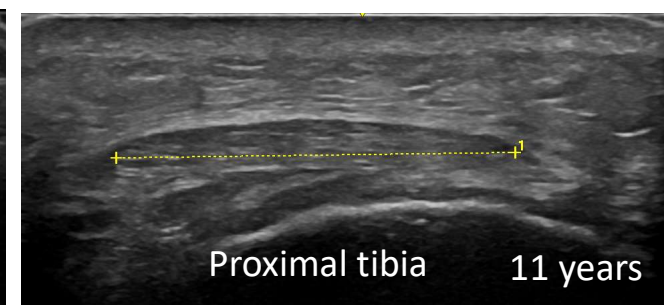
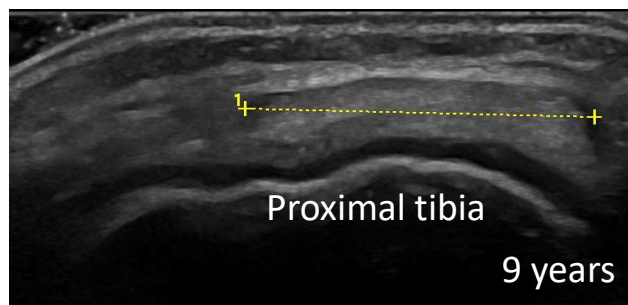
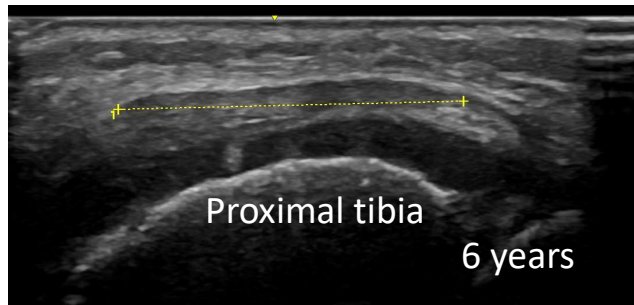
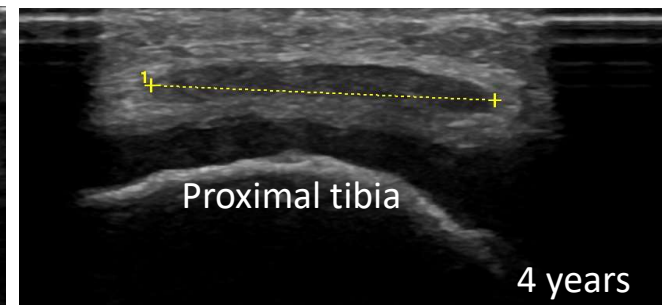
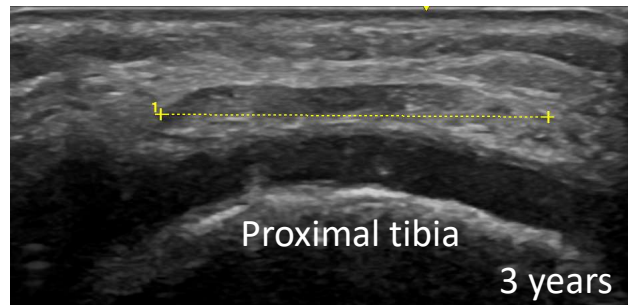
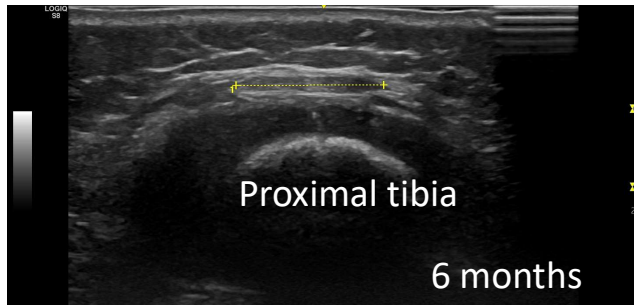
: curved arrow indicates the biceps tendon (fibrillar aspect) in the bicipital groove

: vascular channels

*: the black anechoic line represents cartilage

GT: greater tuberosity; MT: minor tuberosity; CP: coracoid process

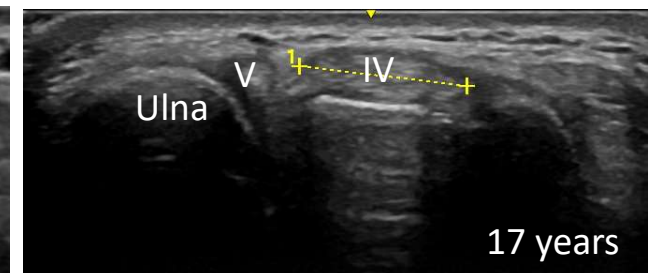
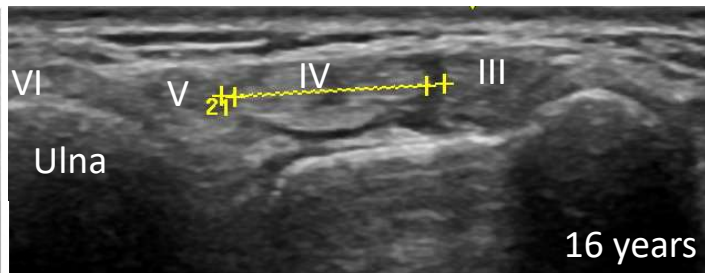
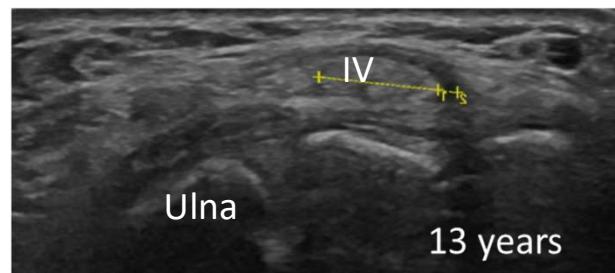
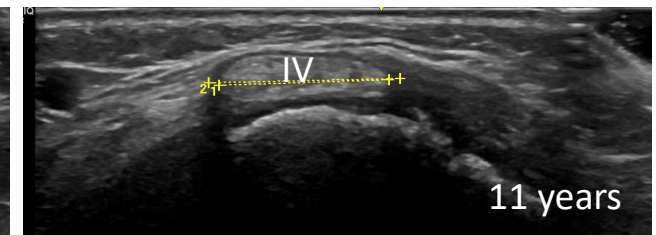
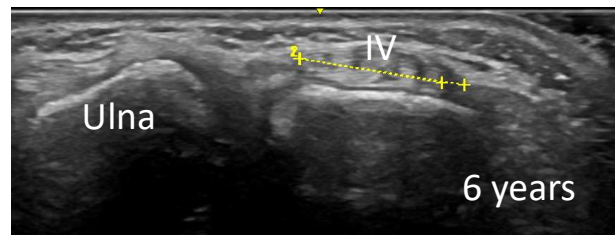
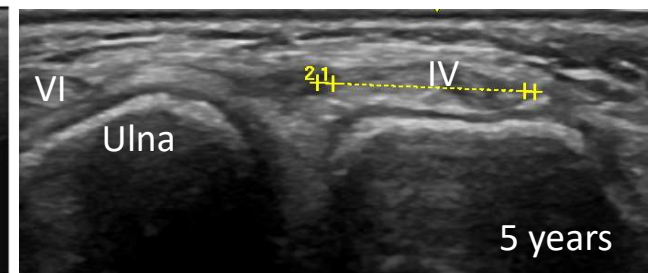
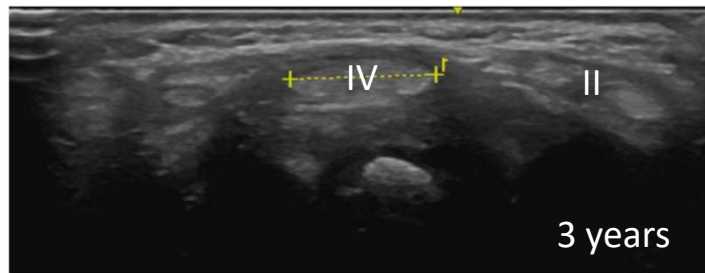
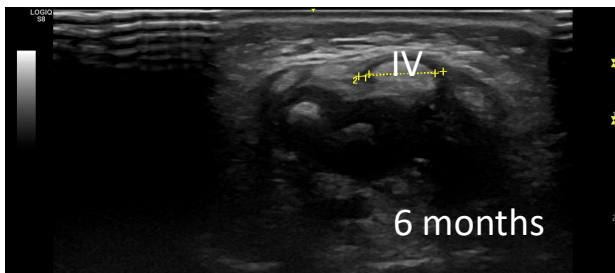
Patellar tendon



Patellar tendon

Transverse view, probe positioned between lower border of the patella and tuberosity tibiae: maximal diameter of the patellar tendon (yellow lines)

Extensor digitorum communis tendon



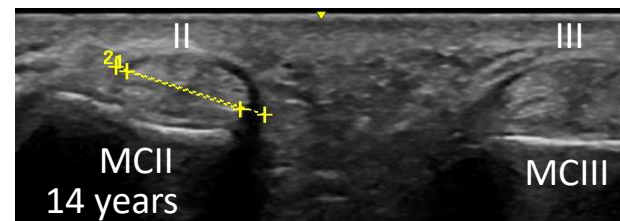
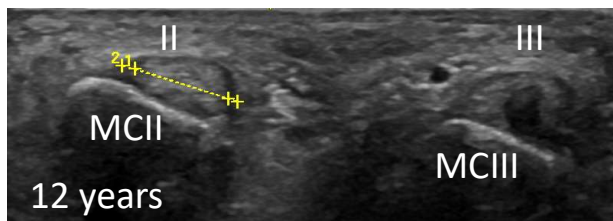
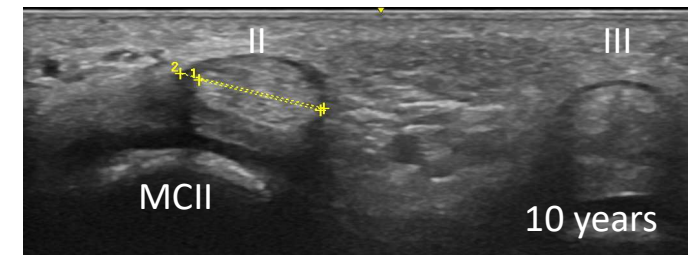
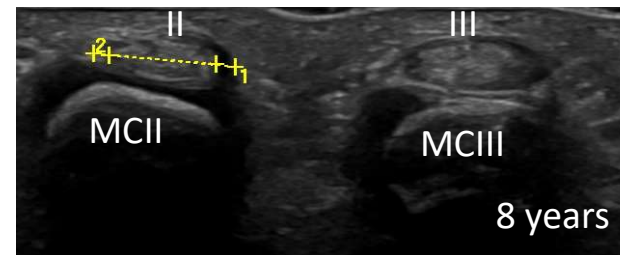
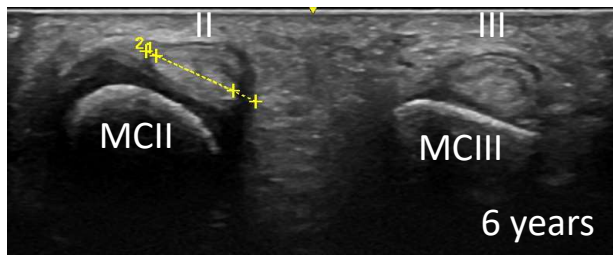
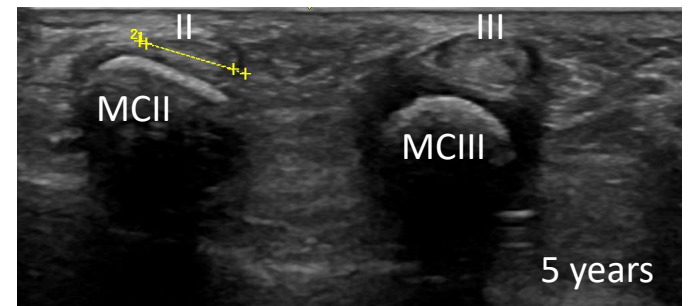
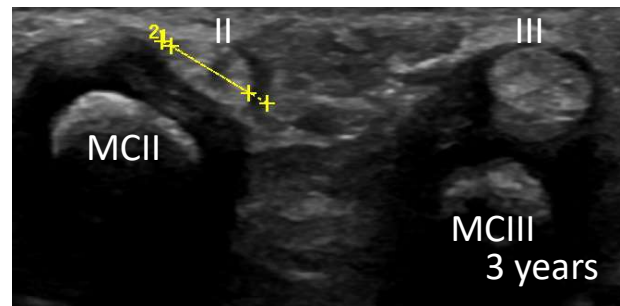
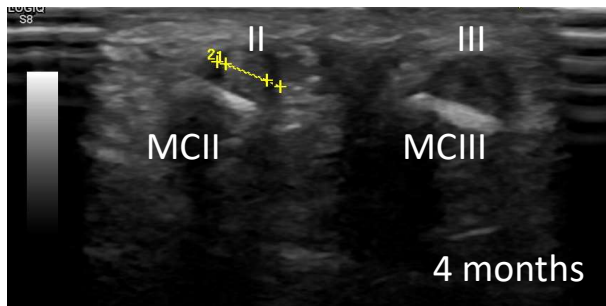
Extensor digitorum communis tendon

Transverse view: the maximal diameter of the 4th extensor compartment is measured. A measurement was performed of the tendon alone (yellow lines, indicated as '1'), and another measurement including the tenovaginum (yellow lines, indicated as '2').

Legend to image:

III to VI: extensor compartment III to VI

Flexor digitorum of the 2nd finger



Flexor digitorum of the 2nd finger

Transverse view, volar side, proximal to MCP joint: the maximal diameter of the flexor digitorum tendon of the 2nd finger is measured. A measurement was performed of the tendon alone (yellow lines, indicated as '1'), and another measurement including the tenovaginum (yellow lines, indicated as '2').

Legend to images:

II: 2nd finger; III: third finger; MC: metacarpal bone