



Classical Horse Training

Combining art with science to achieve balance and harmony



ENGAGING THE THORACIC SLING

'Perfect practise for soundness of the horse'

MANUAL

Foreword

This document is the result of many years of research and personal experience world wide. I sincerely hope that it will be useful to your personal learning experience and contribute to your personal training and development. This document goes together with the video assigned to you in the Online Support Program. Make sure to first watch the video and use the manual as an additional learning tool. I wish you a lot of fun and lightbulb moments diving into these materials.

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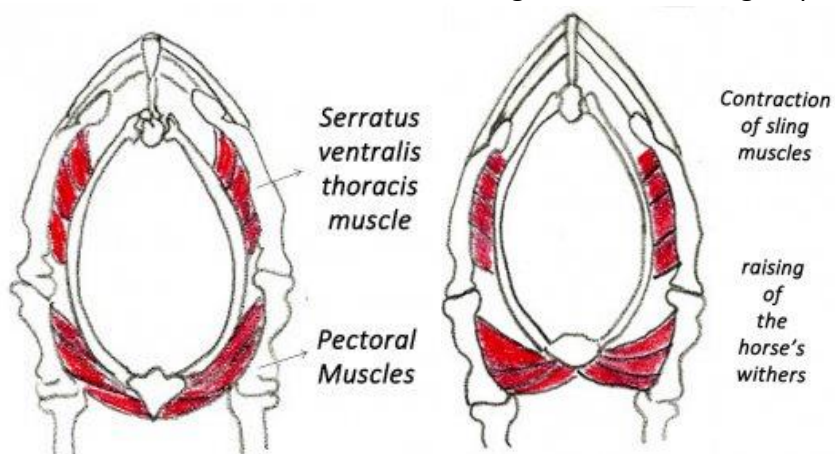
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INTRODUCTION

The thoracic sling of the horse is located between its front limbs and trunk. Unlike humans, horses don't have a collarbone. Therefore, they rely upon strong muscles which connect the inside of the shoulderblades to the ribcage. These muscle groups are called thoracic sling as



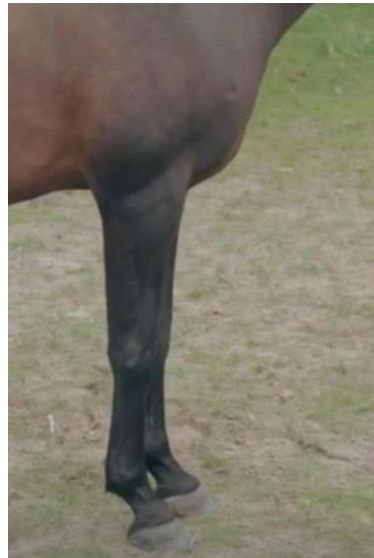
they act like 'slings' and suspend the chest between the horse's front limbs.

The thoracic sling muscles primarily consists of the Serratus Ventralis Thoracis and is

furthermore assisted by the pectoral muscles.

Picture adapted from Clayton et. al 2015.

The thoracic sling muscles of a horse are extremely important for self-carriage as a contraction of these muscles lift the trunk and withers between the shoulder blades. When a horse moves without proper contraction of its sling muscles, the horse's movement looks downhill and on the forehand.



The toning of the thoracic sling muscles increases with a trainer who balances the shoulders throughout training while also balancing with half-halts. This engagement of the thoracic sling – if done correctly – allows the muscles to become stronger and more elastic. Most importantly, they aid in the horse learning to hold its own frame.

Left: thoracic sling not engaged. Right thoracic sling engaged.

Learning how to engage your horse's thoracic sling is thus key in alleviating any blockages in the body as well as supporting the base of the neck and opening up space for the hind limbs so that the horse can develop carrying power.

STRAIGHTNESS

It is a common belief that crookedness of the horse comes from its back or hind legs. However, in most horses asymmetry in the development or use of the sling muscles plays an important part in crookedness.

There are two dimensions that need to be addressed when working on the thoracic sling:

1. Vertical balance → unilateral contraction
2. Horizontal balance → bilateral contraction

The vertical balance described the left- right division of weight on the horse's front limbs. In many horses, the thoracic sling muscles are asymmetrical on the left and right sides and plays a significant role in its crookedness. This is usually most visible in turns where the horse will tend to fall in or out. The natural tendency of the horse is to collapse the weight on the insider shoulder and push of that limb. The results into vertical imbalance. To achieve balance, we have help horses by learning them how to use the outside forelimb to support and lift the inner forelimb when turning. This process takes time as it requires a lot of coordination and goes against the horse's natural tendency to fall in.

It is therefore the task of the trainer to develop the thoracic sling muscles more symmetrically by addressing the vertical balance. This is done through stimulating the unilateral contraction of the thoracic sling muscles to stabilize the ribcage between the scapulae when one front limb is in the air. An exercise on how to exactly perform this exercise I refer to the videos and manuals concerning vertical balance as topic.

The horizontal balance describes the weight division between the horse's front- and hindlimbs. The average horse carries 58 percent of its weight on its front limbs and only 42 percent on its hind limbs. This way, the heavy chest is not out of the way for the hind limbs to step under and the horse will suffer all consequences thereof. We must therefore evolve to become better trainers and learn to horse how to push upwards with its front limbs so that the horse will always carry at least a 50-50% ratio of total weight on both front and hind limbs. A bilateral contraction of the sling muscles is needed to raise the withers and base of the neck and lower the croup. This improves the horizontal balance of the horse.

The exercise in this particular video refers mostly to bilateral contraction of the thoracic sling muscles, holding the ribcage centrally between the fore limbs, contributing to good posture and allowing the horse to elevate the withers. However, horses also need to be able to use these muscles unilaterally to raise and stabilize the rib cage when one of the front limbs is lifted as this develops the strength required to create straightness.

It is important to realize that when working on the thoracic sling the old credo of 'practise make perfect' is outdated. Instead, we should always strive to apply the more advanced concept of perfect practise as without it, the exercise will have no benefit and could even do harm when executed poorly.

HISTORY

In the classical works we don't find any specific references of the term thoracic sling. A simple explanation is that science greatly evolved. Therefore, the old masters simply didn't have the means to investigate the horse 'inside-out' to such an extent as we can today.

Furthermore, true classical training is not about repeating the old masters and holding unto tradition, but to further it through the light of new knowledge that modern day science is able to provide. The words of **Colonel Danloux** (1931) *“Respect for tradition should not prevent the love of progress.”*

A true classical trainer thus learns how the body of the horse works and questions old theories in light of new knowledge so that one can evolve for the horse's sake.



Evolving as trainers is necessary as due to human breeding manipulation, the horse has also evolved. Today, our modern day (sport) horse differs greatly from the horses described by the classical masters. Therefore, adaptation is absolutely key to success.

However, does this mean that the classical masters were completely unaware about the importance of an elevated chest? Of

course not. They were all very much aware of the danger of overloading the front limbs and the importance of true collection.

Professor Jaime Celestino da Costa in the perfect balance necessary to piaffe. Look at that perfect engagement of the thoracic sling.

La Guérinière already wrote: *“It must be noted that a horse, when moving, is naturally inclined to use the force of his loins, haunches, and hocks to thrust his entire body forward; and since his shoulders and forearms are being used to support this action, the horse is, out of necessity, on his shoulders and, consequently, heavy in the hand. In order to place a horse on his haunches and cure him of the fault of being on his shoulders, horsemen have found a cure in the lessons of the halt, the half-halt, and the rein back.”*

A bit later on in history, **Steinbrecht** confirmed these findings by writing: *“As noted before, the hindquarters are stronger by nature than the forehand, not only simply because they*

have stronger bones, joints, and muscles, but also indirectly because their joints, like compression springs, are able to bend under a heavy load. The forelegs do not have this property and must therefore be carefully protected against any sudden, heavy stresses as they occur in poorly performed turns and halts. It is therefore the desire of all riders who espouse a balanced carriage whether they actually understand it or not to bring their horses onto their haunches and relieve them in front. How ignorantly this is generally done and how frequently the work is completely contrary to the nature of the horse is evident from the many broken-down creatures that are victims of dressage training.”

He then continues to say that the *“hind legs can be made flexible only by stressing them, there is no other way for the rider. To bend them more, he must load them more, and the weight requires for this purpose can only come from the forehand. By temporarily directing the weights of the forehand toward the rear, that is, closer to the center of gravity of the horse, so he is able to act in a downward pressing lever-like manner on the dorsal and lumbar vertebrae and transfer this action to the hind legs if he brings them sufficiently forward (...) I have had horses whose front legs were completely worn out, but whom nature had endowed with strong hindquarters, and I have given them such complete freedom in the shoulder and such reliable gaits by bending their haunches that they could compete with the best and most valuable of their species. Under former riders, their strong hindquarters had merely helped to push all of the weight toward the forehand with great force, with such overloading ruining the forelegs in a short time. By taking the load from the forehand, these horses gradually regained their natural elasticity and agility. The higher elevation of the neck also gave them increased action from the shoulders.”*

So there is plenty indication in classical text that the old masters were very aware of the importance of the horse's front end. However, the way to alleviate the front limbs greatly differs. **Guérinière** used the halt, half-halts and rein back combined with lateral work and collection. **Nuno Oliveira** also is a big fan of correct halts stating that the transition from *“trot to the halt and halt to trot is one of the keystones of good dressage, and makes the horse properly collected.”* He often used the transitions from school trot to halt for correcting a faulty piaffe in which the horse places his front limbs too far under him – and thus lacking proper engagement of the thoracic sling.

The controversial French riding master **François Baucher** and his followers used a set of flexions to alleviate and supple the forehand. He also is responsible for developing the ‘Lifting of the Hand’ designed to ride the horse onto the bit or into elevation. Any lifting of the hand always has the effect that the bit pressure moves away from the tongue onto the corners of the lip. In an equestrian world that unambiguously cherishes the deep hand position for a long time, it is understandable that the picture of a rider raising his hands causes confusion right up to rejection as it contradicts with one's own equestrian principles. The lifting of both hands causes the horse to lift up its thoracic sling, support

and round the base of the neck and seek a forward-downwards contact – telescoping ability after which the hands are immediately lowered again with the horse.

So in summary, even though our understanding of the thoracic sling is different, the principle of elevating the horse's forehead so that the front limbs can correctly produce vertical impulse has always had great priority without those seeking true balance and lightness.

THE CONCEPT OF ENGAGEMENT

The title of the accompanying video is called 'engaging the thoracic sling'. Engaging is an abstract concept on which I will elaborate a bit more in this section.

Many would probably consider engagement to be an event that involves people to express their intent to get married. Although I love my horses, I have no intention to marry them (sorry, I have bad humor).

Actually, the word engagement has many other definitions. Rather than being a noun, we should consider it as a verb when working with horses. The word stems from the French verb *engager* which originally meant to 'to pawn or to pledge something' and later 'pledge oneself (to do something)'. The modern definition of the French *engager* is as following: *'Adjective; (of a writer or artist) committed to a particular aim or cause'*.

Looking at dictionaries, the modern definitions of the derived English word engage are, amongst others: *'To participate or become involved in'....'To establish a meaningful contact or connection with'*.

In horse training, this concept refers to both establishing and participating in a meaningful relationship. Horseriding is often referred to as an art and therefore, as an artist, you need to be committed to the relationship with your horse. It is also something you need to initiate as you make the decision to want to train your horse and therefore they don't owe you anything. Being a social animal, the horse is very open to engage if you initiate a healthy relationship of care, love, trust, mutual respect, foreseeing in basic needs, having fun at great times and upholding your horse in hard times. This is the ultimate foundation upon which everything builds. No training can be effective without having established a proper relationship first.

Furthermore, the concept of engagement also refers to connecting your horse with its own body as well as aligning your body to that of your horse. To engage the thoracic sling of your horse is a means to connect your horse in and with its body and mind. It will give the horse a

certain awareness of his own body and posture as well as that of yourself. You will not succeed in engaging the thoracic sling of your horse when hang in your own shoulder blades.

In biomechanical terms, engagement means alignment and proper functioning of the horse's body within its capabilities and limitations. For example, the phrase 'engage the horse's back' refers to allow the horse to optimally use the mechanism of the vertebral column in such a way that it enables the horse to carry our rider weight with most efficiency and at the same to protect the vertebral column from any damage. The concept of engagement thus requires a deeper understanding of the underlying mechanisms. It is therefore that understanding Anatomy & Biomechanics is key to any kind of training.

It is important to understand that engagement of the body is not something we can create. It just requires our commitment to allow the horse to experience this. It is our job to set the conditions optimally so that we're allowing the horse to explore and find its own optimal body balance and posture. This in turn will also enhance your relationship to a deeper level.

In summary, the concept of engagement refers to our commitment to establish a meaningful relationship with our horse and to connect both the horse and ourselves in and with our bodies and minds. Proper engagement enables the horse to move freely and beautifully within its capabilities by allowing most efficient use of its biomechanical mechanisms. This will result in deepening of the relationship as well as increasing healthy performance and ensuring the optimal well-being of the domesticated horse.

IT'S ALL ABOUT...THE FRONT LIMBS

I said it. I can hear your confusion from here: shouldn't it be hind limbs? Isn't that what we've all been taught? Sure is. No matter what discipline, the basis of all equine performance is the engagement of the hindlegs. Therefore, the point is not to question the need for hindlimb engagement, but instead to underline the fact that *"a fabulous hind leg is no good without an equally fabulous front limb (Clayton, 2014)."*

The limbs of any species are made up of a series of rigid bones which articulate at the moveable joints. The length of these bones combined with the angles of the joints determine the limb's ability to support weight and/or provide propulsion.

A strong, straight and vertical skeletal structure is an excellent design for weight bearing, but not so good for athletic purposes. Think for example about heavy species such as an elephant. As their legs are quite upright they act like supporting pillars, but are therefore not capable to create a moment of suspension and jump. This is why a small moat will contain

them at a zoo.

On the other hand, lighter species such as a cat tend to have limbs with highly angled bones and compressed joints. This design allows for a great deal of athleticism and flexibility in which the limbs act as a propulsive lever, but is less suited to bear weight.

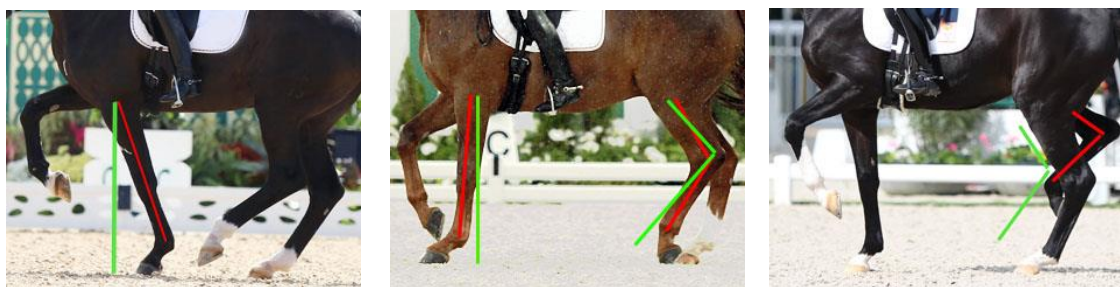
The anatomy of the horse combines these two extremes: more straight legs in the front and more angled legs in the hind. During walk, the horse's limbs mainly act as levers pushing its body forward. At the trot, they act as strings. The canter combines both aspects:

"In inverted pendulum gaits like walk, the limbs act as rigid struts over which the body vaults. In the bouncing gaits like trot, the limbs act as a spring and the body center of mass moves like a bouncing ball. Equine gallop might have both a bouncing and pendulum aspect" (Liduin et al. 2004).

However, very often we can observe abnormalities in which the front leg also act as struts during trot, which it is not designed to do so. Let's get some visuals in.

On the first picture on the left the stance of the right front leg is too far back, meaning the body is vaulting over it. The picture in the middle displays a horse with the left front limb too far in front in a bracing position. The final right picture displays a vertical placement of the left front limb, but hindlegs trailing behind. These abnormalities often lead to (future) injuries and show ignorance in understanding the biomechanics of the horse.

In many training principles it is believed that the horse engages its hind limbs under its body propelling itself upward and forward. However, in reality, most of the upward (vertical) propelling forces are produced by the front limbs: *"In horses, and most other mammalian quadrupeds, 57% of the vertical impulse is applied through the thoracic limbs, and only 43% through the hind limbs"* (Merkens et al, 1993).



Measurements on limb bearing are done through the concept of Ground Reaction Force (GRF) as being the force which actually makes the horse move. When the horse's hoof makes contact on the ground, the limb automatically pushes against the ground. The GRF is the reaction of the ground pushing back to the hoof. The relative sizes and directions of the ground reaction forces affect the horse's balance. Because the front limbs bear more weight, the GRF is always higher on them. By changing the angle of the GRL, the horse controls his

speed and direction. To better understand the relationship between GRF and the roles of the limbs we can use the example of a jumping horse. At take-off, the hind limb forces cause the horse to rotate forward. At landing, the front limb forces cause the horse to rotate backward allowing the horse to shift back towards their center of mass and land on the hind limbs.

This clearly shows that the horse's body movement is a set of opposing forces. The hind limb propels the horse forward while the front limbs counteracts that force from pushing the horse to fall forward by creating vertical forces to maintain an uphill balance. So the push from the hind legs has to be supported by the upward push of the front legs.

However, as explained in the video, the heavy chest has to be up and out of the way for the hind legs to push. As there is no bony connection between the front limbs and the chest, engaging the Thoracic Sling is key to ensure proper locomotion as only then the hind legs can function as they should.

PREPARATION

Engagement of the thoracic sling is one of the first keys to straightness, self-carriage and lightness and therefore, does not require any prior preparation apart from basic horsemanship and a good relationship with your horse.

However, if the horse keeps leaning too much to one shoulder you might consider to start working on the vertical balance exercise first before asking a bilateral contraction.

Furthermore, if halting proves to be too difficult for the horse then try to ask from motion first after a couple of squares of focusing on vertical balance.

STEP-BY-STEP PROCESS

The basic aids include inner intention, body posture, voice, rein and whip aids.

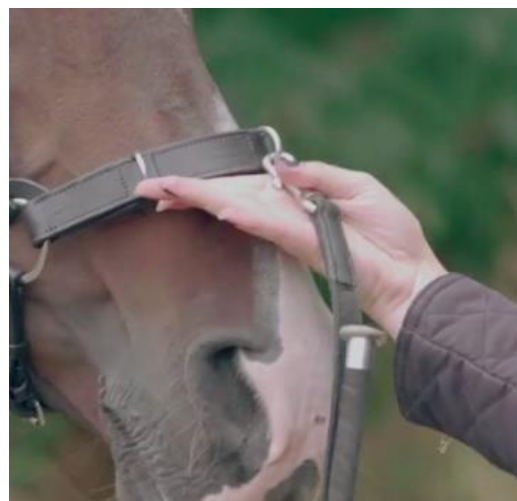
GROUNDWORK – ONE REIN (CAVESSON)

1. Preferably halt your horse after some movement first facing the horse backwards. If the horse is too fidgety in the halt you can try the exercise in movement instead before doing it in halt.
2. Check the position of your horse's limbs:

- If they are in a bracing forwards please take a couple of steps=
- If they are too far backwards that is alright
- If the hind limbs are resting take a couple of forward steps

You don't need to square up the limbs as rather than mechanically targeting the limbs the squaring up should be the natural outcome of the exercise.

3. Make sure the spine is aligned without any bending and that the horse keeps his head/neck relaxed in neutral carriage without any tension in the jaw.
4. In the beginning keep your hand close to the cavesson noseband without holding it or having fingers below it. I usually use a flat hand placing the base of my index finger just below the nose band. Imagine connecting yourself to a dance partner in which you connect your hands in a firm yet soft way.



5. From there, Have a strong inner picture of what you're about to ask and position your body in the proper coordination suited for the exercise:
 - Straighten your shoulders and belly button upwards.
 - Position your legs correctly. In the beginning, one leg forward and one leg backwards usually helps best to travel energy through the body.

When asking the lift, lean a bit more towards the ball of your feet while staying stabilized in your pelvis and aligned in your spine. So keep your pelvis balanced as otherwise the horse will push against you. When asking the horse to shift the weight forward lean a bit more toward the heel of your feet.

6. Start dancing. Really think about initiating a dance in which your lead your partner for the first step of the dance and to connect it to your body and mind. When you move

your body, automatically there will be some pressure on the cavesson, but not because your intention is to give a mechanical aid only – a half halt as such – but simply because it is the result of your body moving.

7. You can use an assisting whip aid to enlarge your energy bubble a bit more if needed. Starting with a pointing energy after which you can slightly tap on the sling muscles if needed.
8. Gradually increase the distance on the cavesson rein to see increase the connection when possible.



9. Enjoy the process and do not tire the horse. This is not something you should endlessly repeat but just apply every now and then to check connection, throughness and balance.

WORK IN HAND – TWO REIN (CAVESSON OR BRIDLE)

1. Position your horse the same way as explained in the groundwork section. However, instead of facing the horse standing backwards, you are now positioned next to your horse's shoulder facing forward.
2. Double check that you are holding the reins slightly above the bit or cavesson noseband to avoid any downwards pressure and create a drawrein effect.
3. From there, Have a strong inner picture of what you're about to ask and position your body in the proper coordination suited for the exercise:
 - Straighten your shoulders and belly button upwards.

- Position your limbs balanced. You don't have to place them apart as in the groundwork but make sure to be properly grounded.

Opposite to the groundwork, when asking the lift, lean a bit more towards the heel of your feet while staying stabilized in your pelvis and aligned in your spine. So keep your pelvis balanced as otherwise the horse will push against you. When asking the horse to move forward just take a balanced step forward connecting all the surface of your foot to the ground.

4. Start dancing. Because you have two reins and facing forward, you will end up with a lifting half halt instead. Make sure it is lifting as this resembles the pressure and direction introduced in the groundwork. Never apply the aid backwards or downwards.
5. You can use an assisting whip aid to enlarge your energy bubble a bit more if needed. To do this in work in hand, it is easiest to take the reins in one hand instead and point the whip towards the horse's haunches or tail.
6. Enjoy the process and do not tire the horse. This is not something you should endlessly repeat but just apply every now and then to check connection, throughness and balance. I mainly use it when I feel the horse pushing too much against the bit or rushing through the chest.

RIDING – TWO REINS (CAVESSON OR BRIDLE)

1. Apply the same body coordination in your upper body: belly button up and shoulders straight. Make sure to stay vertically balanced over your seatbones.
2. Use the same technique on the reins – a lifting half halt – as described in the work in hand.
3. Use the **Baucher** principle of '*hands without leg, leg without hands*'. You can tuck under your own pelvis a bit more but make sure to not 'drive' the horse towards your hands. In the words of **La Guérinière**: *If a horse leans too heavily on the hand the half-halts must be more frequent and only indicated by the bridle hand without any aid from the inner thigh or the legs; rather it is necessary to loosen the thighs or else he would throw himself on the forehand to an even greater degree.*

4. Only when the horse starts moving backwards you could assist with a little bit of heel to restore.
5. You can assist with a whip aid directed towards the tail or croup if needed. To do so correctly, it would again be best to take the reins in one hand.
6. If the horse follows the aid, to not drive its weight forward, but instead initiate movement from this engaged position with the lower leg so that the horse is more able to start movement from the hind limbs instead of 'throwing' itself on the chest in the transitions. You can quickly repeat the process if this happens.
7. Enjoy the process and do not tire the horse. This is not something you should endlessly repeat but just apply every now and then to check connection, throughness and balance. I mainly use it when I feel the horse pushing too much against the bit or rushing through the chest.

CHALLENGES & TROUBLESHOOTING

1. Lifting of the head

The objective is not to engage the thoracic sling and not to lift the horse's head as this is counterproductive to the essence. If this happens, release your aid immediately and go into forward movement before returning to the exercise. Double check the way you apply aids – less pressure and more release – and use less mechanical aids and more energetical ones.



2. Bracing the jaw

If the jaw is bracing you will have to work on this first prior to returning your focus on the thoracic sling. Ask for a couple of lateral flexions after which you do a bit of movement and try again. Furthermore, check your pressure. If you work too mechanically, the horse will brace.

3. Head too low

If the head is too low – that means ears at least a hand below the withers – the horse won't be able to engage its thoracic sling due to the extra weight of the head/neck. So in this case you can gently lift up the head to a neutral and horizontal head carriage with ears at least at the same height as withers and then retry the exercise.

4. The horse is resting on a limb

If the horse is resting you can not perform the exercise. Either ask the horse backwards or forward and try again.



5. The horse moves backwards instead

This can happen as the aids are new to the horse and thus it is guessing what your mean. If the horse moves backwards make sure to not hold on to your aids as it might cause a pull on the horse's nose. Instead, add forward energy with your whip aid so that the horse keeps thinking upwards instead of backwards. With time and with the right timing of your rewards the horse will understand the intentions soon enough.

6. Tilting/twisting

This usually is the result of tension and spinal misalignment. Never try to mechanically resolves to problem. You can check whether the nose is in front of the sternum and restore if not. If it is, sometimes it helps to work on opening of the jaw and vertical balance first before returning to this exercise.

7. Moving backwards

In the beginning some horses will start to move backwards. It is natural that they offer this response when the exercise is new to them. It can also happen when you use pressure for too long. If this happens, don't pull forward on the cavesson noseband, but instead immediatly release the aid. You can assist with a slight forward driving whip aid around the inside girth area or inside hind limb if needed.

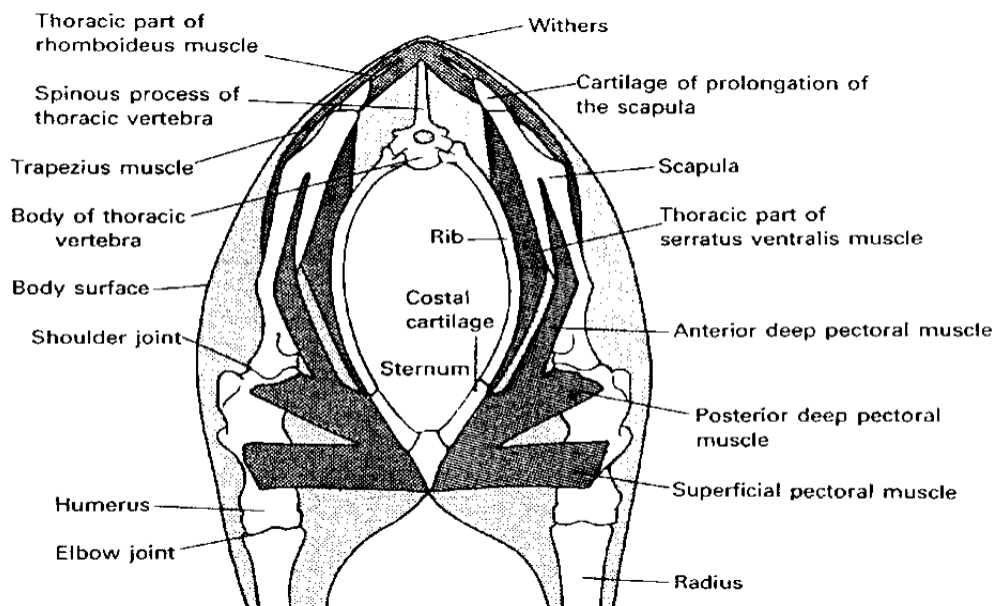
8. Fatigue

This is not an exercise you should repeat over and over. Instead, if the horse engages the thoracic sling then from there you should go into movement and only repeat every now and then when losing the proper contraction. So don't tire the horse too much and enjoy the process 😊.

RELEVANT STRUCTURES

The relevant structures can be divided between direct and indirect. Direct are those considered part of the thoracic sling. Indirect are those that are connected to it. For any type of performance, it is key to understand these structures and their basic functioning. Ignorance of leads to complications in this area. So do your horse a favor and get to it 😊

DIRECT STRUCTURES - THORACIC SLING MUSCLES



The thoracic sling mainly consists of the Serratus Ventralis Thoracicus and is furthermore assisted by the pectorals. Together, these muscles act like 'slings' responsible for suspension between the chest and front limbs as well as lifting its thorax.

The pectorals is a group of four muscles which are divided into two superficial ones and two deeper ones. In different anatomy books they might be referred to with different names. The description below will offer you some guidance on the functioning and location of these important muscles. Furthermore, additional descriptions are listed.

For more explanation of attachments and certain anatomy terms, please refer to the basic anatomy & biomechanics manual.

SERRATUS VENTRALIS THORACIS

Function(s): The *Serratus Ventralis* has both a cervical (SVC) and thoracic part (SVT).

Together, the SVC and SVT provide an elastic support suspending the trunk towards the scapula. If both parts contract on one side only, the weight is shifted to the limb on the side the muscle is acting. When both parts contract together on both sides it raises the scapula resulting in a 'lifted' effect of the thorax and whither. It can also be recruited for forced inspiration.

Origin(s): The *lateral surfaces of ribs 1-8/9*.

Insertion(s): Underneath the scapula at the triangular area on the costal medial surface.

Innervation: 5th till 8th cervical nerves and long thoracic nerve.

Notes: On a living horse, there is only a small part where this muscle can be palpated under the skin. This muscle is intimately connected to the *external oblique* and can be sensitive in some 'girthy' horses. Due to its attachment on the ribs and connection to the *external oblique* this muscle is also important for breathing. The thorax has a direct influence on the heart and lungs of the horse. Especially when ridden, squeezing with the legs can literally 'squeeze' out the breath of the horse by limiting proper functioning of the *Serratus Ventralis Thoracis*. Furthermore, the muscle can be affected by poor saddlefitting. Needless to say, this muscle is extremely important for developing proper overall posture and producing sound movement in the shoulder and front legs.

SUPERFICIAL PECTORAL

Function(s): Adducting and advancing the front leg

Origin(s): Cranial part of the sternum → *manubrium*

Insertion(s): *Humerus* → deltoid tuberosity and the crest
Fascia of the forearm

Innervation: Musculocutaneous

Notes: This muscle is often also referred to as the *Ascending Pectoral* or in my own terms – *the horse's boobies*. As the name suggests, this muscle is superficial and therefore easy to palpate directly under the skin. This muscle is intimately linked to *Omo brachial fascia* and the *Brachiocephalic* muscle inserting unto the *Humerus*. Due to its location, the superficial pectorals are prone to injury such as a kick, running into a fence or knocking over a jump. Any injury will have an effect on the range of motion of the superficial pectoral. When horses lack a proper contraction of this muscle the motion will look downhill will most

weight on the forehead with the sternum pushed forwards and therefore no proper engagement of the hindlegs and back is possible. Very often, the horse is forced to compensate with muscles located in the neck.

TRANSVERSE PECTORAL

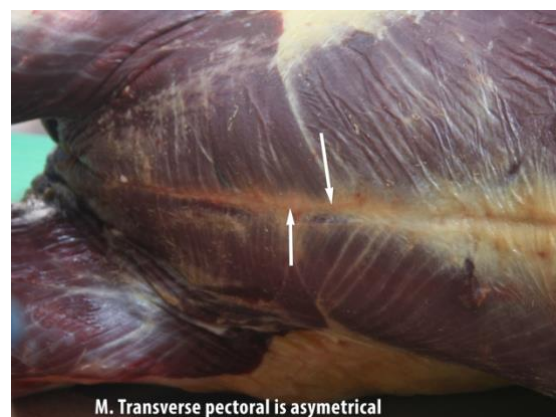
Function(s): Adducting the front leg

Origin(s): Front half of the *sternum* from *ribs 1-6*

Insertion(s): *Humerus* → medial part
Fascia of the forearm

Innervation: Median and Brachial

Notes: This muscle is also superficial and therefore also relatively easy to palpate directly under the skin. Although it lies ahead of the girth, the caudal aspect of this muscle is often influenced by it and should always be checked for injury in girthy horses. Any poor girth fitting influences the range of motion of this muscle. Upon palpation, be careful as some horses might display defensive behavior when this muscle is compromised.



CRANIAL DEEP PECTORAL

Function(s): Adducting the frontleg and drawing it backwards to the body. It also brings the torso forward when the limb is fixed.

Origin(s): *Sternum* and the *cartilages of ribs 1-4*

Insertion(s): *Supraspinatus aponeurosis* and *scapular fascia*.

Innervation: Brachial

Notes: This muscle is sometimes also referred to as '*Subclavius*'. As the name suggests, this is a deep muscle and therefore you can't palpate it directly. It can vary in size in individual

horses. This muscle is hugely effective for extended movement of the front leg. It lies ahead of the girth but any poor girth fitting might impact its range of motion.

POSTERIOR PECTORAL

Function(s): Adducting the frontleg and drawing it backwards to the body. It also brings the torso forward when the limb is fixed.

Origin(s): *Sternum → up till the caudal end*
Xiphoid cartilage
Costal cartilages of ribs 4-9
Abdominal muscles → outside

Insertion(s): *Humerus → lesser tubercle*
Coracobrachialis tendon

Innervation: Brachial, pectoral and musculocutaneous

Notes: Its insertion is significantly smaller than its origin. This muscle is the biggest pectoral in the group and sometimes also referred to as the *descending, ascending or caudal deep pectoral*. As the function is identical to that of the *cranial deep pectoral*, this muscle is also very effective for extension. Due to its location, this is the only pectoral which will always be directly impacted by the girth (no matter whether it lies more forwards or backwards) and therefore should always be considered for girth fitting, especially in girthy horses. A poor fitted girth will decrease bloodflow and might cause damage, pain and injury affecting locomotion of the horse. This muscle can also be traumatised in front from injuries such as kicks and running into fence posts.

INDIRECT STRUCTURES

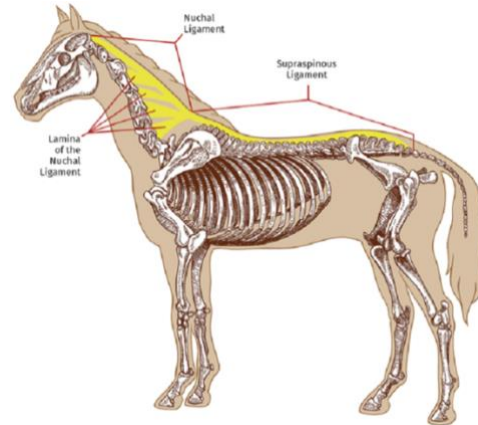
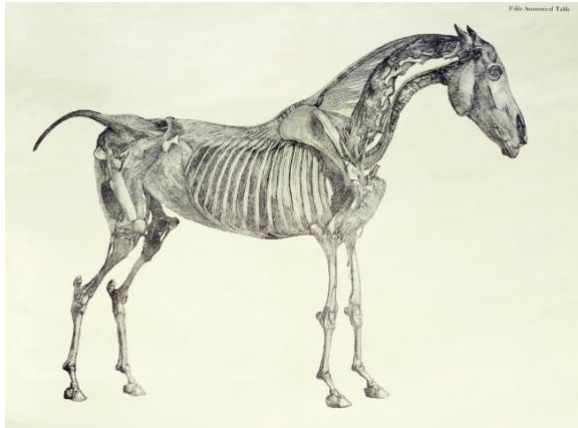
This part describes muscles that are not directly part of the thoracic sling, but have an indirect effect to its functioning due to interconnection.

NUCHAL LIGAMENT

Function(s): Supporting and stabilizing the cervical vertebrae. It counteracts the force of gravity, enabling horses to graze and lower their necks without falling apart. The nuchal ligament lessens the work of the upper neck muscles by up to 55% at the walk and between 32 and 36% at the trot and canter.

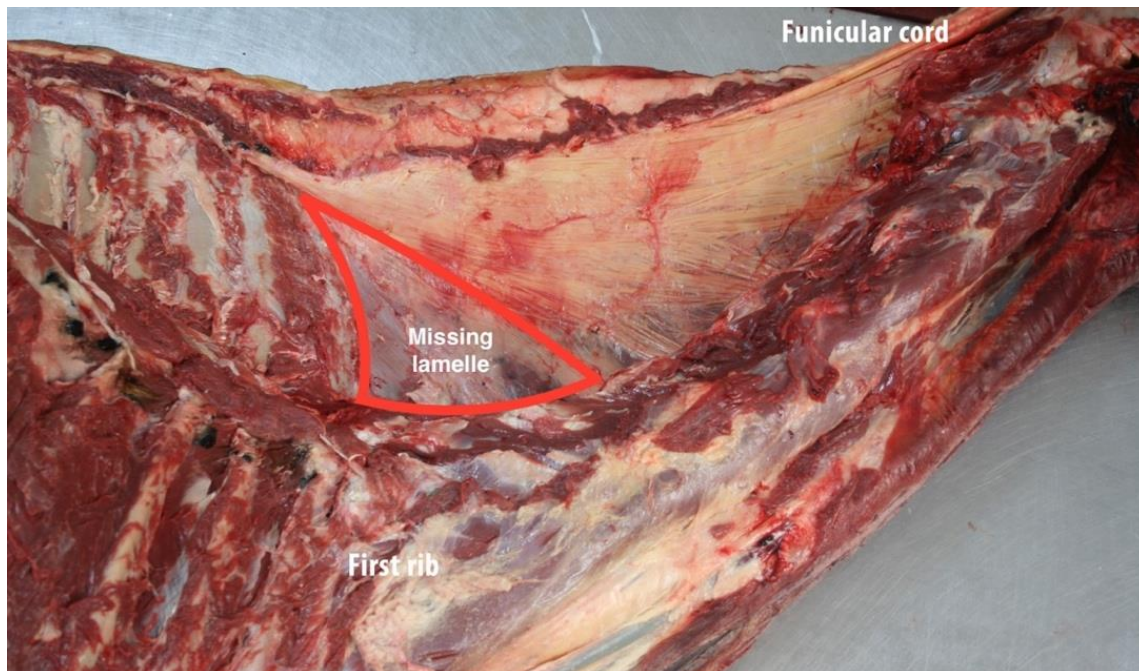
Attachment(s): The funicular cord attaches to the occipital crest and extends to the highest spines of the thoracic vertebrae (T1-T3). The lamellar part forms a sheet that supposedly attaches from the funicular cord to the cervical vertebrae from C2-C7.

Notes: Whereas most ligaments are highly inelastic, the Nuchal Ligament proves to be exception the rule being the largest ligament in the horse's body with greatest flexibility. Unfortunately, renowned pathologist Sharon May-Davis found some implications.



George Stubbs, 1777, showed the NLL attaching from C2 to C7. Modern day textbook showing NLL from C2-C7

Contrary to literature that depicts the lamelle present from C2-C7, her dissection research found the lamelle absent on C6-C7 in domesticated horses. Interestingly, more primitive breeds such as the donkey, zebra, prezswalski, konik and bosnian mountain horse still showed the lamelle present from C2-C7.



Dissection picture of the NLL-present from C2-C5 only. Note how the structure already gets weaker at C4.

The absence of the lamelle on C6-C7 in domesticates impacts our understanding of the postural and locomotive properties of the equine neck and cervicothoracic junction. It is also therefore key to review existing training methods and how they might influence the balance of our horses in a negative way.

To compensate of the lack of support, the cybernetic muscles of Longus Colli and Scalenus can be recruited to some extent to help support the base of the neck. These muscles get activated during browsing as well as through contraction of the thoracic sling area.

BRACHIOCEPHALICUS

Function(s): Laterally flexing the head to the same side of contraction and drawing the limb forward when the head and neck are fixed or extending the head and neck when the limb is fixed.

Origin(s): Cleidomastoidius: *mastoid process and nuchal crest of the skull.*
Cleidobrachialis: *wing of C1 and transverse processes of C2-C4/C5.*

Insertion(s): *Deltoid → tuberosity*
Humerus → crest

Innervation: Assecory, cervical and axillary.

Notes: The Brachiocephalic actually consists of two components, namely *Cleidomastoidius* and *Cleidobrachialis* with the latter sometimes also referred to as *Omotransversarius*. It is a superficial muscle found each side on the neck and can therefore be quite easily palpated. This muscle is under a great amount of strain in horses asked in hyperflexed or overbended positions. Also, as it swings the leg forward, movement gets restricted when reins are held too strongly or with uneven pressure (tilting). Horses with restrictions in the Brachiocephalic often display strain at the poll, struggle with circles and might have problems on picking up front lead on the affected side.

Of particular note is the *Cutaneus Coli* that adheres to the lateral and ventral surface of the Brachiocephalic muscle via the *Superficial fascia* midway along the neck and originates of the *Manubrium*. Aside from its relationship and action with the Brachiocephalic, it can show significant strain in horses that jump or work down hills, as it seems to potentially act as part of the *Thoracic Sling* upon landing. A horse may show pain upon palpation where it adheres to the Brachiocephalic muscle.

EXTERNAL OBLIQUE

Function(s): Unilateral contraction: laterally flexing the trunk to the same side of muscle contraction. Bilateral contraction: flexing and arching the back as well as compressing the abdomen in which it becomes an active agent in expiration, defecation, urination and parturition.

Origin(s): Ribs 4- last → lateral surfaces
Thoracolumbar fascia → caudally

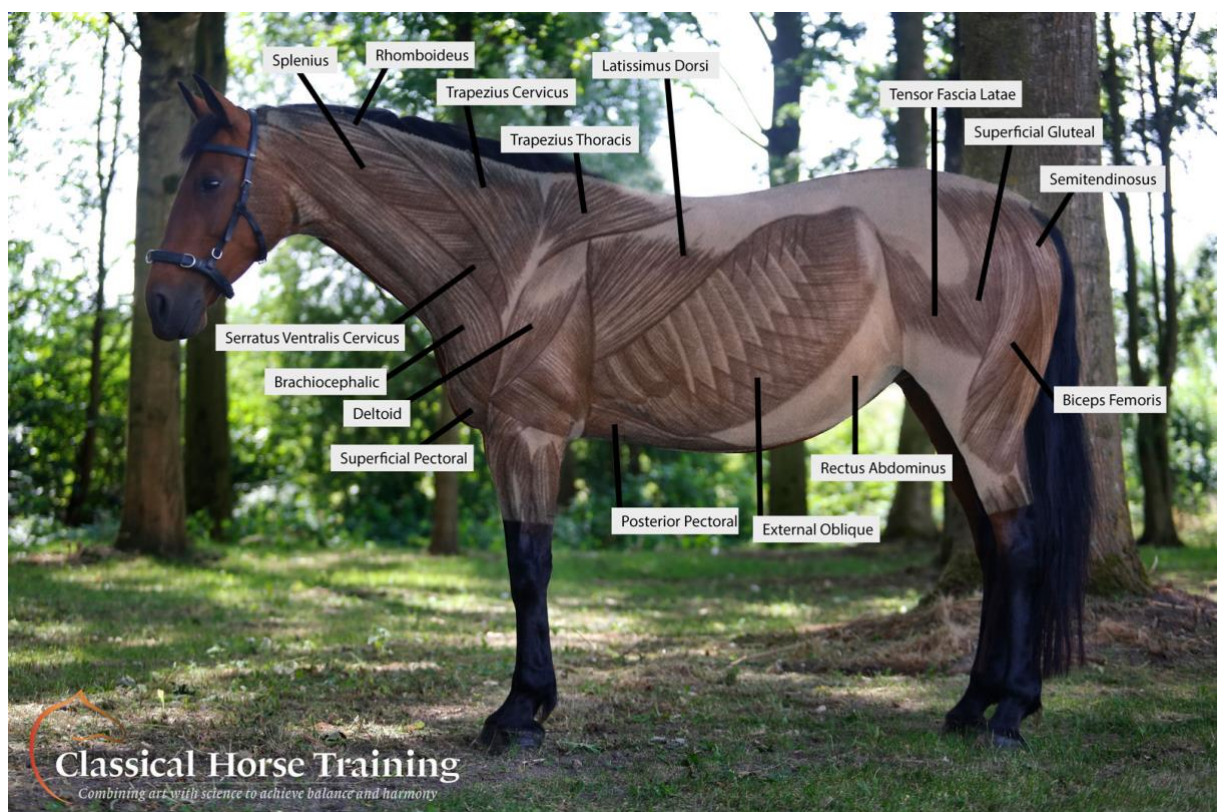
Insertion(s): *The linea alba, prepubic tendon, pubis of the hip, tuber coxae, ilium and the medial femoral fascia.*

Innervation: Intercostal, Costoabdominal and Lumbar.

Notes: The external oblique is part of four abdominal muscles. It is a superficial muscle and can therefore be quite easily palpated directly under the skin. This muscle is linked to the Rectus Abdominis and Internal oblique as well as the Serratus Ventralis Thoracis. It can become quite compromised due to excessive spur use. As it compresses the abdomen, it is extremely important that this muscle contracts in relaxation. Too much leg aid can strain this muscle and therefore 'squeeze' the abdomen. Furthermore, because this muscle laterally flexes the trunk, lateral exercises such as shoulder-in, travers and half-pass, when executed

Correctly, are very important to strengthen this muscle (polework strengthens the other obliques).

On a final note, it is important to realize that a well developed equine core doesn't show muscle linings. Very often, a muscle lining of the Cutaneus Trunci is mistaken for developed of the abdominals which is not the case. A strong core shows in a strong underline and a proper back engagement of the horse.



RHOMBOIDEUS

Function(s): Lifting the scapula and drawing it forward. Also aiding in the telescoping ability of the neck when limb is fixed

Origin(s): Cervical part → Funicular cord of the *Nuchal Ligament*.

Thoracic part → Spinous processes of C7-T2.

Insertion(s): Cartilage of scapula – medial aspect - dorsal to the *Serratus Ventralis*.

Innervation: C6/C7 and thoracic → dorsal branches

Notes: It has a cervical and thoracic part and is linked to the *Serratus Ventralis* muscle. *This muscle gets heavily compromised when the horse is asked in a hyperflexed position.* This muscle often hypertrophies when there are problems in the hind end such as lameness as the head acts a counterlever in movement.



Left: a lame horse showing contraction of the rhomboid in movement.



Right: Severe hypertrophy of the rhomboid

TRAPEZIUS

Function(s): Raising the shoulder and aiding in the telescoping ability of the neck.

Origin(s): Cervical part → *Nuchal Ligament*.

Thoracic part → *Supraspinous Ligament from T3-T10*.

Insertion(s): Spine of *Scapula*.

Innervation: Assecory and thoracic nerve → dorsal branches

Notes: It has a cervical and thoracic part and it can vary in size from horse to horse. The cervical part of this muscle often hypertrophies when there is an issue in the front limb from the knee below. Poor saddlefitting usually results in atrophy of the thoracic part of the Trapezius.



Hypertrophy Rhomboid & Hypertrophy Trapezius Cervicus



Atrophy trapezius thoracicus

LONGUS COLLI

Function(s): Flexing the neck; Fixating, rotating and stabilizing the cervical vertebrae

Origin(s): Ventral transverse processes of C2-C7 and vertebral bodies of T1-T5/6.

Insertion(s): Ventral tubercle of C1; Vertebral bodies C2-C5; Transverse processes of C6-C7.

Innervation: 3rd cervical nerve and spinal nerves → dorsal branches

Notes: This muscle is highly innovative and has postural value as it can be recruited to some extent (training wise or in passive physio such as browsing) to support the lower cervical vertebrae from below which is needed for horses lacking the lamelle on C6-C7. It has also has proprioceptive value as it attaches to C6. However, horses with a congenital malformation on C6/C7 lack an insertion point for this muscle. Especially a unilateral malformation causes great asymmetry.

SCALENUS

Function(s): Unilateral contraction → Flexing the neck laterally

Bilateral contraction → Flexing the neck ventrally

Origin(s): Cranial and lateral border of the sternum rib

Insertion(s): Ventral part → *Transverse processes of C4-C6*

Dorsal part → *Transverse process of C7*

Innervation: Cervical nerves → ventral branches

Notes: This cybernetic muscle has great postural value as it becomes heavily loaded in self-carriage. It can also be recruited to some extent to support the lower cervical vertebrae from below which is needed for horses lacking the lamelle on C6-C7. Together with the *Longus Colli*, it assists in raising the base of the neck giving leverage to the *Rhomboideus* and *Trapezius* to telescope.

GRAZING VS BROWSING

Below you can find some examples of domesticated (performance) horses that were gradually introduced to a 80-20% ratio of grazing – browsing. For the purpose of this article I decided to use the same horses as I did for my basic videos as it will give you a better understanding of the processes involved in their rehabilitation.

ARMANDO

Armando is a KWPN - Dutch Warmblood - bred for dressage. He was performing at high level when he developed a tongue problem. He came into my rehabilitation program in September 2015. I had him diagnosed with unilateral C6/C7 malformation as well as scartissue in the superficial pectorals, blood in the white line of the front feet, thrush in all feet, elbow arthritis, hip, hock and stifle issues. His thoracic trapezius was extremely atrophied, probably due to poor saddle fitting.



On the left you can see the Armando in his preferred grazing position. The right front leg is pushed forwards in the bracing position and the left frontleg backwards. The sternum and superficial pectoral



are pushed forwards. You can see the strain on his entire shoulder area. Looking at his hind end, he stands quite wide with his left toe pointed outside, rotating his hip, hock and stifle. His right hind leg is very straight through the hocks.

On the right picture, you can see Armando in his browsing position. He is standing more square, supporting his shoulders and contracting the sternum upright. His hindlegs are not standing as wide anymore with his toes pointed more forwards.

On the left picture below you can see him eating downhill to challenge him further. Notice his straightness. On the final right picture below you can see that even when eating from a

low position, his balance has immensely changed. Note how his hindlegs with his hindlegs even more supporting its mass.

To achieve these results he had access to some trees in the field/arena and I put up one haynet a day for about five days a week in his stable. Furthermore, I often took him to a spot with a slight ramp so I could feed him up/down the hill.



SHA-RÉ

Sha-Ré is an Arab mare bred for endurance. From a young age, she developed some problems such as a headshaking syndrome and unidentified lameness. On top of that, she suffered from a severe fracture in her right mandibula. She was considered quite 'dangerous' as she could take off without



warning and as if suddenly became 'black before her eyes'.

On the left picture you can see Sha-Ré in her preferred grazing position. Although there is a dark shade, you can still see the bony landmarks and the muscle asymmetry on her shoulder as well as her overdeveloped hamstrings. She is severely leaning over.

On the right picture you can see how this also affected her locomotion. She is terrible on the

forehand. Her front legs are blocking any forward engagement of her hindlegs and the hip, hock and stifle in her right leg are clearly rotating. You can also see the dropped fetlocks. Being so much on the forehand, she had no choice but to speed up to prevent herself from falling.

As Sha-Ré suffered from problems in her lumbo-sacral and SI region, it was important to not start too high. Therefore, I started with walking and eating in a high grass area as well as high water as illustrated below.



From there, I gradually increased the height with hanging up haynets. Below you can see how her posture improved as well. Even in her stable she is standing more square with better posture. On the final picture, you can see improvement in her locomotion in trot which is a sum of many passive and active exercises combined, but browsing proved to be a key component.



ACALIENA

Acaliena is my own mare. She was a rescue horse with an unknown pedigree. I expected she is a crossbreed between dutch warmblood and some cold blood in there. She came into my life when I had poorer knowledge. So when I bought her, I didn't have the knowledge I know have and therefore her issues had manifested in her body for years before I started to

recognize them and therefore she was, and still is, the hardest case of rehabilitation I have ever dealt with as she was my 'experimental' horse and I basically started 'too late'. However, she is that 'once-in-a-lifetime' horse as she put me on this path. Acaliena suffered multiple fractures in her left hind leg as well as severe damage in her hip joint. She has weak stifles and her spine had dislocated due to a gelding jumping on her. She also had severe high heel low heel syndrome.



On the left you can see Acaliena in her preferred grazing position. She was very strong in preference which contributed to high heel low heel syndrome and always had a slight bend in her neck and head to the right causing great asymmetry and tilting movements in training to the left.

Therefore, I started with playing food stations that challenged her to keep her head more upright and to take a left bend as well. For example, I put some carrots to the left side of the stable door as well as taking a lot of walks into lower bushes. From there, I started feeding a haynet a day up high as well as offering her trees to eat from. Below you can see how the high grass affected her locomotion. Look at the beautiful arching of her neck.



The high grass also promotes a better functioning of the joints. For example, she started to lift more through her front knees, elbow and shoulder. She really moved for a couple of steps, took a bit of a snack and then moved further along.

As a result, her low-heel high heel have straightened much more. Her trimmer was surprised that even at a later age her feet started to

normalize more. Of course it will never completely straighten, but change was very obvious. In general, I actually observe her preferring the browsing. Another important aspect of improvement is her mental state. She seems much more calm and rather than spooking to everything unknown she is in more 'exploring' state. Her brain is definitely much more challenged in a positive way since I introduced browsing.

So in conclusion, variation is the key and it is a simple thing to do. Passive exercises such as browsing and 'snack-step' process will give more leverage to the active exercise to engage the thoracic sling. It is all these small little extra things that can make the difference in terms of rehabilitation and longlasting postural changes. Simple yet effective, giving the horse the best chance of a long and happy life!



THE END😊