



# CAN EQUINE HOOF GROWTH BE INFLUENCED BY THORACIC SLING MANIPULATION?

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The thoracic sling in horses is made up of several proximally located muscles which suspend the forelimb. When there is a significant dysfunction of the thoracic sling, it is common to see the affected limb grow an unbalanced hoof. The cause of this can be in part the uneven stress loads put on the hoof. When one side of the sling is restricted more than the other side, there is often the shortening of one limb compared to the other. The forces put on the hoof of the “high” side are very different than that of the ones on the “low” side. It is the farrier’s responsibility to manage this uneven growth. The topic of this paper is to propose the question; can the osteopath make changes in the function of the thoracic sling and influence the growth of the equine hoof? The changes that osteopathy can make will be felt throughout the entire body. By balancing the thoracic sling, the function and performance of the entire body will be influenced. If the front end is operating optimally, then the rest of the body is more efficient and effective. The skeleton and muscles are not the only systems affected. With this type of dysfunction, there is a major toll on the central/peripheral nervous systems and the function of the related organs. If in fact this is possible, the number of positive changes that can be made will increase exponentially.

The equine hoof growth is directly influenced by the stress put on it. Just like bone, the hoof is always managing itself and laying more cellular products in the areas of greater loads. (Gregory page 65) This ability is a key element to the hoofs ability to handle extreme loads during dynamic movement. Horses are one of the only animals that must transfer all their body weight horizontally from the distal phalanx to the ground through the hoof wall. Their bony column does not directly contact the ground. Because of this, horses must manage their hoof growth constantly. When there is a thoracic sling dysfunction, the resulting hoof growth needs to be managed by the farrier to maintain some type of normalcy. In some cases, the horse will grow entirely too much heel. This will change the balance of load on the ligaments of the distal limb. With this balance shift there can be a break down in one of these ligaments. (Gregory page 144) It is the responsibility of the farrier to keep the hoof balance within an optimal area.

As we monitor the loads on the structures of the limb, we begin to see that with every action there is an equal and opposite reaction. This is very important to keep in mind because the goal is to distribute these loads so that the integrity of all the structures remains in good condition. Each ligament in the limb has an antagonist that keeps it in balance. Often, we see the antagonist break down if one ligament is unloaded to a certain degree. This is important to the overall dynamic movement of the horse throughout its lifetime. Some of the more common areas of dysfunction are medial lateral balance and hoof angle. Both can grow out of normal parameters quickly if the load on the hoof is out of balance. The further one of these gets out of balance, the faster it spirals out of control. If the medial heel gets higher than the lateral, it causes an even greater number of imbalances load the further it gets from ideal. This can adversely affect the collateral ligaments of the distal interphalangeal joint. Likewise, if the hoof angle starts to leave the ideal, the stress on the suspensory and superficial digital flexor tendon or conversely the deep digital flexor tendon will increase. This may result in a tear of one of these tendons.

The resulting issue that can occur from this imbalance has a direct influence on the integrity of the thoracic sling during locomotion. The thorax, neck and head are all subject to uneven forces as the hoof imbalance deviates further from the ideal. If the load on the deep digital flexor tendon increases, it can cause the shoulder angle to increase. (Broadhurst page 117) This dysfunction will act in a positive feedback loop. Which means, the further from ideal we get, the worse the dysfunction becomes. The result being the hoof growth then starts to get even further from normal. If this issue is in the thoracic limbs of the horse, the compensatory result will have a negative effect on the pelvic limbs. The horse is

now forced to use their body in abnormal ways to remain able to move. The complexity of this compensation is enormous. It can be observed all throughout the body and in unique areas. With every area of dysfunction on one side there will be a resulting compensation of the opposite side. Also, it is often noticed that each front limb issue will result in an opposite hind limb compensation.

I had the opportunity to do some osteopathy work on one of my shoeing client's horses. This horse named Shine, is a 12-year-old Grande Missouri Fox Trotter. He has been plagued with some chronic body issues. According to his owner, Shine has dealt with both front and hind end problems. In the middle of November 2021, Shine had his hocks injected in as attempt to relieve some hind limb stiffness. At this time the veterinarian also injected his distal interphalangeal joint. This horse has a steep hoof and shoulder angle. The conformation of his hind limbs also leads to very little stifle extension. His neck comes out high from his torso and is relatively short. Shine has a long back in relation to the rest of his body. When looking at his conformation, it is easy to see the propensity to have some structural break downs with much work. Grande Missouri Fox Trotters in general, are known for being hardy little horses. However, they are also known for being rough riding horses that can be hard to keep sound. As with most breeds, there can be large variances depending on the blood lines. This horse had a left hind limb injury at some point in his past. This injury healed and the horse resumed his work. As a result of this injury, he had to compensate in certain areas as it healed. This compensation can cause significant problems in other areas of the body. In this case the diagonal from left hind to right front was severely compromised. The right front limb changed drastically for the worse over time. Shine was no longer able to fully extend in the latter part of the stride phase. This short striding motion has repercussions of its own over time. The ligaments and tendons of the limb start to shorten and lose elasticity. The deltoids, trapezius, and other muscles of the shoulder start to atrophy as they are no longer engaging and being used the way they are supposed to be. The further the thoracic sling gets out of balance, the larger the negative ramifications.

The treatment for Shine, was over a period of eighteen weeks. We saw him every six weeks for three visits. The first visit was very interesting and productive. We trimmed the horse and then worked on the rest of his body. We found numerous restrictions in this thoracic sling and head and neck. A large amount of which were relating to thoracic vertebra number four through ten. These restrictions caused decrease mobility in his shoulders. This decreased mobility was not symmetrical but was far worse on the right side. The neck and head were involved as well. His brachiocephalicus and omohyoideus muscles had shortened and were also limiting movement. These factors caused an uneven pull on the hyoid apparatus which continued up to the atlantooccipital joint. This pull then follows back down to the dorsal processes on thoracic vertebra four through ten. (Pattillo page 207) Thus, completing a circle of the dysfunction. It appears to be common to see some movement and asymmetry regarding the sternum when there is a significant thoracic sling dysfunction. The sternum will end up being pulled medially or laterally and dorsally. This has been a good indicator of thoracic sling dysfunction. We have found checking the position and feeling of the sternum early in the exam gives us valuable information regarding the thoracic sling health.

We used an indirect technique and OAB that allowed a very specific anatomy-based approach to treat the restrictions. These restrictions affect the horse in a layered type of configuration. The restrictions that are the most influential need to be addressed first. The compensatory or secondary restrictions will present themselves and can be worked on after the first have been cleared. This detailed approach makes the treatment very efficient and productive. We also used some OAB and other common techniques to treat the thoracic sling and spine. As we cleared some of the issues in the withers and shoulders, we could then work on the lumbar area. One theory on this situation is that the thoracic dysfunction puts the spine in a torque which is transferred down the vertebra and shows itself as a problem at the vertebra that are

held stable by the pelvis. It is customary to see lumbar problems along with thoracic sling issues. (Masterson page 63) In this case and many others, we see the dysfunction work in a diagonal on the limbs. Shine had most trouble with his right front and left hind limbs. Which also affects the organs in a diagonal pattern. You will see very different organ issues if it's the right limb affected compared to the left. This is because the limited range of motion and the fascia in that limb cause the organs in that area to suffer. However, in some cases the cause and effect are reversed. Meaning it is the organ restriction that is the primary cause, and the limb is a resulting consequence. This is important to the practitioner because he or she must address them in a different order depending on what is primary. It does not seem to be standard practice to think of organ dysfunctions contributing to locomotory issues in equine medicine. This is a mistake because it is very rare that any type of dysfunction does not in some way involve an organ. Thinking about the different systems independently is causing us to miss the big picture and allowing the organs to be overlooked. This is a major reason why symptoms often return after treatment. We are not getting to the root of the problem.

If the dysfunction lasts long enough there is usually an organ component. In this case the pleura of the lungs was compromised. It seems that the visceral pleura of the lungs is usually the first to be affected. The problems do not end with the pleura. It eventually influences to central nervous system at the thoracic vertebral level of four through ten. This can spread the effects up or down the spinal cord. As certain tracts of the spinal cord are influenced, others are compromised and the consequences can be all over the body. Depending on which vertebral segment is restricted will determine which organs, muscles, or areas of the body that are compromised. This is an extremely complex and delicate system and the ramifications can be enormous. Usually, these types of dysfunctions will eventually have some type of effect on the hypothalamus, pituitary, and adrenal axis. (Anatomy and Physiology Bit by Bit) Once things have escalated to this level the whole body is affected. There are no anatomical parts or physiological systems that are safe once it reaches the brain. When the problems have lasted this long and gone this far it is nearly impossible for the animal to return to completely normal function on its own. However, it seems that the majority of the time that the body is able to continue to function at some level. It is amazing how the body can cope with all kinds of issues and continue to keep the necessary systems operational.

It seems that the organ component of these dysfunctions is usually an extremely important part of the equation. If we do not address this part of the problem, then the animal has a very difficult time with complete healing. We often see practitioners neglect working on the organ portion and the animal regresses after the treatment. This shows us that the function of the organs rates very high on the importance scale compared to other systems. There is another very important piece to the puzzle and that is the balance between the sympathetic and parasympathetic nervous systems. This aspect cannot be taken for granted. As we get this out of balance the dysfunction runs wild through the body. This is probably the area that most dysfunction spreads between systems. In horses and other prey animals, the balance between sympathetic and parasympathetic nervous system is very sensitive. It seems that this balance has a very difficult time repairing itself. When the HPA axis is compromised, the prey animal has a hard time restoring normal hormone production and neurotransmitter function. This system is so fragile that when it is having issues, it can be many different areas that are affected. It can be hormone production, neurotransmitter function, or even neurotransmitter receptors that are restricted. These three things are very different in cause, but the affect can be similar.

The dysfunction in the Hypothalamus, Pituitary, and Adrenal axis is a fascinating system. If all the information is utilized during the exam, we can usually use the process of elimination to figure out which part of the system is not working. The treatment is different depending on what is not functioning. It is imperative to have thorough information from the owner or trainer. This information can really help

narrow down the diagnosis and streamline the treatment. As we see more and more cases, we start to hear key words and phrases. This allows us to understand what questions to ask and what areas to investigate. The adrenal gland is involved with numerous processes in the body. It is customary to think of the adrenal as just the creator of cortisol, epinephrine and norepinephrine. However, it does so much more than that. The outer layer of the adrenal gland regulates mineralocorticoids, the next layer regulates glucocorticoids, the third layer regulates some secondary sex hormones, and the middle core makes the epinephrine and norepinephrine. The HPA axis has widespread consequences on the entire body. It only takes a minor imbalance to cause major problems in multiple systems. With these hormone and systemic imbalances, there is no limit to the areas that can be affected. (Anatomy and Physiology Bit by Bit)

As with bone, the equine hoof grows as a result of the forces applied upon it. The hoof wall is dictated by the forces coming down the bony column and up from the ground reaction forces. If these forces are not balanced or even over the wall there will be more growth in the areas receiving less pressure. This can be evident in medial/lateral or anterior/posterior imbalances. It is very common for horses to grow more hoof on the medial side. This is due to the orientation and movement of the joints above. As these joints go through their range of motion, there is more force coming down the outside of the limb than the inside. The horn on the lateral aspect of the hoof is often distorted and can flare to the outside. It is less common, but some horses have the opposite scenario occur. In this case the medial side of the hoof is crushed, and the lateral grows tall. Horses with long sloping shoulders and pasterns have the tendency to crush their heels. This is a result of having more force coming down onto the heels compared to the toe. Conversely, in club footed cases we see the toe stressed and the heels growing excessively. There is a theory that the toe has limited blood supply and for that reason it tends not to grow. In most cases it is more likely that the horn tubules at the toe are stressed beyond their ability to withstand. Hoof balance is a very complicated and multifaceted. It is up to the farrier to do their best to manage these factors.

One of the other major factors is the range of motion of the thoracic sling above. The movement of the shoulder and the flight path of the front limbs plays a large role in the forces put on the foot. (Clayton page 35) If the shoulder is limited in the forward swing phase, it will cause more pressure to be put on the toe and less on the heel. This is a common reason for excess heel growth. There are lots of reasons why this might happen. Spinal nerves can be involved in the restriction. When the fascia around these nerves is tight it will cause the nerve to become compensated. This will limit the shoulder mobility and cause a shortened stride phase. This shortened stride changes the forces applied to the entire limb. When the forces are altered, the compensatory results are immense. There are major changes in the flexor tendons and the suspensory ligament. The timing of when these tendons are under maximum load during the stride phase is altered and can have a huge effect on the function of these structures. Along with the nerves affecting the thoracic sling, there are other anatomical structures that can disturb the balance of this complex structure. Arteries, veins, and organs all can have a negative effect on the sling if there is significant dysfunction. It is common to see some type of organ component to these problems. Whether this is primary or secondary is very much case specific. Sometimes the organ causes the sling dysfunction and other times the sling dysfunction causes the organ to become adversely affected. Either way, the organ or organs that are involved need to be addressed and released in order to have complete healing. Relieving all the anatomical structures except the organ may allow temporary relief but, the compromised organ will almost always cause the form of dysfunction to return.

Shine's situation was one of these very cases. The dysfunction in his sling caused by the spinal nerves, atlantooccipital joint, foramen magnum, and lung pleura caused thoracic sling dysfunction and unequal forces on the hoof. This, in turn, caused the horn of the hoof wall to be stunted at the toe and grow excessively at the heels. Over time this will cause the limb to become upright or clubby. It has been

my experience as a farrier that it often does not matter what you do to a foot like this. It will usually not respond to hoof care alone. We must address the thoracic sling dysfunction along with good hoof care before the limb can resume normal function and the hoof can return to normal angles. This realization has completely changed the way I look at, and address, unwanted hoof growth. A low heel/long toe type conformation can be improved with the same type of thoracic sling manipulation. These pathologies have been so frustrating for the farrier community for a long time. If we combine osteopathy along with solid hoof care practices, we will see many more positive results in these cases. The equine body needs to be treated as a sum of its parts and not just piece by piece.

This course has been a great start for me to work on the whole horse and really understand locomotion and what is going on during movement. I am excited to continue my education and develop my skills. It is fascinating to learn more about anatomy and physiology. I appreciate the opportunity to learn with and under The London College of Animal Osteopathy.

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