How to Take and Interpret Radiographs of the Equine Stifle

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1. Introduction
Stifle radiography in the young performance horse is a fairly routine procedure for most equine practitioners. The primary reasons for taking radiographs of the stifle include radiographic evaluations for purchase, stifle joint effusion, lameness associated with the stifle, evaluation after a traumatic event associated with the stifle, and comparison of the perceived normal stifle to the affected stifle. Acquisition of stifle radiographs is not always intuitive for the beginner. A thorough knowledge of the 3D anatomy of the stifle as well as the anticipated pathologies of the stifle are necessary to properly position the x-ray generator and detector plate. Proper positioning results in acquisition of radiographs with sufficient quality to allow the veterinarian to make an informed diagnosis.1–4

2. Immature Horse
From birth until ~36 months of age, the stifle matures from a structure with six ossification centers: metaphysis and distal epiphysis of the femur, proximal epiphysis and metaphysis of the tibia, tibial tuberosity (apophysis), and patella. The lateral and medial trochlear ridges of the femur are initially fairly equal in size and the proximal portions of these ridges often have an irregular contour and opacity that must be differentiated from a suspected septic joint. This irregularity generally resolves by 3 to 5 months of age.

The distal femoral physis generally closes by 24 to 30 months of age. The physis between the tibial tuberosity and the tibial epiphysis tends to close by 9 to 12 months, and the physis between the tibial tuberosity and the tibial metaphysis closes at 30 to 36 months. The proximal tibial physis, between the proximal tibial epiphysis and the tibial metaphysis, closes at 24 to 30 months of age.

3. Stifle Joint Pathology
Osteochondrosis is reportedly the most common abnormality in the young performance horse stifle, affecting the trochlear ridges of the femur, the femoral condyles and the patella, and less frequently, the proximal tibia. Osteochondritis dissecans (OCD) of the trochlear ridges involves primarily the lateral trochlear ridge with the medial trochlear ridge less commonly affected. The articular surface of the patella also is a common site for OCD. Subchondral bone cysts are primarily observed in the medial femoral condyle, with much less frequency in the patella and even less frequently in the lateral femoral condyle.
Other abnormalities include osteoarthritis, tumoral calcinosis (calcinosis circumscripta), collateral and patellar ligament desmitis, meniscal injuries, injuries to bone and soft tissues from acute...
Fig. 4. A and B, Typical poor positioning for lateromedial view. Beam is directed at a proximal to distal angle instead of horizontal.

Fig. 5. (A) Positioning for caudocranial view. (B) Apparently normal caudal-cranial radiographic view of a mature Thoroughbred gelding.
traumatic events, and other miscellaneous sclerosis and lucencies of the trochlear ridges and proximal tibia).

4. Radiographic Views

There are three standard radiographic views that are commonly acquired for most stifle evaluations, including the lateromedial, caudal to cranial (10–20° proximodistal), and 30° caudolateral-craniomedial oblique. Optional views that are not acquired routinely, but are necessary views to highlight specific anatomic structures, include the patellar skyline, flexed lateromedial, and 30° to 45° caudomedial-craniolateral oblique views. In addition, special oblique projections can be very useful for specific joint abnormalities when the standard radiographic views do not sufficiently demonstrate the abnormality.

Lateromedial View

The horse should be positioned with both hind limbs fully weight-bearing with the limb to be imaged slightly caudal to the contralateral limb (Figs. 1–4). The x-ray beam should be directed horizontally, centered on the femorotibial joint, caudal and distal to the apex of the patella. The beam will most commonly be directed ~10° to 20° caudal to cranial to the frontal plane to accommodate for the typical hind limb anatomy of most horses. As a rule of thumb, align the beam parallel to the heel bulbs of the limb to be imaged.

The lateromedial view highlights the medial and lateral ridges of the femoral trochlea, the intertrochlear groove, the peritendinous and subchondral areas of the patella, the tibial crest, the tibial plateau and areas of attachment of the cranial cruciate ligament and the cranial ligaments of the menisci, the extensor fossa, and the femoral condyles.

Caudal to Cranial View (10–20° Proximodistal)

The horse should be positioned with both hind limbs fully weight-bearing. The center of the beam should be directed at the soft tissue indentation at midline and the angle of the beam directed 10–20° proximodistally (Figs. 5–8).

30° Caudolateral-Craniomedial Oblique

The horse should be positioned with both hind limbs fully weight-bearing. The center of the beam
should be directed on the femorotibial joint, ~10 cm caudal to the cranial aspect of the limb. The x-ray beam should be directed horizontal to the ground or slightly proximal to distal 10°–15° (Figs. 9–13).

Patellar Skyline (Cranioproximal-Craniodistal Oblique View)
The patellar skyline view is taken with the stifle flexed and the tarsus either flexed or extended. The cassette is held approximately horizontal with its caudal edge against the cranial aspect of the tibia, centered just proximal to the tibial crest. Depending on the horse, the beam angle may range from a proximal 10° lateral-distal medial oblique direction to a 30°–40° proximocranial-distocaudal direction. Adducting the flexed limb may facilitate positioning by rotating the stifle outwards.

The indications for the patellar skyline view include assessment of a suspected patellar fracture, and to better assess a known patellar fracture or suspected osteochondrosis of the patella or lateral trochlear ridge of the femur (Figs. 14 and 15).

Flexed Lateromedial View
Positioning is similar to the lateromedial view. The degree of flexion of the stifle can vary from just slightly flexed with the horse resting the toe on the ground to moderate flexion. The beam is directed horizontal, centered on the patella (Figs. 16 and 17).

The indications for the flexed lateromedial view include a better assessment of the apex of the patella, to
Fig. 11. (A) Lateromedial view and (B) 30° caudolateral-craniomedial oblique view of mild osteochondral defect (arrow) in the lateral trochlear ridge in an 18-year-old Warmblood gelding.

Fig. 12. (A) Lateromedial view and (B) 30° caudolateral-craniomedial oblique view of a large osteochondral fragment of the lateral trochlear ridge of the femur in a 15-month-old Standardbred filly.
Fig. 13. (A) Caudo-cranial and (B) 30° caudolateral-cranio medial oblique view of small subchondral bone cyst of the medial femoral condyle with secondary mild osteophyte on medial tibial condyle in a mature Quarter Horse gelding.

Fig. 14. (A) Positioning for patellar skyline view. (B) Apparently normal patellar skyline radiographic view of a mature Thoroughbred gelding.
separate and better assess the articular surfaces of the patella and the proximal aspects of the trochlear ridges of the femur, and to better assess the attachment sites of the cranial ligaments of the menisci and cranial cruciate ligament in the region of the cranial aspect of the intercondylar eminences.

Fig. 15. Patellar skyline (cranioproximal-craniodistal oblique view). Shaded areas are common sites of subchondral lucency with/without sclerosis. Adapted from O’Brien.3

Fig. 16. (A) Positioning for flexed lateromedial view. (B) Apparently normal flexed lateromedial radiographic view of a mature Thoroughbred gelding.
References


Fig. 17. (A) Lateromedial and (B) flexed lateromedial view of calcification (arrow) of the cranial attachment of the medial meniscus in a 3-year-old Standardbred filly.