Canine Gait Analysis

Gait analysis is the systematic study of animal locomotion. This is achieved through observation but can be augmented by instrumentation for measuring body movements, body mechanics and the activity of the muscles. Gait analysis is used to assess, plan, and treat patients with conditions affecting their ability to walk. (Whittle E. Michael, 2007)

Through familiarising ourselves with 'normal' canine gait mechanics, we can identify abnormal patterns and lameness. There is a huge variation to normal mechanics based on the breed differences and size of the dog e.g. the gait of a terrier compared to the gait of a Labrador

Before You Start

There should always be a thorough subjective history taken prior to any physical examination of the dog. Make sure you know the dog's medical history, current condition and any recent surgery it has had. This allows you to take into account factors which may be contributing to the animal's conformation and the way they move.

This may include orthopaedic/neurological conditions, recent injuries/operations, previous injuries/operations and any acquired genetic problems etc.

Assess the dog in standing before you ask the owner to walk the dog up

- Static observation - With the dog standing look at its conformation.

  Conformation evaluates the degree of correctness of an animal's bone structure, musculature and its body proportions in relation to each other. You also need to observe and take note of the dog's posture; this will give you clues about possible areas of discomfort before you watch them walk.

  Look for symmetry/asymmetry: Assess from front, back and both sides

- Head position (head tilt, turn)
- Tail carriage (symmetrical?)
- Trunk / top line (kyphosis, lordosis, scoliosis, arched)
- Foot placement (Base of support, should be 1 leg in each corner)
- Weight distribution (FWB, PWB, TWB, NWB, offloading hind limbs, off-loading forelimbs?)
- Limb alignment (flexion/extension/rotation/abduction/adduction)
- Muscle bulk (symmetrical?)

You can gain a lot of information by just observing the dog standing. Often, pain in a limb can be identified by assessing weight distribution in stance and the alignment of the limbs.

Normal	Should be equally weight bearing on all four limbs
	Should stand square over the limbs
	Good alignment through limbs
	Symmetrical muscle bulk
	Able to stand comfortably while you talk to the owner
Abnormal	Off-loading a limb / shifting weight forward or backwards/side to side
	Mild off-loading may not be detectable, look at how much the pad is splayed and angle of the leg - the limb may be positioned slightly out to the side or front and externally rotated
	Moderate off-loading. In more painful conditions the dog may be more obviously partially weight bearing (PWB) and just toe touching (TWB).
	Severe offloading. Toe touching or limb may be held off the ground completely (NWB)
	Shifting from side to side in stance - can indicate a bilateral lameness
	Shifting weight backwards - may indicate pain bilaterally in the forelimbs or neck/upper thoracic spine
	Shifting weight forwards - may indicate pain bilaterally in the hind limbs or lumbar spine
	Inability to maintain standing and trying to sit down/lay down – potential problem somewhere

- **Locomotion**

Having an understanding of locomotion helps us to evaluate conformation and the gait patterns of our animal patients. It also helps us determine the location and cause of lameness.

Normal gait

Normal gait can be divided into **symmetrical** or **asymmetrical**

Walk, trot & pace = examples of **symmetrical** gaits

Canter and gallop = examples of **asymmetrical** gaits
Symmetrical gaits are the best to analyse because abnormalities are easier to detect.
We tend to only look at walk and trot in our orthopaedic patients but in athletes and working dogs it may be necessary to look at other gaits.

Good websites to observe gait patterns are: http://vanat.cvm.umn.edu/gaits/index.html and http://www.youtube.com/watch?v=JrAlxe3SRiw (poodle walk, amble & trot)

- Walk

A four-beat gait in which each limb steps (lift/swing/support/thrust) in sequence. When walking, the dog never has fewer than two feet on the ground (usually three feet), and occasionally all four feet may be on the ground.

The neck and head are lowered during initial forelimb support phase and then rise again as the limb recovers ready for swing phase. The trunk swings laterally as well as vertically, and the tail and head swing toward the side being laterally supported.

'Tracking up'. The hind paw approximately overlays the site occupied by the ipsilateral (same side) fore paw.

- Trot

The trot is a symmetrical gait produced when the diagonal pairs of legs move almost simultaneously. The trot usually places two feet on the ground at all times (left fore/right hind and vice versa). The left side mirrors the right sight and should look symmetrical during movement.

Dogs with short body length and long legs have difficulty trotting, since their hind legs interfere with their front legs. Crabbing is a method of avoiding this type of interference by twisting the body to allow the hind feet to pass to one side of the forefeet, so that the dog moves forward and laterally simultaneously.

How to Analyse Gait

The first time you meet a patient you should undertake a thorough gait analysis. This gives a baseline (objective marker) with which to detect any improvement or deterioration.

You should also re-assess each patient before and after they enter the pool/treadmill. Always question the owner closely if you are concerned that things have deteriorated and modify the session accordingly.

It is particularly important in your role as a hydrotherapist to pick up any changes (positive or negative) to help determine the effectiveness of the hydrotherapy programme. Any changes seen should be DOCUMENTED on the record card, so you can monitor the dog's immediate response to hydro and plot their progress week by week and over the course of treatment. It especially helps to keep track if more than one therapist is working with the same dog.

Remember to look at the dog in standing before you look at movement.

Walk / Trot up

Get the owner to walk the dog away from you and back towards you so you can view the dog from the back and front. It is good practice to view the dog from each side too. If nothing is detectable at walk have the owner speed up the walk or trot the dog as well. Make sure the owner hasn"t got the lead too tight and watch to see if they keep correcting the dog as you won"t see a true picture.

Look for symmetry/asymmetry: Assess from front, back and sides

- Head
- Pelvis
- Trunk movement
- Tail carriage
- Foot placement (position in relation to body)
- Foot flight
- Tracking up
- Limb alignment
- Weight distribution

Abnormal Gaits

Both painful musculoskeletal conditions and almost every neurological condition will be associated with an abnormality of gait. These signs vary according to the type and severity of the condition and the location of the problem.

Deviations from normal gait can include

- Lameness
- Circumduction, dishing or scissoring with the limbs
- Shortening of the stride and/or swing phase
- Unnatural shifting of weight from one limb to another
- Irregular foot placement
- Head bobbing
- Stiffness through trunk or limbs (look at flexion/extension through the joints)
- Toe scuffing

- Development of a protective mode of walking demonstrates severe pain such as arching of the back, or lowering of the head and neck, or extension of the head (disc disease in the neck or thoracolumbar area)

All these signs can indicate that the dog is experiencing pain or is attempting to minimise pain by compensating/altering their gait pattern. Try to analyse which limb is the problem and which joint the abnormal movement is coming from.

Neurological problems may present in the dog as:

- Toe dragging, knuckling, lameness, unsteadiness, ataxia (proprioceptive deficits).

Lameness

'A variance from normal gait'

Lameness can be divided into anatomical/mechanical and pathological lameness

Anatomical (mechanical): Not necessarily painful - can be genetic or acquired e.g. muscle contracture, leg length discrepancy

Pathological: Painful - Neurological or musculoskeletal

Identifying <u>Forelimb</u> Lameness (weight bearing)

- 'Head nod': The head will rise during weight bearing on the painful limb and lower when the normal limb contacts the ground in an effort to off load the painful forelimb (weight is shifted to the back legs).

    This is the most consistent indicator of forelimb lameness

- The dog will shorten the length of time that the sore leg is on the ground and at the same time remove the weight from this leg by raising its head and neck
- The normal leg will have a longer stance phase and may have a longer stride length than the injured leg.
- The back legs may also be carried further under the body to receive weight that is shifted from the front.
- The lameness will usually be more exaggerated at a trot than at a walk (increased force through limbs).

Identifying <u>Hind Limb</u> Lameness (weight bearing)

- Painful limb will have reduced stance time

- May extend and lower the head to transfer weight to the forelimbs
- When the hind leg is placed on the ground, the dog may exaggerate the downward motion of the head and neck to lessen weight on the hind limbs.
- The tail may move up and down with the up motion occurring when the injured leg contacts the ground, rather than swinging from side to side as in the normal dog.
- With bilateral hind limb lameness may lack impulsion and have a shortened stride
- No perceptible head bob

The severity of the pain determines how much the dog will try to off-load the limb

- Usually with a severe sharp constant pain the dog will carry the limb and keep the weight off it when lying down.
- A dull aching pain will produce a limp during the gait analysis.
- A lesion that produces a small pain that occurs in certain phases of locomotion allows the dog to adjust its gait for relief.

N.B The quadruped has the ability to minimise pain by altering movement in such a way that the abnormality may be unnoticeable. This altered gait can lead to subsequent orthopaedic problems.

(Robert L. Gillette, DVM, MSE www.sportvet.com)

N.B. Remember lameness may be bilateral

Once you have ascertained which is the problem limb(s) you can look in more detail at how the joints of that limb are moving to localise the site of lameness. E.G. reduced elbow flexion in arthritis of the elbow. Make a note of what you see so that you can reassess that specific underline objective marker each time you see the dog.

Spinal pain

- Arching of the back can be a sign of pain and disability of the back itself.
- Also look for equal lateral sway of the trunk, tail and hind limb stride length and head position

Lameness Scoring

A numerical rating scale (NRS) can be used to measure lameness to aid objectivity: .

Ranged from 0 (clinically sound) to 10 (could not be lamer).

Score	Category	Criteria
0	Clinically sound	No lameness
1	Very mild	Barely detectable at walk
2	Mild	Hard to detect at walk and/or trot
3	Mild	Hard to see at walk easier to see at trot
4	Mild to moderate	Detectable at walk & easy to detect at trot
5	Moderate	Obvious at walk (head nod)
6	Moderate to severe	Marked head nod at walk
7	Severe	Severe off-loading & unwilling to trot
8	Severe	Hobbling at walk and unable to trot
9	Extreme	Reluctance to weight-bear at walk
10	Could not be lamer	Completely non weight bearing

Reference List

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