

The Equine Pelvis

By Nikita Canot

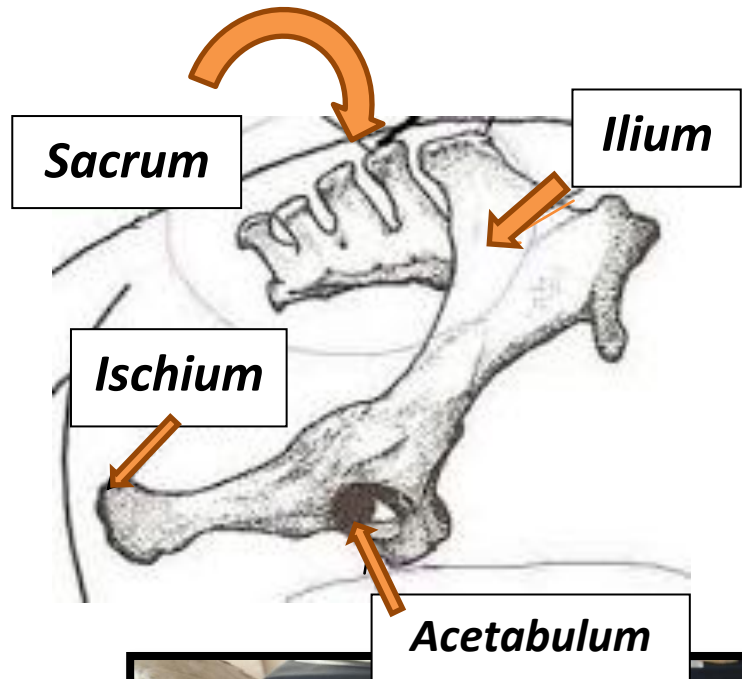
The front limbs of a horse will determine the how the gait is going to be performed as well as length of stride but the hind quarter is the power house. The hind quarter provides the propulsion for upward and forward movement which is often at great speed. The equine athlete has to move at high speeds but also have to turn sharply and stop suddenly, this requires balance and coordination. When assessing lameness in the equine athlete you will commonly look to see if it is a tendon, joint or bone problem, the pelvis is over looked as an area of potential problems.



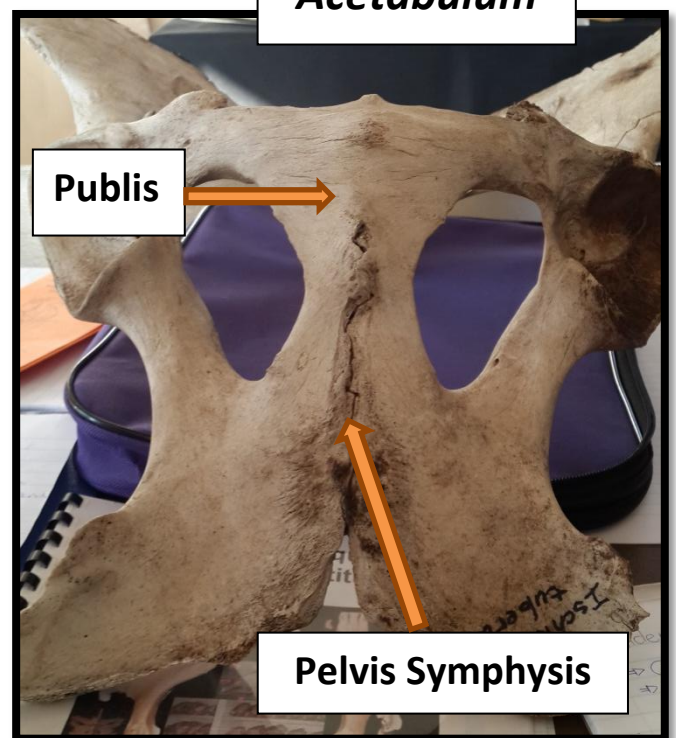
Structure of the Pelvis

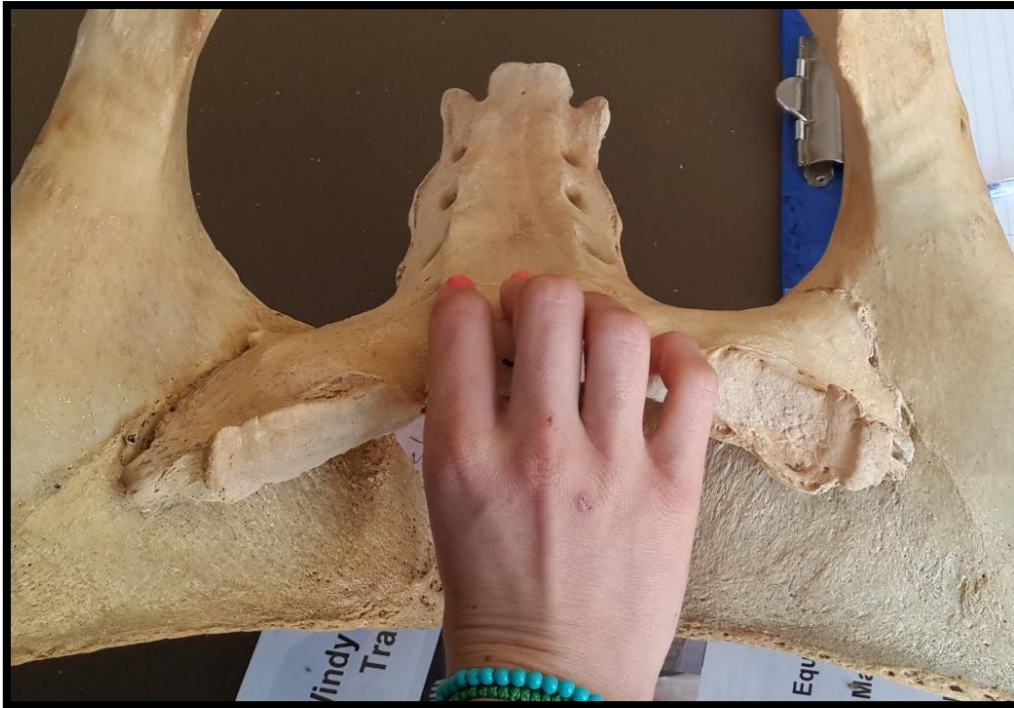
The structure of the pelvis is made up of 3 bones:

- ❖ Ilium
- ❖ Pubis
- ❖ Ischium



The Ilium and Ischium fuse together to form the Acetabulum, the Acetabulum is where the head of the femur fits and articulates to the pelvis through a ball and socket joint. The ilium is the biggest of the 3 bones, it allows for the sciatic nerve to run over the medial surface of the bone. The pubis forms the anterior floor of the pelvis, the actual shape of the pubis can be different when comparing genders. In a stallion the pubis will be more convex and in mares concave and smooth.





The pelvis is connected to the skeletal structure at the sacral vertebrae. The five sacral vertebrae are fused together, which creates a stable structure for attachment.

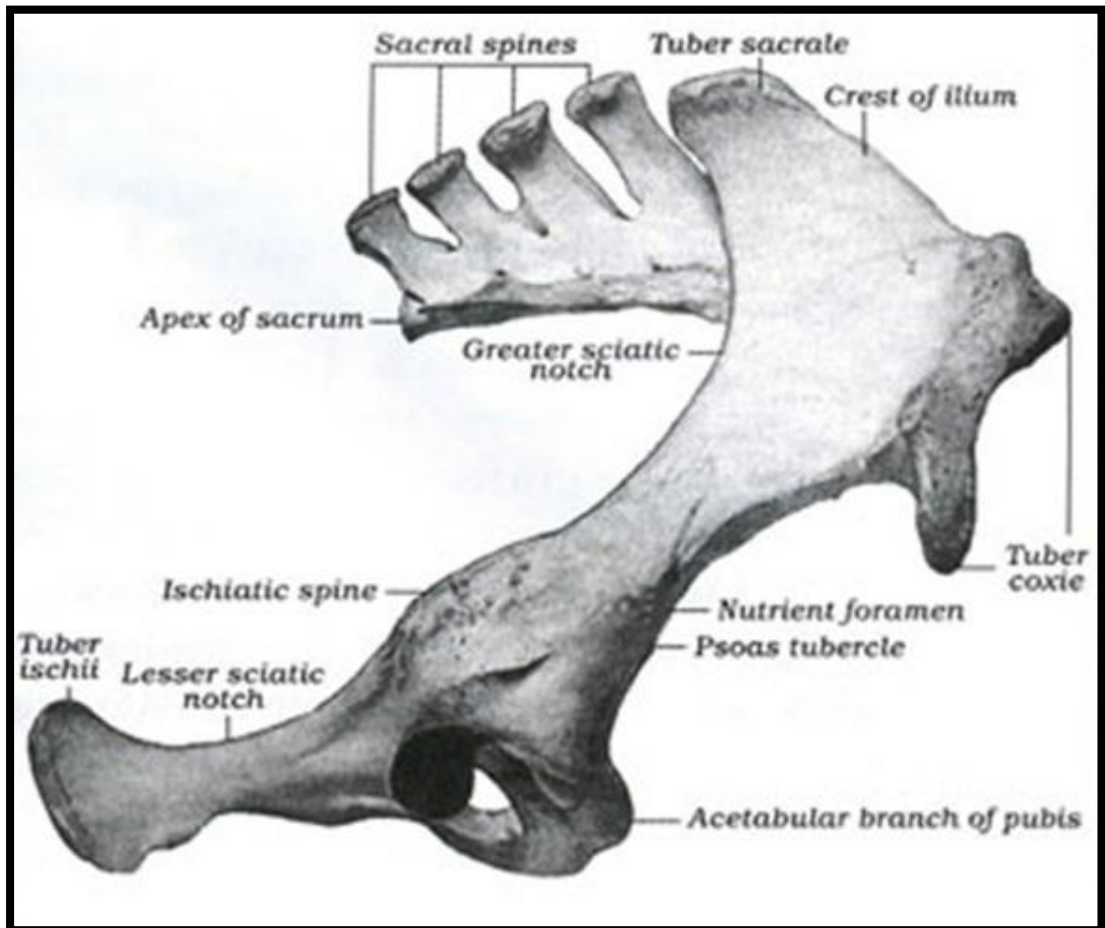
The sacral wings are found at S1, they are connected to the pelvis at the wings of the ilium by connective tissue and strong fibrous bands known as the sacroiliac ligament. The gap between these two bones is no more than a slit, the junction is known as the Sacroiliac Joint. The sacroiliac joint is a combination of synovial and fibrocartilaginous fibres. This joint is very different to other as it is very rigid.

human hand



There are 3 point of the pelvis that can be palpated by the

- ❖ *Tuber Sacrale*, known as the point of croup
- ❖ *Tuber Ischii*, known as the point of buttock
- ❖ *Tuber Coxae*, Known as the point of hip



The word 'Tuber' is used to describe a bony protrusion. This is the most common place where fractures can take place.

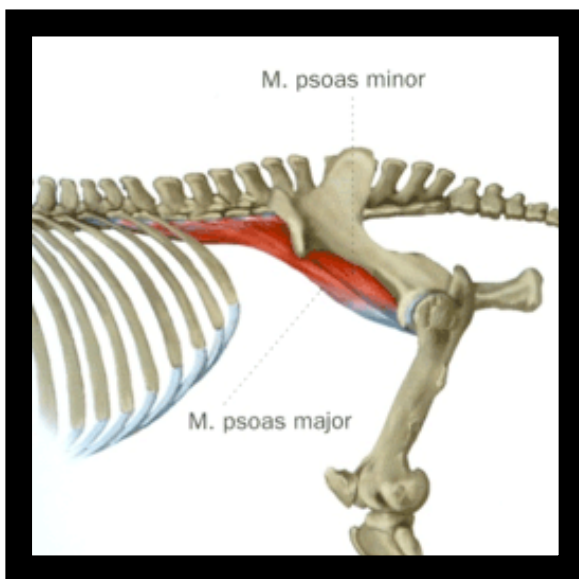
Muscles involved with the pelvis

There are a number of muscles attached to the pelvis that all play their own different roles with the movement of the hind limbs and flexion of the hind quarter. Most muscles have a double action but there are few muscles that are connected to the pelvis broken down into different categories.

Longissimus Muscle *originates at spinous processes of the thoracic, lumbar, sacral vertebrae and the wings of the Ilium. Inserts at the transverse processes which will extend and stabilizes the vertebral column. The longissimus is the longest muscle in the horses body and it connects the hind quarter to the front end.*

Flexion of the Pelvis and Hip

Psoas Group *Consisting of the Psoas Major, Psoas Minor and Iliacus. A series of deep muscles in the pelvis that affects movement and soundness.*



- ❖ *Psoas Major originates at the lumbar transvers processes and last 2 ribs, it inserts into thetrochanter. It helps maintain posture as well as flexes the hip and rotates the thigh laterally.*
- ❖ *Psoas Minor originates at T 16 to 18, L1 to 3 and inserts at the tuberosity of theIlium. The psoas minor is a powerful flexor of the lumbosacral joint and into the sacroiliac joint.*

- ❖ *Iliacus originates at the sacroiliac surface of the ilium and wing of the sacrum, inserts at the femur. The psoas major and Iliacus rotates the pelvis outward, flexes the hip joint. The Iliacus and Psoas Major work together and form what is known as the Iliopsoas muscle.*

Quadratus Muscle

Originating at the ventral side of the ischium and inserting at the trochanteric fossa. This muscle extends the hip and causes the retraction of the hind limb.

Quadriceps Femoris Muscle

Also known as the 'Quads' as there are 4 parts to this muscle.

- ❖ *The Vastus Lateralis*
- ❖ *Medialis*
- ❖ *Intermedius*
- ❖ *Rectus Femoris*

With the Quads originating on the lateral, medial and cranial aspects of the femur and then inserting at the Tibia, Fibia and Stifle this will cause the stifle to extend. The rectus femoris originates at the pelvis near the acetabulum and has the same insertion as the rest of the Quads this action will flex the pelvis.

External Obturator

Originating at the pelvis close to the obturator foramen and inserting at the trochanter it is responsible for adducting the hind limb.

Deep Gluteal Muscles

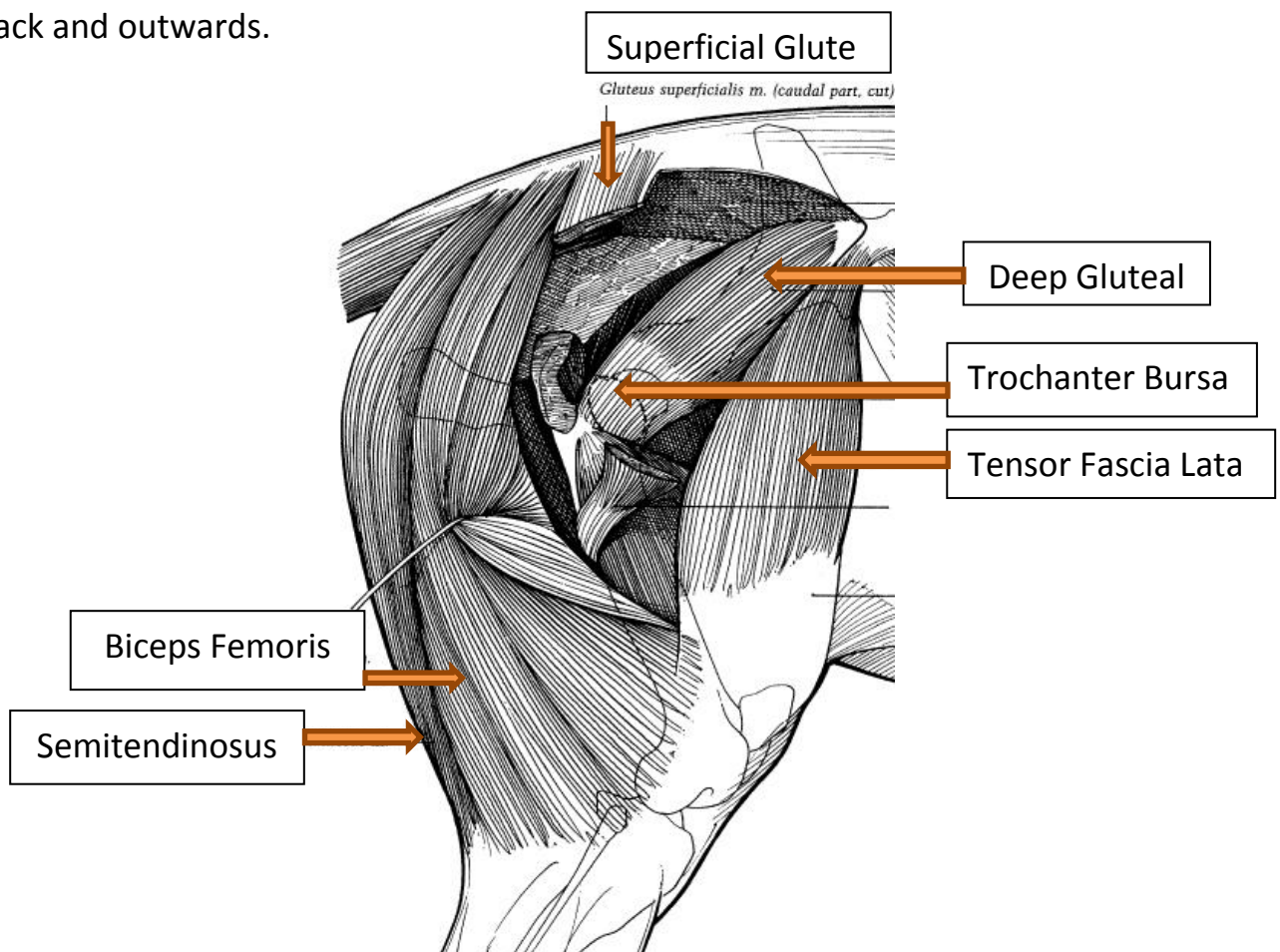
Originates laterally on the ilial shaft and insert on the short tendon of the greater trochanter. Abduction of the hind legs is controlled by the deep gluteal muscle

Flexion and Extension of the stifle

Biceps Femoris Muscles Largest and most lateral of the caudal hind quarter muscles. Originates at the Ischial tuberosity and the spinous processes of the sacral vertebrae, there are two tongues that will reunite and split into three parts where it inserts into the femur, the patella and the tibia. Its main function is to stabilize the pelvis as well as extend the hip and abduct the limbs.

Tensor Muscle (Tensor Fascia Lata) Originating at the tuber Coxae and inserting into the fascia on either side of the femur. The Function of this muscle is to extend the stifle and flex the hip, it works against the semitendinosus causing stability in the limb when in motion.

Semitendinosus Muscles Originates at the pelvic head (Ischial Tuberosity) and inserts at the cranial margin of the tibia. Its function is to extend the hip and stifle when the horse's hind leg touches the ground, causing that propulsion of the leg. When the foot is non weight bearing it flexes and rotates the stifle back and outwards.



Conformation and Movement

When assessing a horse's conformation it is important that the horse's croup (Tuber Sacrale) is lower than the withers. If the horse is crouched higher there will be extra weight put on the front legs. This will have a negative effect on the joints of the front legs due to the extra concussion. The horse can be divided into 3 different parts: the Shoulder, Barrel and Hind Quarter. Each needs to be in equal parts for the perfect conformation, meaning the length of the back could be equal to the length of the hind quarter, as well as the length of the shoulder.

The larger and better angled pelvis the horse has, it will be able to generate more power. The angle of the hip should be proximately the same angle as the shoulder.



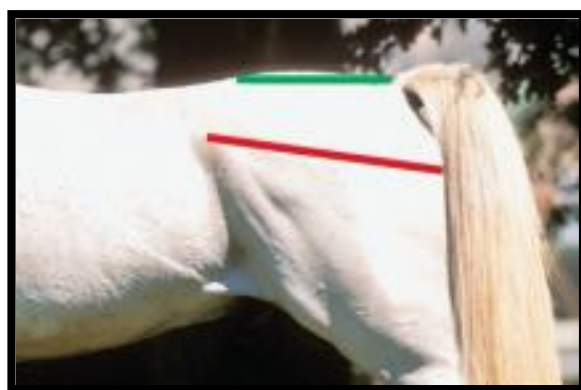
A good pelvic angle should range between 18 to 22 degrees.



A steep pelvic angle makes it very hard for the horse to bring the hind quarters underneath its self and this will affect the range of motion. You will often see a shortened stride compared to over horses. Steep pelvic angle is usually seen in Quarter horses.

In a flat pelvis the lumbo- sacral joint will be extended, the horse will most likely stand with the hind legs camped out. The angle of the pelvis will be about 10 degrees, which will make the angle look horizontal. The horse will have difficulty flexing the lumbo- sacral joint to bring the hind legs under. Dressage

movements that involve engagement of the hind quarters will be very difficult for this type of horse. This type of pelvis encourages a long flowing stride and during endurance this would be beneficial of the Arabian Breeds



The movement of the equine athlete and the range of motion that the hind quarter can produce is very much linked the pelvic angle of the horse. Horses that are camped under are likely to have a very steep angled pelvis, as you can see the pelvis angle does not only affect the length of stride but also the conformation and angel of the hind legs. If the hind legs are not 90 degrees to the floor, there will be additional pressure put on the horses joints and tendons which will negatively affect the horses well being.

Injuries to the Pelvis

There are a number of signs that will show if the horse is suffering from a pelvis injury. You will see sudden hind leg lameness, dragging the toe, muscle atrophy over the lumbar and gluteal area or change in performance. There are 3 main injuries that happen to a horse's pelvis:

Pelvic Fractures:

Commonly caused by Trauma, this could include a horse being cast, falls or walking into stable door ways. Fractures can happen at any time but most common when they are around 6 months to 2 years. It can happen to nearly any part of the pelvis, the horse will experience a lot of pain and mostly likely to be immediately lame.

Treatment varies from vets, trainer and therapists. Depending on the site of the fracture, a vet would recommend that the horse be stable rested for 9 to 12 months as to allow the pelvis to settle and the structure to heal.

Prognosis for a pelvic fracture will all depend of the actual fracture and where the fracture has taken place. The prognosis will be the better if the fracture occurs on the tuber coxae rather than the acetabulum as this is where the femur connects to the pelvis.



A scan of a normal ilial wing



Image showing a fractured ilial wing

Pelvis Dislocation:

Usually caused by trauma, a slip or fall, could even happen when a horse twists over a jump. The pelvis dislocation occurs when the Sacroiliac Ligament is ruptured or the joint capsule itself, the extent of the rupture will determine if the pelvis is Luxated(Displaced) or Partial Sublux(Partly displaced).

Treatment can include an operation to relocate the pelvis but the success of this surgery is not very high, so I would not recommend this method of treatment. Most vets would recommend that the horse be box rested and given anti-inflammatory drugs when the dislocation has just happen, the amount of rest would depend on the severity of the dislocation.

Prognosis is very good for a horse with a partial subluxation, the horse will adapt to the changes in the pelvis. Performance wise a horse can perform just as well as a horse with a level pelvis.

Sacroiliac Ligament Strain:

A strain to the ligaments that supports and stabilizes the pelvis to the fused sacral vertebrae occurs when the ligament is stretched passed its potential length and when this happens the ligament will practically tear. The tears are very tinylike micro tears. This strain can be caused by trauma or a continuous about of stress and tension on the ligament

Treatment can include box rest and then a well-structured rehabilitation program which would include walking, soft tissue stimulation and physiotherapy. With the Transeva we could give a light treatment to the surrounding areas to get a pull into the sacroiliac area, which would increase the blood flow and stimulate recovery of the fibers.

Prognosis is very good if the strain is picked up quickly.

Winks Green taught Beth Shaw that yes it is important to rest a horse for 6 months when the pelvis has been injured but to not restrict all movement. The horse should be hand walked every day for a few minutes, it should be very slow and only in straight lines. It is important that the horse does not make any sharp turns during the hand walking.

Importance of the Pelvis

DRESSAGE



In the canter the back is lifted and rounded, with the pelvis tucked under. In a collected canter the pelvis needs to flex even more to carry the additional weight.

The Psoas group is the major flexor of the hip, the psoas muscle will contract with every canter stride and bring the hind leg underneath the horse and tilts the pelvis to create engagement of the hind quarter.

In more advanced dressage movements the horse will have to carry more weight on the hind quarter to lift the front end to perform movements such as piaffe and passage. There will be an increased flexion of the hips, stifle and hocks, as well as lumbo- sacral joint.



The hip consists of a ball and socket joint that allows for a large amount of rotation which gives the horse the ability to abduct and adduct the hind legs. Ligaments around the hip joint restricts the amount of sideways movement. The biceps femoris and gluteals muscles assist the horse is abducting the hind legs.

Horse Racing

As the hind leg is about to hit the ground this is known as the 'Swing Phase', the abdominal muscles will help lift the back through the thoraco-lumbar joint and then the lumbar-sacral joint. Both these joints will need to flex efficiently so the hind legs can be brought further under the body.



Jet Bella showing the full range of motion through the pelvis by flexing the Lumbar-Sacral Joint

*The muscles involved in the extension part of the gallop are very similar to when a horse is about to take off when jumping.***.*



Hot Ticket crossing the finishing line, displaying his wide range of motion. Off hind is fully extended backwards

Jumping



During take-off a lot of power needs to be created, the muscles in the protractor chain brings the hind legs further underneath the body compared to a normal canter stride. The pelvis will look tilted and tucked under because of the flexion through the Lumbro-Sacral joint and hip joint.

- ❖ *The Hamstring group will contract to extend the hip joint this will assist in the upward motion*
- ❖ *The Gluteals muscles will assist in the upward motion but also the forward motion needed to go across the jump*



As the horse is about to take-off the maximum extension of the hip occurs

Polo

Polo is a combination of many different aspects of riding. Polo horse gallop, halt from a canter and do really sharp turns at the blink of an eye. They are really put to the test during their 7 minutes of play.



The muscle strength needed when moving the skeletal system to perform these tasks is very important. The hind legs play a vital part in the polo pony, when checking up the horse has to bring the hind legs underneath itself to tilt the pelvis to stop quickly. The horses will go from a standstill to flat out gallop in seconds chasing after the ball, the entire hind quarter is put under pressure to create that forward motion effectively. The sacroiliac area is put under a lot of strain due to the sharp turning and twisting while at play.

As you can see when looking at these 4 different disciplines that the pelvis plays a vital role in the performance and how well the horse can perform tasks asked by the rider. It is essential that the muscles and ligaments attached to the pelvis are functioning correctly as these muscles will work together in the movement of the hind limbs and flexion of the back. The pelvis is a stable structure in the equine athlete, muscles and ligaments depend on the pelvis to be secure and stable so that movement of the hind limbs can be executed correctly.

Case Study

Jedi

History: Colic operation in 2013, after surgery he stood up with his pelvis dropped to the off side. He holds his tail and hind quarter to the off side when walking out plus walking wide with the off hind.

21/08/2014: Treatment to off hind showed no real sensitivity but contraction on the iliopsoas was incorrect, took time a developed better contractibility. Lumber sacrum area very sensitive on both sides, did work through sensitivity.

After treatment I found that he walked a lot better with the off hind. He is a dressage horse and does basic prelim tests. He might be sound and going sweetly but I have to think to myself.

Why is he not putting on muscle or weight since his operation, could it be from pain or that the muscle is so damaged and strained that it can't or possible nerve damage?

Near hind iliopsoas very restricted and sensitive, took lengthy RX to warm, did give good release.



Charlie

History: Called out to treat Charlie as he was unsound near fore, he was worse on the left rein. He has a partial subluxation to the near side. Before treatment we trotted him up and down a hill as well as on a circle in both directions to investigate his unsoundness.

Treatment:

31/07/2014 spasm found on near side iliopsoas and hip, this released. Off side S.I and hip restricted and took time to correct movement. His temperament during his Transeva treatment was calm and did not move around much.

01/08/2014 Beth came to give us some good news that Cheryl has called to tell her that Charlie was trotting perfectly sound and the Transeva treatment has made a huge difference in his way of going.

08/08/2014 Lengthy Rx to near hind iliopsoas, worked through well. Off side S.I very sensitive and had a big blow.

15/08.2014 near hind iliopsoas slight spasm but worked through. Off hind very sensitive and lots of nerve involvement.

This was his last treatment.

When speaking to Birgit about his last treatment she explained that he had become dangerous when working on that off side and that she has suggested that his off hind S.I gets injected. He was injected and Cheryl called to report that he was going very well and they were very happy with the results.

Gee Gee

History: Owned by Andrew Jonsin and ridden as a polo pony, Gee Gee had come to visit BSET on 2 occasions for unsoundness to her near fore. She had a partial subluxation to the near side and a piece of the off side tuber coxae missing.

Treatment:

29/05/2014 she had a Transeva treatment where off hind iliopsoas and lumber was quite sensitive, took lengthy RX to release. The near hind iliopsoas and superficial glute had incorrect movement, did release with time. She walked out better after treatment.

03/06/2014 off hind iliopsoas spasm took time to work through and get a release. Topline warmed well and near hind iliopsoas better contractibility, not so crunchy.



Gee Gee first arrived at BSET Academy in 2012

Conclusion

When looking at my three case studies involving partial subluxation I saw a pattern in the restricted and sensitive side of the hind quarter. I am not 100% sure that this will be the same for every horse as there are always exceptions to the rule. I feel that a horse's muscle on the higher side of the subluxation will be more restricted and sensitive, this makes sense to me because when the pelvis shifts to one side and the muscles have to change. The muscles on the high side will stretch and become longer to accommodate the shift, this will strain the muscle and create sensitivity and possibly lesions in the muscle. On the dropping side the movement and elasticity will be incorrect as the tension of the muscle will be looser.

Subluxation is not a major issue in the equine world as many horses have them and perform just as well as a horse that does not have one. In the racing world we see subluxations as young as 3 years old, Jet Bella has a partial subluxation to the near hind and she won her race at Gold Cup in 2014.

Horses are amazing animals as they can adapt to change and compensate where needed to ensure they are working as well as they can. Most people will not even realize that their horse is compensating and when seeing a partial subluxation will not think my horse could be in pain from the partial subluxation even though it happened years ago. I feel that it is important to treat and look after issues like skeleton changes in the body as this does not only affect the bones but muscles, tendons and joints as well.

Bibliography

http://en.wikivet.net/Hindlimb_-_Anatomy_%26_Physiology

en.wikivet.net/Rump_Muscles_-_Horse_Anatomy

<http://extension.uga.edu/publications/detail.cfm?number=B1400>

<http://www.equisearch.com/article/the-anatomy-of-dressage-horse-hindquarters>

<http://www.distanceriding.org/php/articles/health/Function.pdf>

Book: Rear End Conformation an Analysis by Liz Graves©2001

Book: The horse in motion by Sarah Pilliner

Book: Horse Conformation by Juliet Hedge

Book: How your horse moves by Gillian Higgins

<http://www.equestrianlife.com.au/horsecare/Understanding-the-sacroiliac-joint>

<http://www.thehorse.com/articles/23088/sacroiliac-joint-motion-and-pelvic-deformation-aaep-2008>

http://www.markjohnstonracing.com/mjr-pdf/vets/2013_02_If%20only%20they%20could%20talk%20-%20Fia%20Brink%20on%20pelvic%20fractures.pdf