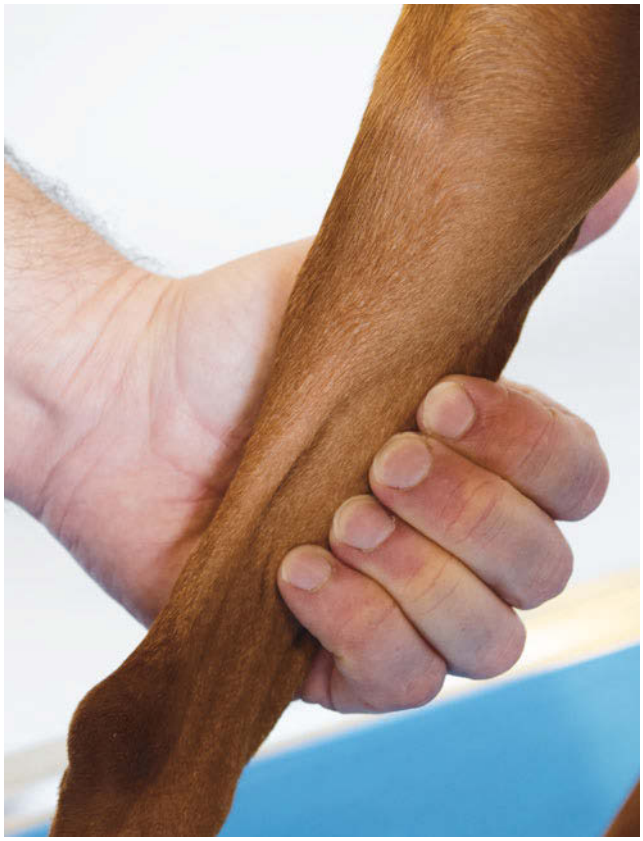
5.3.3 Crural region

The tibia and fibula are palpated from distal to proximal. The palpable features of the fibula are the lateral malleolus, distally, and the head of the fibula, proximally. The medial aspect of the body of the tibia (planum cutaneum) is palpable along its length. The muscles of the crus are tested for swelling and pain on digital pressure. Swelling due to trauma occurs particularly in the lateral compartment, where the large tibialis cranialis is located (▶ **Fig. 5.11**).

Findings and Differential Diagnosis

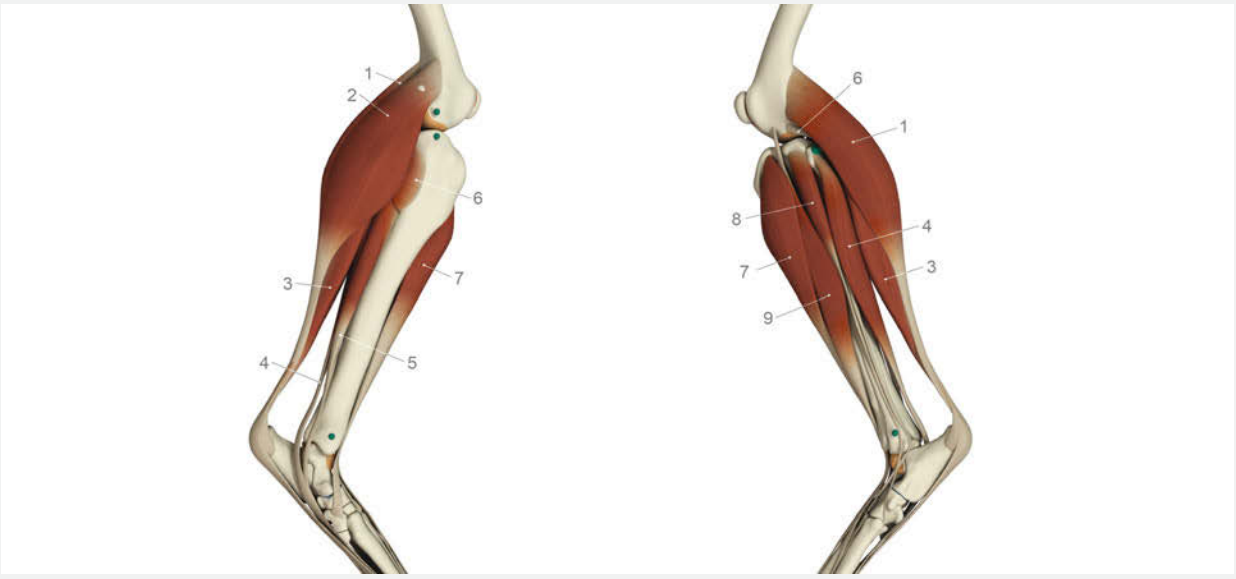
- swelling
  - neoplasia (p. 194)
  - hematoma
  - compartment syndrome
- crepitation
  - fracture
- axial deviation
  - fracture
  - malalignment
- pain
  - fracture
  - neoplasia (p. 194)
  - panosteitis (p. 188)
  - compartment syndrome



▶ **Fig. 5.11** Assessment of the medial surface of the body of the tibia (planum cutaneum) for abnormal surface contours and pain on digital pressure. (source: Gaby Ernst, Saland, Switzerland)

Anatomy

- The tibial planum cutaneum separates the extensors and flexors. For the most part, the muscles continue as long tendons in the lower half of the crus (▶ **Fig. 5.12**).

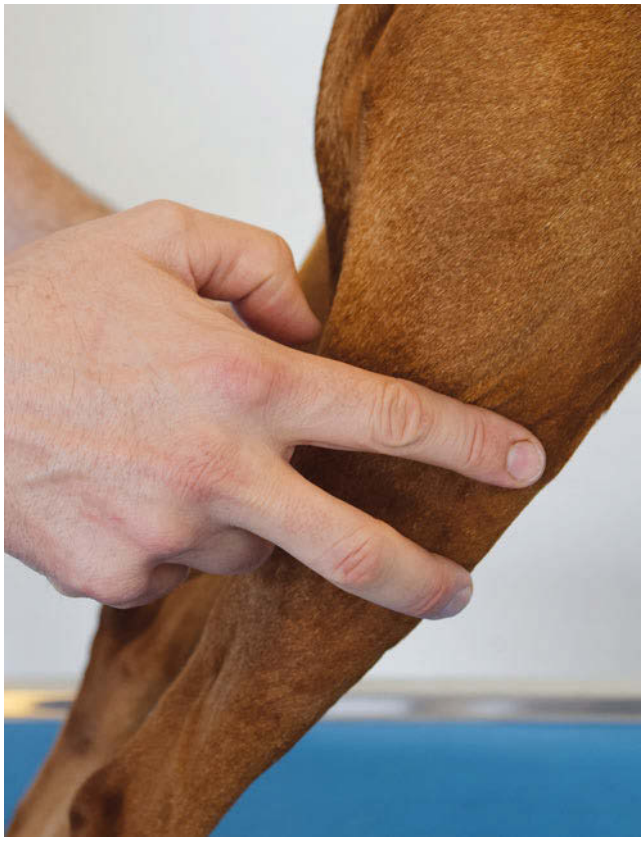


▶ **Fig. 5.12** Muscles of the crus. Medial and lateral view. 1 m. gastrocnemius lateralis, 2 m. gastrocnemius medialis, 3 m. flexor digitorum superficialis, 4 mm. flexores digitorum profundi, 5 m. flexor digitorum longus, 6 m. popliteus, 7 m. tibialis cranialis, 8 m. peroneus longus, 9 m. extensor digitorum lateralis. (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

5.3.4 Stifle Region

Joint Palpation

Positioned behind the patient, the examiner uses their left and right hand to examine both stifle joints simultaneously (▶ **Fig. 5.13**). The thumb and index finger are used to assess the region between the patella and the tibial plateau, just caudal to the patellar ligament, for joint effusion, pain on palpation and heat. In the healthy dog, the patellar ligament can be distinguished clearly from the caudally located joint.



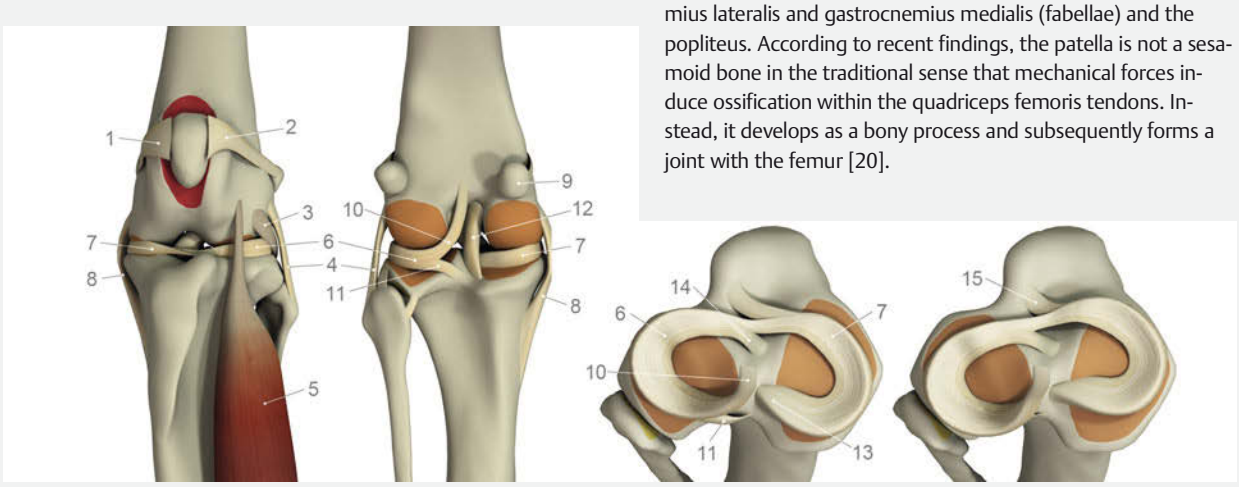
▶ **Fig. 5.13** Reference points for identification of the stifle joint: patella, tibial crest and femoral condyles. (source: Gaby Ernst, Saland, Switzerland)

Findings and Differential Diagnosis

- swelling, heat and/or pain
  - cruciate ligament rupture/partial cruciate ligament rupture
  - meniscal injury
  - avulsion of the extensor digitorum lateralis
  - neoplasia (p. 194)
  - patellar luxation (p. 204)
  - osteochondrosis (p. 185)
- fluctuating swelling
  - acute trauma
  - joint fracture

Anatomy

- The stifle joint consists of 3 articular components (▶ **Fig. 5.14**):
  - femorotibial joint
  - femoropatellar joint
  - proximal tibiofibular joint
- The lateral meniscus is larger and thicker than its medial counterpart, both are thick abaxially and taper towards their axial border. Extension and flexion of the stifle joint forces the menisci to undergo a rolling, sliding movement. The medial meniscus is less mobile due to its attachments to surrounding structures.
- The menisci are stabilized by 6 ligaments. A single ligament attaches the lateral meniscus to the femur.
- Up to 3 additional sesamoid bones are associated with the stifle joint. These are located in the tendon of origin of the gastrocnemius lateralis and gastrocnemius medialis (fabellae) and the popliteus. According to recent findings, the patella is not a sesamoid bone in the traditional sense that mechanical forces induce ossification within the quadriceps femoris tendons. Instead, it develops as a bony process and subsequently forms a joint with the femur [20].



▶ **Fig. 5.14** The stifle joint with ligaments and menisci. Cranial and caudal view and illustration of the menisci in the extended and flexed joint. 1 lig. femoropatellaris medialis, 2 lig. femoropatellaris lateralis, 3 m. popliteus, 4 lig. collaterale laterale, 5 m. extensor digitorum longus, 6 meniscus lateralis, 7 meniscus medialis, 8 lig. collaterale mediale, 9 fabella, 10 lig. meniscofemorale, 11 lig. tibiale caudale menisci lateralis, 12 lig. cruciatum caudale, 13 lig. tibiale caudale menisci medialis, 14 lig. tibiale craniale menisci lateralis, 15 lig. tibiale craniale menisci medialis. (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

Bone Contours

The tibia, patella and distal femur are assessed along the joint margins for pain on palpation and the presence of osteophytes (▶ **Fig. 5.15**).

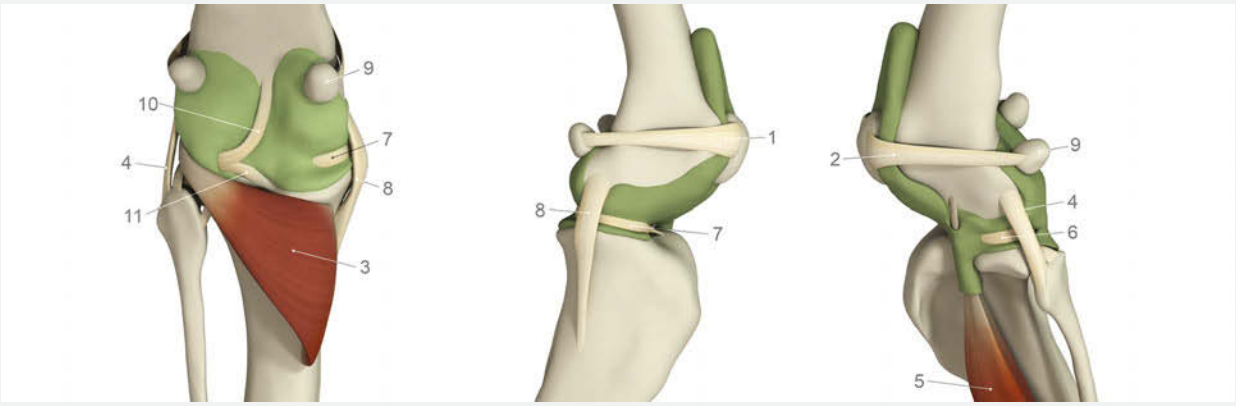
▶ **Fig. 5.15** Osteophytes occur at the joint margins. They may be palpable, particularly on the femur. (source: Gaby Ernst, Saland, Switzerland)

Findings and Differential Diagnosis

- abnormal bone contours
  - osteosarcoma (p. 194) of the distal femur or proximal tibia
  - severe osteoarthritis

Anatomy

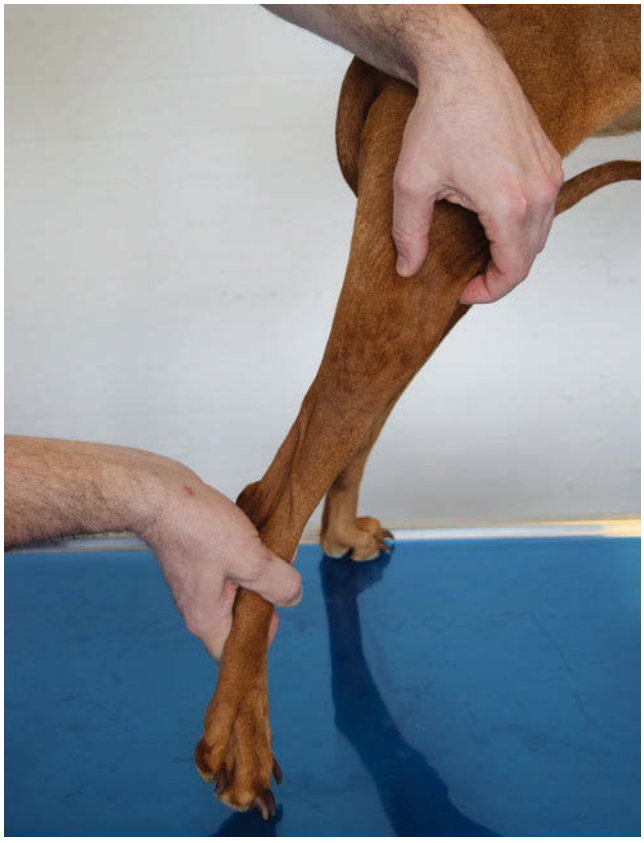
- The large joint capsule forms 3 communicating cavities between the femur and tibia, and beneath the patella (▶ **Fig. 5.16**).
- The stifle joint has 15 ligaments, 6 of which are attached to the menisci. The meniscal ligaments attach the menisci to the tibia and also attach the lateral meniscus to the femur. These are conventionally referred to as the cranial and caudal ligaments of the medial and lateral meniscus, the meniscofemoral ligament and the transverse ligament.
- Lateral collateral ligament (LCL): passes from the lateral epicondyle, immediately proximal to the origin of the popliteus, to the head of the fibula; loosely connected to the joint capsule.
- Medial collateral ligament (MCL): passes from the medial epicondyle to a broad area of attachment on the proximal tibia. A bursa is located near the site of attachment. The MCL is approximately one third longer than the LCL.
- During extension, the tensed ligaments prevent rotational joint movement; during flexion, internal rotation is permitted by the laxity of the lateral collateral ligament, though this is counteracted by the cruciate ligaments. External rotation is prevented only by the lateral collateral ligament.



▶ **Fig. 5.16** Stifle joint with ligaments and joint capsule (green). Caudal, medial and lateral view. 1 lig. femoropatellaris medialis, 2 lig. femoropatellaris lateralis, 3 m. popliteus, 4 lig. collaterale laterale, 5 m. extensor digitorum longus, 6 meniscus lateralis, 7 meniscus medialis, 8 lig. collaterale mediale, 9 fabella, 10 lig. meniscofemorale, 11 lig. tibiale caudale menisci lateralis. (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

Position of the Patella

The position of the patella is assessed. It should be located in the middle of the distal femur, positioned firmly in its sulcus. The thumb and index finger are used to attempt to luxate the patella medially and laterally (▶ **Fig. 5.17**). This can be facilitated by reducing the tension in the quadriceps femoris to some degree. To achieve this, the examiner places their knee under the dog's thigh, allowing the dog to take weight off the limb.



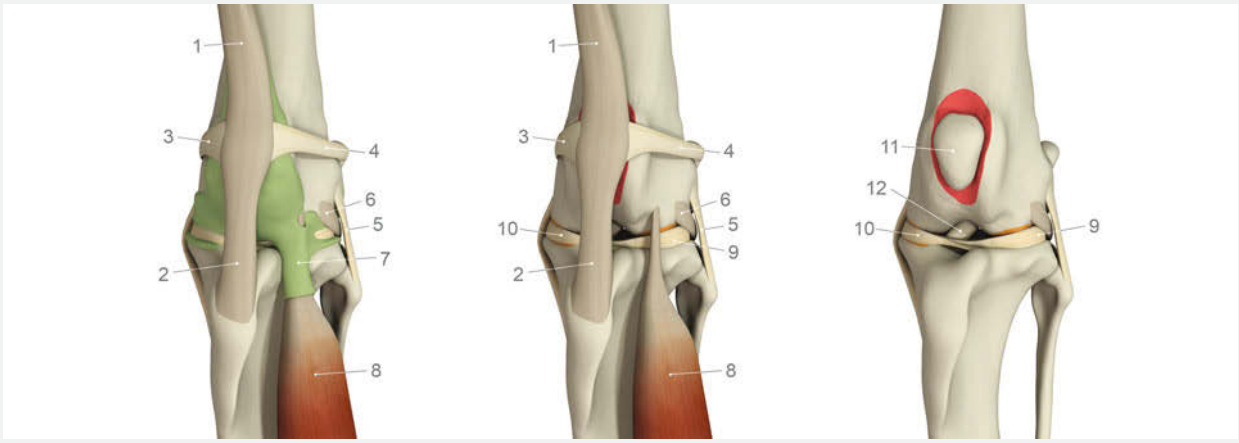
▶ **Fig. 5.17** Assessment of the position of the patella relative to the femur and preliminary testing for patellar luxation. (source: Gaby Ernst, Saland, Switzerland)

Findings and Differential Diagnosis

- hypermobility of the patella
  - medial or lateral patellar luxation
- hypomobility of the patella
  - contracture of the quadriceps femoris
- pain on palpation of the patella and patellar ligament
  - cartilage wear
  - polyarthritis (p. 191)
  - traction osteochondritis at the insertion of the patellar ligament

Anatomy

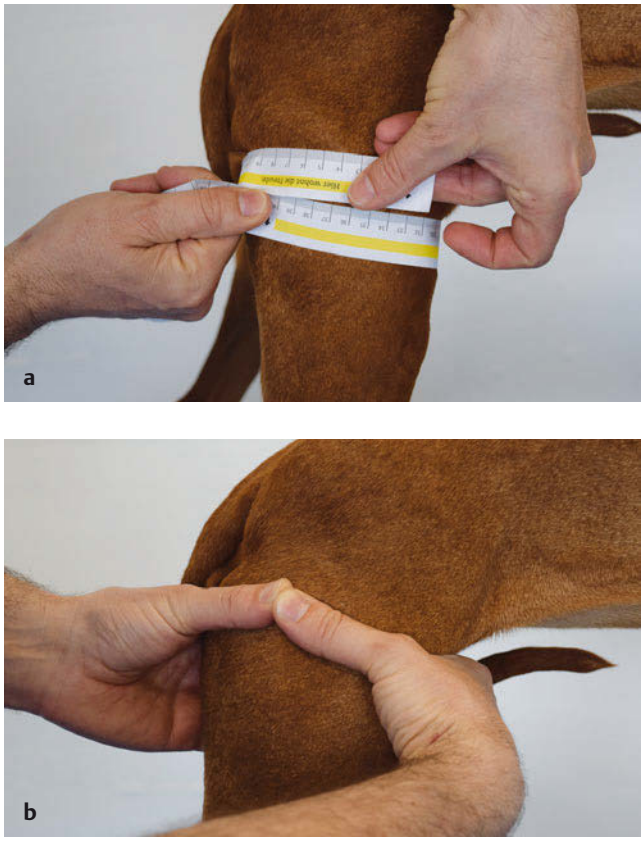
- The patella is held in the proximal portion of the trochlear groove by the lateral and medial fascia lata and by the femoropatellar ligaments (▶ **Fig. 5.18**).
- Patellar ligament: component of the tendon of insertion of the quadriceps femoris that passes from the patella to the tibia, separated from the joint capsule by a fat pad.
- The cruciate ligaments are intra-articular but extrasynovial.
- Cranial cruciate ligament (CrCL): passes from the caudomedial region of the lateral condyle to the cranial intercondyloid area of the tibia, twisting on itself along its course; restricts cranial movement and internal rotation of the tibia.
- Caudal cruciate ligament (CdCL): passes from the lateral side of the medial condyle (medial to the CrCL) to the popliteal notch; counteracts internal rotation of the femur and external rotation of the tibia.
- Each cruciate ligament has 2 functional components that exhibit varying states of tension.



▶ **Fig. 5.18** Stifle joint and patella, cranial view.
1 tendon of insertion of m. quadriceps femoris, 2 lig. patellae, 3 lig. femoropatellaris medialis, 4 lig. femoropatellaris lateralis, 5 lig. collaterale laterale, 6 m. popliteus, 7 vagina synovialis m. extensoris digitorum longus, 8 m. extensor digitorum longus, 9 meniscus lateralis, 10 meniscus medialis, 11 patella, 12 lig. cruciatum craniale. (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

5.3.5 Thigh

The muscles of the thigh are palpated from distal to proximal, noting their position, course and dimensions, and the presence of any pain. The total circumference of the musculature of the thigh is determined using a measuring tape, a piece of cord or the examiner's hands. To achieve reliable results, the circumference should be measured proximally, with the hands or measuring tape positioned at the level of the inguinal region (▶ Fig. 5.19).



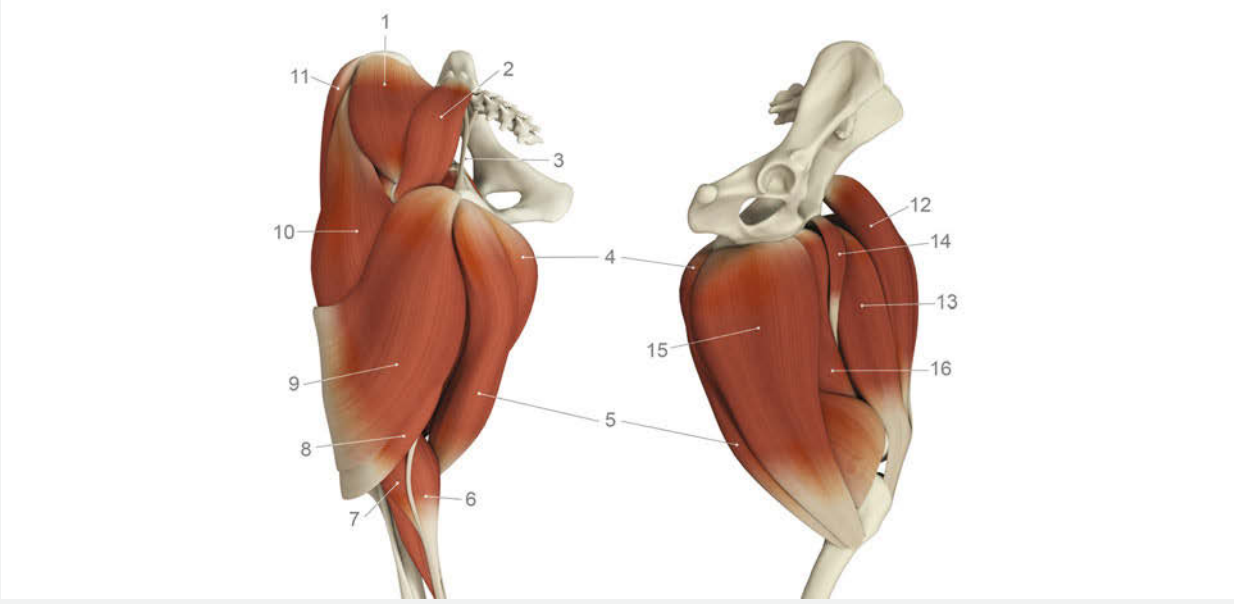
▶ **Fig. 5.19** Assessment of thigh muscle circumference.
a Using a measuring tape. (source: Gaby Ernst, Saland, Switzerland)
b Using the hands. (source: Gaby Ernst, Saland, Switzerland)

Findings and Differential Diagnosis

- painful or hypomobile muscles in the caudal thigh
  - fibrosis of the ischiocrural („hamstring") muscles
- reduced thigh muscle circumference, compared with the contralateral limb
  - chronic reduction of limb loading, disorder located within the limb or laterally in the region of the vertebral column
- painful or swollen quadriceps femoris
  - contracture of the quadriceps femoris
- painful pectineus
  - hip dysplasia (p. 212) or coxofemoral osteoarthritis (p. 212)

Anatomy

- The ischiocrural („hamstring") muscles are comprised of the biceps femoris, semitendinosus and semimembranosus (▶ Fig. 5.20).

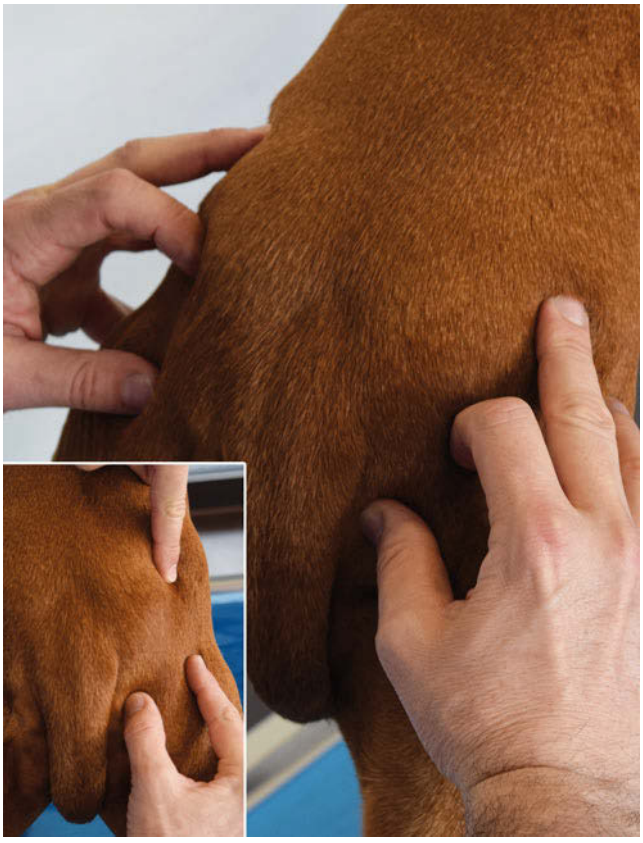


▶ **Fig. 5.20** Proximal hindlimb with palpable features. Muscles of the thigh. 1 m. glutaeus medius, 2 m. glutaeus superficialis, 3 lig. sacrotuberale, 4 m. semimembranosus, 5 m. semitendinosus, 6 m. gastrocnemius medialis, 7 m. gastrocnemius lateralis, 8 m. biceps femoris pars caudalis, 9 m. biceps femoris pars cranialis, 10 m. tensor fasciae latae, 11 m. sartorius pars cranialis, 12 m. rectus femoris, 13 m. vastus medialis, 14 m. pectineus, 15 m. gracilis, 16 mm. adductores. (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

5.3.6 Hip Region

Hip Joint Position

The relative positions of the ischial tuberosity, greater trochanter and iliac crest are palpated using the thumb, index finger and middle finger (▶ **Fig. 5.21**). These points should form similarly shaped triangles on the left and right sides.



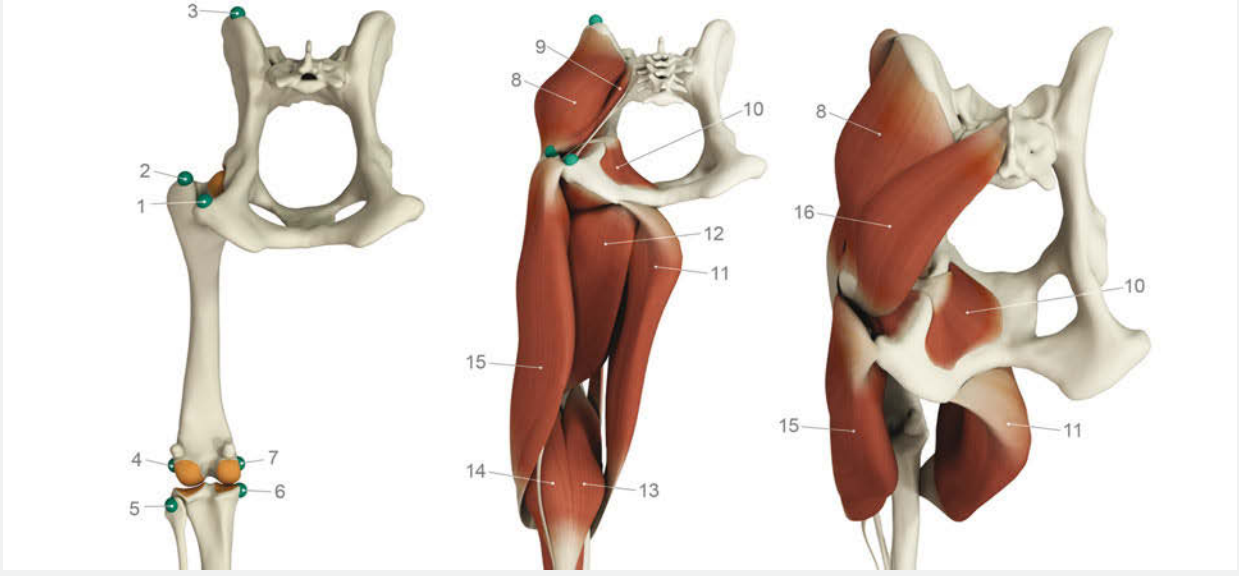
▶ **Fig. 5.21** Palpation of the three bony prominences (ischial tuberosity, greater trochanter and iliac crest) used in the diagnosis of femoral head luxation. (source: Gaby Ernst, Saland, Switzerland)

Findings and Differential Diagnosis

- greater trochanter abnormally positioned or not palpable
  - luxation of the hip joint (p. 218) in a craniodorsal, caudoventral or cranioventral direction

Anatomy

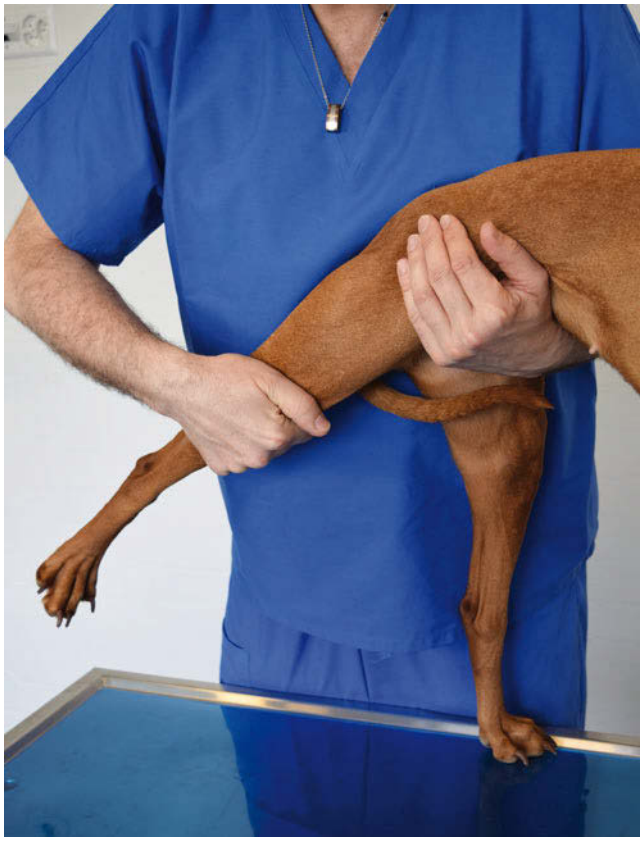
- Forces generated in the hindlimbs are transmitted through the pelvis and sacrum into the lumbar vertebral column and thereby into the trunk. Movement of the lower vertebral column results from movement of the limbs. This is reflected in the frame-like construction of the pelvis. The sacroiliac joint acts largely as a buffer designed to absorb peaks of load (▶ **Fig. 5.22**). Loading of the sacroiliac joint by compressive and tensile forces is disproportionately higher in large breeds.



▶ **Fig. 5.22** Proximal hindlimb with palpable features. Deep ischiocrural and croup muscles.
1 tuber ischiadicum, 2 trochanter major, 3 crista iliaca, 4 epicondylus lateralis, 5 caput fibulae, 6 condylus medialis, 7 epicondylus medialis, 8 m. glutaeus medius, 9 m. piriformis, 10 m. obturator internus, 11. m. gracilis, 12 mm. adductores, 13 m. gastrocnemius medialis, 14 m. gastrocnemius lateralis, 15 m. biceps femoris, 16 m. glutaeus superficialis. (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

Manipulation of the Hip Joint

With one hand on the distal femur and the other over the greater trochanter, the hip joint is extended, flexed and abducted on the left and right side. During this procedure, the dog stands only on the contralateral leg. In all of these maneuvres, it should be possible to move the femur into a horizontal position (▶ **Fig. 5.23**).



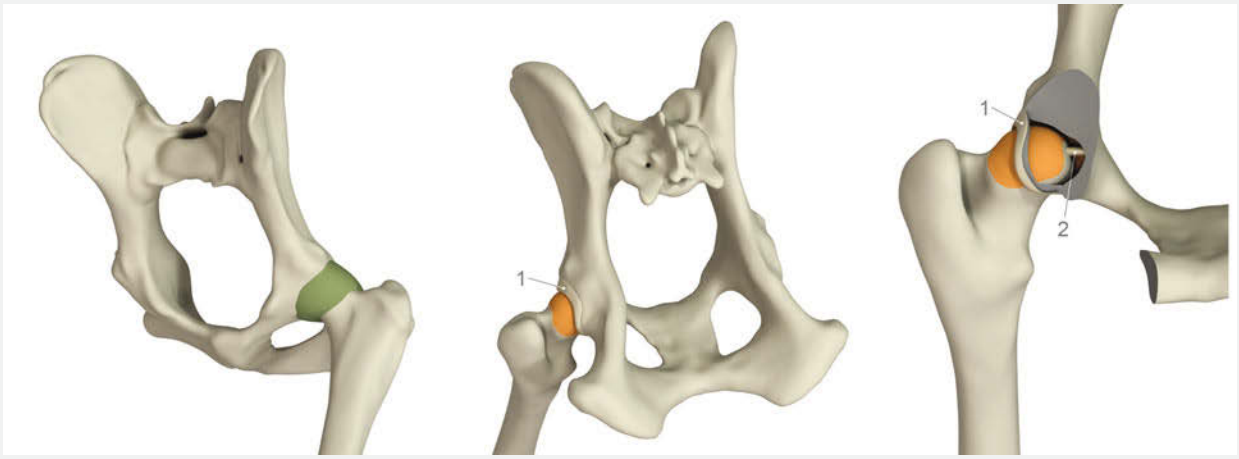
▶ **Fig. 5.23** Maximum extension of the hip joint. This manipulation places pressure on the hip joint, iliopsoas and the lumbar vertebrae and may elicit a pain response. (source: Gaby Ernst, Saland, Switzerland)

Findings and Differential Diagnosis

- general reduction in range of movement of the hip joint
  - coxofemoral osteoarthritis
  - hip dysplasia (p. 212)
  - hip joint luxation (p. 218)
  - neoplasia (p. 194)
- pain only on extension of the hip joint
  - coxofemoral osteoarthritis
  - hip dysplasia (p. 212)
  - cauda equina compression
  - spondylosis
  - intervertebral disc disease
- crepitation and pain
  - coxofemoral osteoarthritis
  - neoplasia (p. 194)

Anatomy

- In the hip joint, the hemispherical head of the femur articulates with the Ω-shaped lunate surface of the acetabulum. The pelvic side of the articulation is enlarged by the fibrocartilaginous acetabular labrum (▶ **Fig. 5.24**).
- There are no mechanically functional ligaments in the hip joint. The intra-articular, extrasynovial ligament of the head of the femur passes to the Ω-shaped recess of the acetabulum. The transverse acetabular ligament joins the tips of the lunate sur-
- The spacious joint capsule attaches proximally at the edge of the acetabular labrum and below the head of the femur near the cartilage-lined articular surface. Thickenings of the capsule are present dorsally (zona orbicularis) and in the cranial and caudal capsule walls. The fibers of the articularis coxae muscle radiate into the outer layer of the capsule, to which they can apply tension.



▶ **Fig. 5.24** Hip joint with joint capsule (green), acetabular labrum and illustration of the ligament of the head of the femur by „removal" of the dorsal acetabulum. 1 labrum acetabulare, 2 lig. capitis femoris. (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

Examination of the Iliopsoas

The femur is rotated inwards at full extension, resulting in maximum stretching of the iliopsoas (▶ **Fig. 5.25**). Digital pressure can be applied laterally to the cranial and middle portions of the muscle, ventral to the vertebral column. In dogs below approximately 25 kg body weight, the iliopsoas can be palpated rectally, cranial to the ilium.

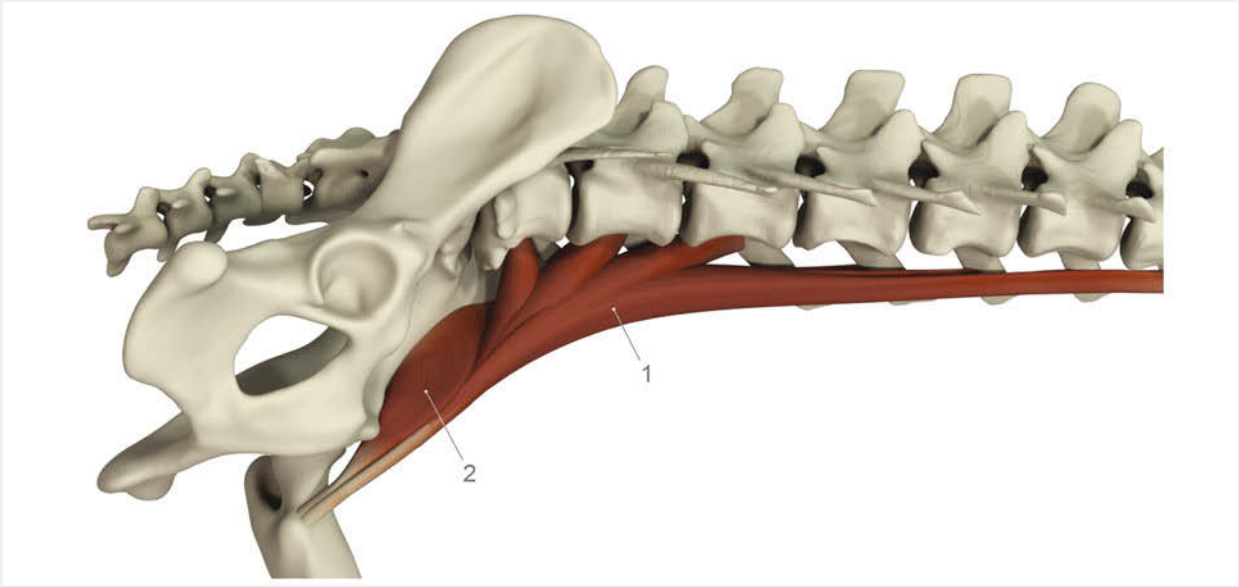
▶ **Fig. 5.25** Maximum lengthening of the iliopsoas via simultaneous extension of the hip joint and internal rotation of the limb. (source: Gaby Ernst, Saland, Switzerland)

Findings and Differential Diagnosis

- pain response elicited only when the femur is internally rotated at full extension
  - iliopsoas strain (p. 220)
  - coxofemoral osteoarthritis
- pain elicited by pressure on the iliopsoas
  - iliopsoas strain (p. 220)

Anatomy

- The iliopsoas is formed by the juxtaposition of the psoas major and iliacus (▶ **Fig. 5.26**). These muscles can easily be separated, as far as their attachment to the lesser trochanter. The psoas major arises from the transverse processes of L2 and L3, by means of an aponeurosis from L3 and L4, and from the ventral surface of L4–L7. The iliacus takes its origin from the caudomedial aspect of the ilium.
- During walking, the iliopsoas is active at the end of the stance phase and in the swing phase. During trotting and galloping, its activity commences earlier, in the first third of the stance phase, thus contributing to stabilization of the limb.



▶ **Fig. 5.26** Medial view of the psoas major (1) and the iliacus (2). (source: Martin S. Fischer, Jonas Lauströer, Amir Andikfar)

5.3.7 Overview of Common Differential Diagnoses and Video of Examination

The following table (▶ **Table 5.1**) provides an overview of the most important differential diagnoses.

▶ **Tab. 5.1** Overview of differential diagnoses.

Region	Key Differential Diagnoses
digits, metatarsus and tarsus	• polyarthritis • fractures • neoplasia
tarsal joint	• instabilities • osteochondrosis of talus • rupture or partial rupture of common calcaneal tendon
crus	• panosteitis • neoplasia
stifle	• cruciate ligament rupture • partial cruciate ligament rupture • patellar luxation
thigh	• neoplasia • panosteitis • muscular induration/fibrosis
hip	• hip dysplasia/osteoarthritis • hip joint luxation • Legg-Perthes-disease

Refer to ▶ **Video 5.3** for a video showing examination of the hindlimb of a dog in a standing position.

▶ **Video 5.3** Examination of the hindlimb of a dog in a standing position. This sequence includes: standing symmetry, testing for pain in the distal limbs, palpation of the metatarsal and tarsal bones, palpation of the tarsal joint, palpation of the common calcaneal tendon, palpation of the crural region, palpation of the stifle joint and the patella, the cranial drawer test, palpation of the femur and „hamstring“ muscles, palpation and examination of the hip joint and examination of the iliopsoas. (source: Tele D, Diessenhofen, Switzerland)