Optimal Radiographic Views for Evaluating Thoroughbred Yearlings—Quality Control of the Radiographic Image

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Introduction
Detecting bone changes on radiographs is an important part of assessing the Thoroughbred yearling before sale. Significant bony lesions may not be detected if the quality of the radiographic examination is inferior. The quality of the radiographic image can be determined by assessing radiographic film quality and the optimal part or joint position for each radiographic view used. Without adequate quality control, the radiographic examination may be misleading by omission of significant radiographic bone changes.

Radiographic Film Quality
Radiographic film quality factors to assess are contrast latitude and spatial resolution. For orthopedic examinations a wide contrast latitude (wide gray scale, not black and white) is most desirable. This will provide a diagnostic radiograph for evaluation of bone and soft tissue structures, will better enable a diagnostic image of variable thickness parts on the same image, and will allow for a wider variation of exposure factors set on the x-ray machine to produce a diagnostic image. Wide contrast latitude is best accomplished by using a wide latitude film-screen combination. With adequate contrast latitude and a properly exposed film (i.e., not over or underexposed), cortical, subchondral, and trabecular bone in the medullary cavity, along with soft tissue structures, can be visualized and evaluated.

Good spatial resolution is also necessary to adequately evaluate bone structures and identify subtle bony lesions. However, film-screen systems that provide higher spatial resolution also require increased radiation exposure. A compromise of adequate spatial resolution and acceptable radiation exposure can be made without decreasing the diagnostic quality of the radiographs. Rare earth film-screen systems with wide latitude film and 100–200 speed provide a radiographic image that is optimal for orthopedic examinations in yearling Thoroughbred horses. Spatial resolution and film contrast latitude are adequate when trabecular bone structure within the medullary cavity in the metaphyses of long bones; cortical and subchondral bone; and soft tissue structures can be visualized on the radiograph.

Radiographic Views—Position Evaluation
Evaluating the position of the anatomic part or joint on the radiographic image is also important in determining radiographic examination quality. Adequate visualization of areas known to be most affected by significant pathologic changes should be evaluated on all radiographic views. The following anatomic areas or structures should be identified on the specified radiographic views to determine if image quality and positioning are adequate.
Fetlocks
Radiographic views of the fore and hind fetlocks consist of a flexed lateromedial (fore fetlock), straight lateromedial (hind fetlock), dorsal 30° proximal-palmar (plantar), dorsal 45° medial-palmarolateral and dorsal 45° lateral-palmaromedial oblique views. The radiographic views should be aligned with the limb which may be a different angle from aligning with the horse.

Lateromedial and flexed lateromedial views
The condyles of the third metacarpal (metatarsal) bone and the proximal sesamoid bones should be superimposed and the metacarpophalangeal joint space identifiable. Subchondral bone and adjacent trabecular bone in the condyles of MC III and MT III should be visualized. On flexed lateromedial views the articular surfaces of the proximal sesamoid bones and the dorsal aspect of the sagittal ridge should be identifiable.

Dorsal 30° proximal-palmar (plantar) view
The proximal sesamoid bones should be situated proximal to the metacarpophalangeal joint space so as not to mask bone changes that might be present in the subchondral bone. The borders of the proximal sesamoid bones should also be identifiable in their superimposed position over the distal aspect of MC III and MT III.

Dorsal 45° medial-palmaro (plantar) lateral and dorsal 45° lateral-palmaro (plantar) medial oblique views
The extensor process on the proximal phalanx should be identifiable. The base of the sesamoid bones should not superimpose over the proximal palmar process of P1 and the peripheral border of the sesamoid bones should be visible.

Carpus
Radiographic views of the carpus consist of a flexed lateromedial, dorsal 30° medial-palmarolateral oblique and dorsal 45° lateral-palmaromedial oblique views.

On all views the joint spaces should be identifiable with little or no superimposition of adjacent carpal bones over the joint space. The exposure should be sufficient to allow identification of borders on all carpal bones. On the dorsal lateral-palmaromedial and dorsal medial-palmarolateral oblique views the second or fourth metacarpal bones respectively should be superimposed over the medullary cavity of the third metacarpal bone.

Tarsus
Radiographic views consist of lateromedial, dorsal 45° medial-plantarolateral and dorsal 10° lateral-plantaromedial oblique views.

On all views the joint spaces should be identifiable with little or no superimposition. On the lateromedial view and dorsomedial-plantar lateral oblique view the intermediate ridge of the distal tibia and the trochlear ridges of the talus should be identifiable. On the dorsolateral-plantaromedial oblique view the medial malleolus of the tibia should be identified not superimposed over the talus.

Stifle
Radiographic views commonly used consist of a lateromedial and a lateral 20° caudal-mediocranial oblique view. A combination of views that would provide a thorough examination of the stifle would be lateromedial, lateral 20° cranial-mediocaudal oblique and a caudocranial view.

On the lateromedial view the patella and femoral trochlea should be identifiable. The trochlear ridges, trochlear groove, and the medial and lateral articular surfaces of the patella should be visible. On the lateral 20° caudal-mediocranial oblique view the lateral femoral trochlear ridge and the lateral condyle are more cranial in position. The lateral 20° cranial—mediocaudal oblique view is a superior view to visualize areas more commonly affected with pathologic lesions because the medial trochlear ridge and the medial condyle are more cranial in position and more adequately evaluated. Both trochlear ridges and the cranial aspect of the medial femoral condyle can be seen and evaluated on this view. It is important to visualize the cranial articualr margin of the medial femoral condyle on this view for subtle subchondral bone lesions. On the caudocranial view the femoral and tibial condyles should be identifiable with sufficient exposure to adequately penetrate the femoral condyles. Early evidence of degenerative joint disease is often seen as periarticular osteophytes on the lateral and medial border of the tibial condyles and adequate exposure through the femoral condyles will produce radiographs for evaluation of osteochondrosis lesions.

Conclusions
1. Radiographs with relatively wide contrast latitude and good spatial resolution (detail) are optimal for orthopedic examinations on yearling Thoroughbred horses. This can be accomplished by using a rare earth film-screen system with approximately 100-speed and wide latitude x-ray film.
2. Optimal position of a joint or anatomic part on each radiographic view should be checked by being familiar with the anatomic structures that are more frequently affected with pathologic changes and noting adequate visualization of those structures on the radiograph.