Posture

A single word can indeed be substituted for structure and function: posture. But now you are probably thinking 'What has my horse's posture got to do with anything?' The answer is that it has everything to do with the way he stands, moves and performs. But even more importantly poor posture is significantly implicated in primary injury and secondary dysfunction in the horse. For the horse, sound and lame are two ends of a very wide spectrum and, in the absence of trauma, a series of small compensatory postural changes can take place over several days, weeks or even months. By the time that clinical lameness manifests, a number of small, sub-clinical anatomical pressures have been created. Without an appreciation of this phenomenon, treatment of the primary lameness, whilst ignoring the compensatory changes that led to it, will simply lead to a relapsing or evolving condition. Further, in the absence of physical trauma, escalating subtle postural compensations can eventually result in lameness in anatomical structures far away from the original source of pain. Why should this be so? The answer lies in the fact that the horse evolved primarily as a prey animal. His major means of defence is to outrun a predator. Therefore, the predator will select as its target that which it perceives as the sick, lame or lazy animal from the herd. Consequently it is in the interests of the horse to disguise that he is in any way impaired from running because of pain. Horses, more so than any other animal, have developed strategies to conceal injury, and therefore by the time that lameness is expressed, the animal is already in significant pain and may have been so for some time. Further if postural compensations have been longstanding, he may be experiencing pain in many areas of his body and the particular lameness that he is exhibiting may be completely disassociated with the original painful area. So if only the presenting lameness is addressed, the mechanisms which created that lameness are still likely to be present. It takes a very experienced and critical eye to perceive pre-lameness postural compensations in the horse. It is what veterinary surgeons will refer to as a sub-clinical lameness, as there is dysfunctional movement but nothing that would classify it as clinically 'lame'. New advances in gait analysis with horses have shown the remarkable extent by which the horse can imperceptibly transfer his body weight to compensate for pain. An original postural compensation can result in a minor overload of another anatomical structure, which in turn becomes painful and the horse must shift his weight again and again. This leads to a downward spiral of complex compensatory mechanisms which inexorably result in observable lameness when the horse is unable to disguise his pain further.

Functional anatomy

Functional anatomy is essentially the study of movement and physical activity. Whilst the latter is basically a physiological subject, physiology and anatomy are close bedfellows and cannot be easily separated. However, functional anatomy is the fundamental building block of biomechanics and is therefore generally considered to be a mechanical system.

Injury is an unfortunate effect of sporting life and brings with it pain, and incapacity. For the owner it also brings the inevitable emotional and economic costs. It is a sad fact that 70 per cent of horses involved in sport will sustain at least one lame episode in each competitive season. Some of these will, of course, be as a result of direct trauma such as a fall, striking a solid fence etc., but many of them will be as a result of compensatory gait patterns which have gone unnoticed by the rider/trainer/owner.

If a horse is not doing what you want him to do there are usually three main causes:

1. He doesn't understand what you want him to do.

2. He is not physically capable of doing what you want him to do.

3. It hurts him to do what you want him to do.

Horses are vertebrate animals, which means they have a vertebral column (axial skeleton) attached to which are limbsm(appendicular skeleton). Bones are usually joined together by means of arthroses (joints). Muscles are attached to bone by way of tendons. Muscles contract and relax and transmit the forces they generate via the tendons to the bones, to either change joint angles to produce locomotion, or to stabilise joints when stationary, enabling standing. In basic biomechanical terms we can think of joints, particularly in the appendicular skeleton, as levers. As in all mechanics theory, the more efficient the levers, the greater the power produced and the more effective the movement generated.

Elastic energy in equine locomotion

Another important aspect of equine locomotion is the heavy reliance on elastic energy for forwards movement. As a prey animal, whose major means of defence is to outrun a predator, the horse has evolved to make greatest use of movements that do not require direct energy derived from food (ATP [adenosine triphosphate] derived from glycogen, fat, proteins etc.) which would drain energy levels on any activity that is not actually propelling the horse away from that predator. These movements are primarily those which involve movements of the limbs whilst they are non-weight bearing, such as flexion and protraction. In physics elasticity is a physical property of materials which return to their original shape after they are deformed. When an elastic material is deformed due to an external force, it experiences internal forces that oppose the deformation and restore it to its original state if the external force is no longer applied. Put very simply, imagine an elastic band. If you stretch it you are applying an external force, but when you release it, it will return to its original length. So returning to its original length did not require any additional energy input, the elastic band simply stored the energy as part of the stretching process and released it to return the band to the original dimensions when you let it go. All musculoskeletal tissues exhibit varying degrees of viscoelastic behaviour (i.e. time and rate dependent), but for the horse it is mainly the viscoelasticity of tendons in the distal (lower) limb, or tendinous tissue running through muscles that protract the fore and hind limb, that have highly evolved to display maximal elastic energy utilisation.