How to Use Lunging and Flexion Tests to Assist, but not Detract from your Lameness Evaluation

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Veterinarians evaluate the horse at the lunge and perform flexion tests during lameness and pre-purchase evaluations. Lunging and flexion tests are thought to expose or exacerbate lameness that may not be seen with the horse trotting in a straight line. Many veterinarians also believe that lunging and flexion tests help localize lameness within the limb. Horses with bilateral lameness may not appear lame when trotting in a straight line, but the lameness becomes visible, sometimes on the outer limb, but more frequently on the inner limb, when the horses in lunged. There is a valid biomechanical explanation for this. Moving in a circular path alters type and amplitude of limb forces. Lunging is also (if the horse lunges easily and well) an efficient method to evaluate a horse for lameness when you are alone, or if you do not have someone physically capable of trotting a horse on a lead shank.

However, lunging a horse or performing flexion tests is not always safe or helpful. These activities have potential to distract the veterinarian, causing him/her to proceed incorrectly, unnecessarily prolonging the lameness evaluation.

**Lunging**
When a horse is lunging, additional centripetal force is active, “pulling” the horse to the center of the lunging circle. This force is caused by the horse changing direction. Changing direction generates transverse ground reaction forces and shear stresses, especially within the distal limb. Also, the torso of a horse trotting in a small circle is tilted, relative to the ground, towards the center of the circle. This tilt can be up to 18° for a 10 m diameter circle. Larger horses, smaller circles, and faster trotting speeds may increase this tilt. Surface characteristics, like evenness (more precisely unevenness) or hardness, also affect the amplitude of tilt. Because the torso is tilted, inside and outside limbs experience different compressive load patterns, with the abaxial half of the inside limb and the axial half of the outside limb experiencing greater compressive forces. Thus, pain from lameness conditions with some lateralization of pathology within the limb can be worse with the horse moving in a circle. Examples include conditions such as collateral ligament desmitis, or carpal arthritis, since carpal arthritis is commonly localized on the axial half of the joint. Horses with carpal arthritis can be expected to be worse during the lunge when the most affected limb is on the outside of the circle.

Because the horse is tilted when lunging, movement of the torso and limbs, even in the sound horse, will not be the same in each half cycle (left and right) of the stride. Height of torso from the ground is shorter for the inside limb, so the inside limb must flex more during the swing phase of the stride. Greater flexion of the inside hind limb as it swings forward rotates the pelvis toward the inside of the circle. Comparatively, the outside hind limb flexes less when swinging forward and the pelvis rotates less to the outside. Hypothetically, these asymmetries, if seen when the horse was trotting in a straight line, would appear to be like movement in a lame horse. This exposes two weaknesses in the logic of evaluating horses for lameness at the lunge. First, the “thresholds” for asymmetric movement between right and left sides of the body that indicate lameness are necessarily larger for the lunge than for straight line trot. Second, it will be more difficult (if not impossible) to detect lameness at a “snapshot” in time when the horse is lunging in the first direction. You must at least evaluate the horse lunging in the other direction before the decision for the existence of lameness is declared.

The asymmetric patterns of vertical torso movement when horses are lunging have been studied extensively through experiment using objective measures of movement, especially using body-mounted inertial sensors. From these studies it is clear that the asymmetric patterns in normal horses (and therefore not indicative of lameness) depend much on ground surface hardness. Horses lunging on hard ground will frequently display more downward movement of the head and pelvis when the outside forelimb and hind limb are weight bearing. Also, the tuber coxae will move up more during the swing phase of the inner hind limb compared to the outer hind limb, giving the movement the appearance of a “hip hike” on the inner hind limb. Therefore, on hard surface even normal horses sometimes may appear to be lame on the inner forelimb and hind limb.

By contrast, on soft ground a horse will frequently raise the head up more when the outside forelimb is in the second half of stance. It will then fall a large vertical distance during the subsequent first half of opposite (inner) forelimb stance. The horse uses this upward vertical head movement to assist in the directional change (toward the left lunging left and to the right when lunging right), and the ability to accomplish this is slightly reduced with the outside limb sinking into the soft surface. In a 2-component model of head and “rest-of-body” movement in a lame horse, this normal movement would appear to be an outside forelimb pushoff type lameness, which is exactly the opposite effect as seen on hard surface. In the hind limbs the effect of soft surface on vertical pelvic movement is also different than on hard ground. The horse does not have a heavy counter-weight on a long lever arm attached to the hind part of the torso (like the head in the front of the torso), a counter-weight with which to use to assist in changing direction. Changing direction is therefore primarily accomplished by changes in the forces of hind limb impact and pushoff. On soft ground,
when the outside hind limb pushes off at the end of stance, the foot sinks into the soft surface. As a result the pelvis rises less relative to the ground, which is equivalent to an apparent outside hind limb lack of impulsion or pushoff type lameness. However, the pelvis still falls less on soft ground when the inside hind limb is in stance, giving the appearance (as on hard ground) of an inner hind limb impact type lameness.

Summary
On hard ground many normal horses appear to have inner forelimb impact type lameness and inner hind limb impact (hip hike) and pushoff (hip dip) type lameness. On soft ground many normal horses appear to have outer forelimb and hind limb (hip dip) pushoff type lameness and inner hind limb impact (hip hike) type lameness. The asymmetries should be taken into consideration when evaluating horses for lameness at the lunge.

Based on biomechanical considerations, it is more likely that many forelimb lameness conditions will be worsened more significantly than hind limb lameness during the lunge, and that many hind limb lameness conditions will be somewhat masked during the lunge. In a horse that is trotting in a straight line at moderate speed (4 m/s) the forelimbs act primarily as struts, braking the forward movement of the torso, but with very little propulsion imparted to the torso. The hind limbs also brake, but most of the work of propulsion to advance the torso forward is supplied by the hind limbs. The needed propulsive force to move the horse forward in a straight line is greater than that needed during the lunge, since at the lunge the horse is primarily changing direction. So, the braking effect of both the forelimbs and hind limbs is biomechanically more important during the lunge, but the need for propulsion, which is supplied by the hind limbs, is less important during the lunge. Experimental findings with natural and induced lameness seem to support this.

It is uncommon for horses to show lameness in only one limb during the straight line trot, but then to show lameness in only one limb opposite to that seen in the straight line trot. It is, however, common for horses to show multiple limb lameness, either compensatory (or false) lameness and secondary lameness, during the lunge. Thus, lunging the horse can complicate the clinical appearance of lameness in the horse. Agreement between veterinarians for detection of lameness when allowed both evaluation of straight line trot and lunging is less than between veterinarians when allowed only evaluation with the horse trotting in a straight line. Additional complexity and confusion can arise when horses are evaluated for lameness trotting straight on one surface and then while lunged on a different surface. Because of these complicating factors I do not recommend evaluating horses for lameness at the lunge, unless the lameness cannot be definitively detected in the straight line trot, or unless there is no other way (you are by yourself). If the lunge is needed it is important to use the same, or similar surface, as that used in the straight line trot evaluation, and to have a patient who is practiced and lunged regularly. Mixing surfaces, activities (lunge, straight), size of lunging circles, besides being time consuming, rapidly complicates the lameness evaluation and increases the likelihood of confusing compensatory or secondary lameness for the primary problem. Lunging should be considered an extra step, an advanced examination, to be employed only if needed.

Flexion tests
The use of flexion tests by veterinarians in both lameness and pre-purchase evaluations is traditional and common. Attempts at logical explanation of the apparent increase in lameness following flexion range from flexion-induced stress on soft tissue structures to an increase in intra-articular pressure. However, there is little objective evidence of the effectiveness of these tests to 1) help isolate the focus of lameness within a limb, or 2) to bring out lameness as a clinical sign indicative of existing but subtle orthopedic dysfunction. Evaluation of response to flexion tests varies greatly depending on the individual evaluator (some are more prone to indicate positive response), the “strength” of the flexion (amount of pressure applied to the flexion of the joint), time of flexion, and horse. Many horses with no history of lameness that display positive response to flexion do not develop lameness later on. There is no association between response to flexion and pathology. Objective measurements seem to indicate that a positive response to proximal hind limb flexion is limited to decreased pushoff of the hind limb, regardless of whether the horse has a primary impact or pushoff type hind limb lameness before flexion. Responses to flexion tests frequently complicate the lameness picture and make it difficult to unequivocally evaluate nerve and joint blocks. What does it mean if a horse seems improved after a block when trotting in a straight without flexion, but then appears worse after flexion, and vice versa, a horse that does not appear better but has less lameness after flexion?

Conclusion
Flexion tests are useful for some lameness evaluations but with some caveats. Care should be given to overzealous interpretation of response to flexion tests during pre-purchase evaluations. There is little objective evidence to support the use of flexion test to localize lameness within a limb. Flexion tests are most useful to “bring out” lameness that is not visible. When performing flexion tests use short time durations and do not flex too “firmly”.

Core information in support of these proceedings:
References