Equine Gait Analysis for Lameness Diagnosis

Steve Adair MS, DVM Dip ACVS & ACVSMR
University of Tennessee Veterinary Medical Center

Qualitative Analysis

• Clinicians use semi-quantitative method when assigning a lameness grade
  – AAEP 5 grade system
  – European 9-10 grade system
• Generally highly subjective evaluation based on evaluator’s experience
• Greatly varies between evaluators
• Human eye has limited ability to detect subtle changes in movement
• AAEP lameness grading scale attempts to standardize but still allows for variations between evaluators

Quantitative Methods of Analysis

• Kinematic
• Kinetic
• Electromyographic
• Computer Modeling
Kinematic Analysis

- Measure the geometry of movement without considering forces
- Use videographic or optoelectronic systems integrated with computer

McPhail Equine Performance Center, Michigan State College of Vet Med

Kinetic Analysis

- Study of forces responsible for movement
- Force plates, in shoe pressure systems, strain gauges

Oklahoma State College of Vet Med

Combined Kinematic and Kinetic

- Combination of force plate and cameras
- There are also treadmill systems that have built in force plates

http://cvm.msu.edu/research/research-centers/mcphail-equine-performance-center
Pressure Mapping Systems

- Display contact area, average and peak pressures, and Center of Pressure and its trajectory
- Side-by-side comparisons of pre- and post-treatment conditions
- Measure distance between two points
- Isolate and analyze specific regions of the hoof

http://www.tekscan.com/medical/system-hoof.html

Gait Types

- Symmetric gaits
  - Walk, tölt, pace, trot
- Asymmetric gaits
  - Canter, gallop
- Variations occur in each
- Trot is best gait to evaluate lameness
  - Symmetric and diagonal
  - Center of mass of the body has the greatest vertical excursion at the trot

Definitions

- Stride
  - Full cycle of limb motion
- Stance phase
  - Part of the stride when limb is in contact with ground
- Swing phase
  - Part of the stride when limb is not in contact with ground
Definitions

• Suspension phase
  – At trot, pace, canter or gallop when there is no hoof contact with ground
• Stride frequency
  – Number of strides per unit of time
• Stride length
  – Distance between 2 successive hoof placements of the same limb

Application of Gait Analysis

• LAMENESS
• Shoeing
• Track design
• Improving performance

Commercial Systems

• Simple HD Camera
• ETB Pegasus – UK System
• Quintic Software Systems
• Gait Trax System – Motion Imaging Corp
• Tekscan Systems – Hoof Pressure
• APAS – Ariel Dynamics
• Lameness Locator*
• Kinovea*
• OnTrack Equine*
• EquineTec*
Lameness Locator®

- Windows Based
  - http://equinosis.com/
- Cost - ~$14,000
- Inertial Sensor system
- Detects head and pelvic movement as well as stride
- Wireless

Inertial Sensor System

Gyrosopes  Accelerometer
Kinovea®

• Windows Platform
  – http://kinovea.org/
• Open Source and free
• Capabilities
  – Dual windows
  – Comparisons
  – Measurements
  – Tracking
  – Live Capture
  – Import/export
  – Slow motion
  – Many more

ONTRACKEquine®

• IPhone and iPad only
  – Used to be available for windows and Mac
• Uncertain as to total cost
  – IPhone - $9.99 plus subscription
• Capabilities
  – Capture
  – Import/export
  – Measurements
  – Still and video
  – Slow motion
  – Reports
  – More
EquineTec®

- Windows based
  - www.equinetec.com/
- Cost
  - $200 to 800 depending on version
- Capabilities
  - 2 to 8 windows
  - Measurements
  - Slow motion
  - Dual camera capture
  - Tracking
  - Import/export
  - Many more