D I A G N O S I C  D I A G N O S I C  I M A G I N G  

for lameness and poor performance

L ameness and poor performance cases are frequently referred to Rossdales Equine Diagnostic Centre (REDC) for a definitive diagnosis and recommendation for treatment. Early detection of a problem can often prevent more serious injury and our veterinary surgeons undertake a detailed clinical examination to identify the potential problem areas prior to undertaking diagnostic imaging. But how do these imaging techniques work and what are the indications for their use?

Radiography, ultrasonography, nuclear scintigraphy (bone scanning), magnetic resonance imaging (MRI), computed tomography (CT) and infra-red thermography are digital imaging techniques, which we frequently use at REDC. Depending on the nature of the individual case, any combination of these techniques can be used, where appropriate, to ensure accurate diagnoses are made and to formulate effective treatments, particularly of more complex conditions. The indications for these same conditions can then be monitored by repeat imaging.

Digital Radiography
Diagnosis using traditional radiography (or ‘x-ray’) is produced by a x-ray generator. The beam of x-rays penetrates the tissue and, depending on the tissue density, is absorbed to varying degrees. In the original analogue x-ray systems the x-rays were captured on a film, which was then developed manually by a series of chemical processes. With digital radiography the x-rays are captured by a digital electronic detector plate, which are scanned and the resulting radiographic images transmitted to a computer, where they can be viewed almost instantly on high-resolution screens. The advantages over the traditional analogue system include the ability to store the images electronically as digital files, which can be reviewed at leisure by the referring veterinarian, or networked for comparison in the event of any complications or contraindications in the future. Additionally, the images can be manipulated, for example magnified, for better visibility of any abnormalities, or in a variety of viewing modes to assist with the diagnosis.

Ultrasonography
Ultrasonography can use the acoustic energy of sound waves emitted by a transducer (probe) to image tissue. The sound waves ‘bounces’ back when they hit tissue interfaces, and the time delay is recorded. The returning waves are detected by the probe and conveyed to an image on a screen. Ultrasonography can be used to visualize a variety of structures including tendons, ligaments, joints, vessels and internal organs and is frequently used in both orthopaedic and medical diagnostic investigations. Ultrasonography is not just useful for diagnosing injuries, it also frequently used to monitor the healing of lesions (abnormal tissue), to guide interventional procedures such as biopsies and ultrasonograph-guided medications (e.g. when pathology has been detected in the paws of the neck, back and pelvis), and to monitor bone formation and reproductive cycles and to detect pregnancy. Mentor will be well-feeding and examine the uterus and ovaries in the early stages of pregnancy. It is very useful for demonstrating bone, muscle or soft tissue problems and diagnosis in pregnant mares. It may also be used to monitor the pregnancy and to deliver the foal in difficult cases.

Nuclear Scintigraphy
Nuclear scintigraphy (commonly known as ‘bone scanning’) is a diagnostic imaging technique in which a radioactive compound has been injected into the horse and its distribution in the body is monitored by ‘gamma’ cameras. In this digital x-ray image a horse’s head is being imaged at the level of the eyes. The image was used by our surgical team to plan the best way of removing the tooth.

CT images of a horse's head at the level of the eyes. All images through the head from top to bottom were used. Areas of bone which were detected by the scan are shown in red, areas of internal organs which were detected by the scan are shown in blue, for example, the teeth of the mouth and muscle are shown in red, area of bone infection and for the purpose of the bones.

Thermography
Thermography measures the surface temperature by detecting changes in skin blood flow. This can be a radical subject to the other diagnostic techniques and is most useful for early identification of inflammation in soft tissue and bone. It can also be useful to monitor the healing process. We first use for tendon, foot and back problems. Thrombosis can be clearly demonstrated by detecting the presence of inflammatory changes on the surface of skin, at the site of injury and within underlying tissues. An infra-red scanner converts radiation from the skin into electronic images, which are translated into a thermal image (colour visual image) on a video screen. Areas of increased temperature indicate regions of increased activity in the skin, red being the hottest and indicating areas of inflammation. The most important diagnostic imaging techniques currently used for horses and ponies is intended to help the reader understand their basic principles and use further articles are planned to discuss such technique in greater detail.

Magnetic Resonance Imaging
Magnetic resonance imaging (MRI) is a relatively new imaging technique that uses a strong magnetic field and the magnetic properties of water molecules within the body to generate images. Unlike radiography and ultrasonography, it does not use ionising radiation. However, it primarily uses image from the foot, where soft tissue injuries occur that cannot be visualised with radiographs. As the foot is enclosed in the hoof capsule. However, it is also commonly used to investigate lameness related to the fetlock or carpus, particularly. Thoracic and abdominal injuries and injuries to the proximal suspensory ligament MRI is an advanced imaging technique and is only used when the site of lameness has been localised to a specific region but a conclusive diagnosis has not been reached using other techniques such as radiography and ultrasonography.

The Halliday equine MRI system was installed at Rossdales in 2006 and we have used the information provided to achieve an accurate diagnosis and to plan treatment and rehabilitation periods in almost one thousand horses since that time. Additionally, we have also been interested in the use of MRI for the diagnosis of more subtle problems such as magnetic resonance imaging (MRI) is a relatively new imaging technique that uses a strong magnetic field and the magnetic properties of water molecules within the body to generate images. Unlike radiography and ultrasonography, it does not use ionising radiation. However, it primarily uses image from the foot, where soft tissue injuries occur that cannot be visualised with radiographs. As the foot is enclosed in the hoof capsule. However, it is also commonly used to investigate lameness related to the fetlock or carpus, particularly. Thoracic and abdominal injuries and injuries to the proximal suspensory ligament MRI is an advanced imaging technique and is only used when the site of lameness has been localised to a specific region but a conclusive diagnosis has not been reached using other techniques such as radiography and ultrasonography.

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It is an important diagnostic aid in cases where:

• there is an area of lameness that has been localised on radiography or ultrasonography or this area
• there are multifocal or multi-limb lameness
• there is history of poor performance
• it is not possible to examine the area radiographically due to the location of the abnormality or to the presence of osseous changes.

Bone scanning is a simple procedure for the horse, but is not a painless procedure, and in cases of joint disease bone scanning is a suitable procedure for the horse, but is not a painless procedure, and in cases of joint disease the external detector (a ‘gamma’ camera) captures the detecting the radiation and forms images on the computer screen. Bone that is rapidly turning over (or

Modeling) wears more new bone than the surrounding bone. This is used to detect radioactivity, both in normal areas of the body and in areas where abnormal bone is present, such as fractures, non-accidental or chronic bone injuries and in cases of joint disease. Bone scanning is a safe procedure for the horse, but it is not a painless procedure, and in cases where a specific indication to do so and where a diagnosis cannot be made using other imaging techniques.

In this digital x-ray image of the right fore fetlock of a thoroughbred, a joint defect (or ‘radiolucent’) line is seen on the joint surface (arrow). This represents a fracture line and, should the horse be exercised with this defect present, there is a risk of joint damage. If the bone is repaired surgically, then the joint defect may develop. The ability to monitor the appearance of the bone defect and the bone repair process is of great benefit, and may otherwise be missed potentially using bone scanning.

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