

# Intermittent Upward Fixation of Patella in the Horse:

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## Part II: An Equine Case Study

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# Intermittent Upward Fixation of Patella (Locking of the Stifle Joint) in the Horse: A Case Study.

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### *History:*

Patient was a 14 year old gelded male horse used primarily for pleasure riding. The owner's **chief complaint** was a three year history of progressive periodic episodes of lameness. The owner noted an increase incidence of "clicking" of his stifles and multiple episodes of the horse tripping. She reported that he had had several episodes of the bilateral hind limbs "giving out" and "locking up" causing his hind end to collapse while she was riding him. She had decided not to ride him anymore for his and her safety. She kept him in stall rest to prevent further episodes of his stifles locking up. Two veterinarians had confirmed the horse to have "locking patellae" by observation only. No other diagnostic measures or blood work had been done.

### *Evaluation Findings:*

Upon visual inspection, this horse presented with poor body condition of approximately a 4 out of 6 point condition-scoring, for being 50 pounds over weight on a medium to small frame. When viewed from behind and from the side, there was significant bilateral hollowing in the area of quadriceps femoris, tensor fascia latae, and bicep femoris musculature area indicative of atrophy. Audible clicking was noted of bilateral stifles as the horse shifted weight on to and off of hind legs in preparation of locomotion. A visible "jump" of the patellae was noted bilaterally upon each step the horse took. Quadriceps and bicep femoris muscle fasciculations were noted after this horse was asked to move and then stand still. No stifle intracapsular joint effusions were noted upon manual palpation of both joints, but the horse exhibited pain responses indicating tenderness was present in bilateral stifles upon this palpation. No crepitus was noted upon passive movement of patellae or with passive weight shifting of hind end. No other outstanding findings were noted regarding the musculoskeletal system or confirmation faults other than a lax abdominal musculature and weakened topline (epaxial muscles of back and neck) and general under development, common to the out-of-work condition.

### *Diagnosis:*

Chronic intermittent upward fixation of patella bilaterally (*with report of occasional upward fixation of patella*)

### *Problems:*

1. Atrophy of hind end musculature
2. Pathomechanics of stifle
3. Pain
4. Dysfunctional mobility of locomotion for pleasure riding use
5. Risk of articular cartilage damage to stifle
6. Decreased proprioception possible cause for "stumbling"
7. Generalized decondition of topline muscles and abdominals.
8. Excess body weight.
9. Lack of owner education of stifle pathomechanics and dysfunction

10. Increase expense to maintain horse when not doing his job as a pleasure riding horse

*Treatment Objectives:*

1. Strengthen hind end musculature surrounding the stifle to optimize patella mechanics.
2. Increase overall conditioning of hind end, abdominals and topline: muscle strength, motor control flexibility, proprioception, and coordination for synergistic muscle use for safe locomotion and riding.
3. Decrease joint pathomechanics to prevent cartilage wear of joint surfaces.
4. Educate the owner re: IUFP pathology and treatment approaches.
5. Decrease pain

*Measurable Goal:*

Reduce number of audible and palpable “clicks” from 12 out of 15 upon attempted weight shift movements to 2 “clicks” out of 15 with in 4-8 week period.

## Treatment Methods and Rational

*Increase Activity Level:*

Avoid stall rest. This horse needed more continual movement for contraction of the muscles surrounding the stifle joints. Encouraging the horse to walk around the pasture promotes hip and stifle musculature to utilize all of the following contractions types; isometric holding, isotonic contracting and relaxing, and eccentric control into decelerating and lengthening contractions through out the various gaits and transitions. Putting the horse out to pasture with a buddy or with herd will promote constant roaming in a herd-like fashion. Hay should be placed about the paddock in several locations to encourage the horse to move from pile to pile. Slopes and hills are ideal to have in the pasture for encouraging all of the above with the added effect of gravity and deceleration control. If there is fear of injury from other horses that are wearing shoes, a companion pony, Miniature horse, or a goat, can be a fine companion to keep the horse moving about the pasture.

Ideally a paddock and stall combination with direct open-door turnout is best. The horse can come in from elements as needed and return out doors to roam frequently. Constant indoor box stall confinement with little turn out or for riding only is the least ideal situation for horses with IUFP. This inhibits the true nature of the horse from doing what nature intended, which is to roam many miles, while foraging for food. If it is necessary to stall board a horse with stifle problems it is essential to instruct the owner, trainer and barn manager to turn the horse out as much as possible during day or night. Sometimes the horse can be set free in the indoor arena for the evening hours. In the most optimal of situations horses should have an access of at least an acre per horse of varied terrains, providing both grazing and pasture for exercise to mobilize the horses’ muscles and joints on a daily basis.

### *Stretching of tight structures:*

Flexibility of the surrounding hip and stifle is important for maintaining full range of motion, proper skeletal alignment and correct biomechanics. Tight muscles or soft tissue structures can cause pain, weakening of that tissue or contribute to abnormal biomechanics of surrounding joints. Flexibility stretching is the ability of muscle or soft tissues to yield to a stretch force<sup>1</sup>. Sharma et al 2005, indicate stretching has been shown to increase collagen synthesis and improve collagen fiber alignment, resulting in higher tensile strength of tissues<sup>2,3</sup>.

The owner of this horse was already doing some basic hind limb stretching techniques of the basic muscle groups surrounding the hip and stifle joints by passively bringing the limb forward under the horse's belly stretching the posterior hamstring group (semitendinosus and semimembranosus) and gluteals and biceps femoris. Bringing the limb into combined stifle and hock flexion towards the posterior of the horse stretches the tensor fascia latae and the quadriceps femoris, sartorius, and possibly psoas major and minor<sup>4</sup>. Continuation of stretching exercises was encouraged with instruction of additional methods of stretching into abduction and adduction and lengthening the time in which the stretches were held.

There are many texts written about equine stretching with good instruction for stretching of limbs, neck and trunk. The deficit of these instruction manuals is the absence of the proper length of time to hold a muscle in the stretch that is known to provide the desired physiological lengthening of the fascicles. Bandy's acclaimed research suggests that maintaining a passive stretches of 30 seconds is most optimal<sup>5</sup>. This research indicates that change in flexibility appears to be dependant on the duration and frequency of stretching<sup>5</sup>. Therefore the owner was instructed to hold the stretches longer ( she was holding for only 10 seconds) to 30 seconds as tolerated to get muscle relaxation and physiological lengthening, allowed a rest, and then repeated 3 times each stretch. These stretches were repeated daily to all muscle groups as tolerated.

### *Strengthening Exercises:*

The significant atrophy of this horses' bilateral quadriceps and biceps femoris muscles was the probable reason for the faulty biomechanics of the stifle-patellae complex. Therapeutic exercise was the primary treatment of choice to address the disuse atrophy. A regime of motor control relearning and progressive strengthening was initiated soon after evaluation. This began with weight shifting exercises, promoting co-contraction around the stifle and hip musculature facilitated by the manual cueing facilitation techniques commonly known to physical therapists. In-hand work of backing, walking and trotting on (firm to soft) terrains, up and down gentle hills was initiated. This progressed on to more strenuous exercises of long lining, large circle lunging, and round pen work. Degree of difficulty was increased by transition emphasis in and out of walk, trot and canter, and then progressing onto riding under saddle, starting on firm surfaces working towards more unstable surfaces. All of these utilize isotonic control with emphasis on eccentric control via downward transitions. The following techniques are not evidence based, but come from the author's experience as a physical therapist, horse owner, equestrian and certified equine rehabilitation practitioner.

## **A. Multiple angle sub-maximal isometric exercises:**

Weight shifting exercises can elicit isometric and co-contractions of the horses weakened muscles surrounding the stifle joint. This can be done in the following two methods. The horse stands in both squared-up and out of square positions for the multi-angled strengthening to occur.

1. “Tail Pulls” to one side- The tail is an easy object to grasp to impose a weight shifting. ***Caution should always be used in close proximity to the horse’s hind end to avoid being kicked!*** Gently pull the tail to one side. This imposes a weight shift to that side, facilitating contraction of the quads, TFL and bicep femoris muscles for stabilization of the hip and stifle. Hold for 10-20 seconds as tolerated, release, and repeat several repetitions, on each side as tolerated. The horse can be eating a meal or grazing while performing this exercise. If the horse objects to the tail pull, the therapist can utilize manual cueing to shift weight in the direction of the involved limb. The horse can be positioned in the squared-up position of all four legs directly underneath or unsquared with legs placed in a variety of positions to address multi-angled directions of muscle facilitation.

2. To increase the isometric demands of these muscles, one can advance this exercise to have the horse shift it’s weight totally onto the affected limb by picking up the opposite hind leg or the diagonal forelimb. Continue in a variety of leg positions for static holding co-contractions for 10-20 sec as tolerated. Controlled weight shifting perturbations can be alternated, repeating as tolerated.

## **B. Isotonic (dynamic) exercises:**

Isotonic exercise involves the concentric (shortening) and eccentric (lengthening) muscular contractions that result in movement of joint or body part against a constant load<sup>1</sup>. The load (resistance) of isotonic exercise is the constant of gravity pulling on the horse’s body and limbs while in locomotion. Resistance is constantly being applied to muscles as they shorten or lengthen. Resistance can be increased by utilizing hills, water, a rider on the horse’s back, or pulling a cart. Below is an example of a protocol for progressive strengthening a program.

### Ideal Progressive Rehabilitation Protocol for Stifle Weakness

1. Backing in hand: start with short lengths of 10 ft on level ground, for 5 minutes intervals, as tolerated. Daily for 1-2 weeks.
2. Walking up and down hills in hand- start gradually with 5 minute intervals up to 15 minutes daily as tolerated. Day 4 for 2 weeks.
3. Walk trot transitions “in hand” – Day 7 for 2 weeks. Decelerating transitions going from trot to walk requires emphasis on eccentric control of the quadriceps muscles.
4. Lunging activities: week 4 utilizing a long line or a posoa, both with full tack, bit and bridle. This technique encourages abdominal muscle recruitment, lengthening of epaxial (paraspinals) muscles for development of proper self carriage, proper movement patterns and better propulsion from the hind end. Large circles are best to avoid increasing torque

stress on the stifle. Lunging a horse with halter and rope encourages a hollowed shortened back and poor dynamic balance encouraging improper motor control training in less than ideal posturing.

5. Transitions up and down through out the three gaits will encourage the horse to come up under himself and rounding throughout the top line thus encouraging proper use of his hind end into a more flexed position. Downward transitions require eccentric contractions, essential for conditioning of the improved stifle function.

6. Intermittent ground poles can be introduced slowly to increase flexion of the stifle and hock while in motion. This also provides proprioceptive awareness of limb placement, improving coordination of fluid movement patterns and balance reactions.

7. Riding: After an eight week period with emphasis on the above exercise regime, there was noted reduction of IUFP and no signs of lameness, it was appropriate for a trial of the horse's tolerance of rider on the horses back. The horse was able to withstand the weight of a rider and to continue to do conditioning under saddle, of slow progression of W-T-C. Continuation of the above exercises were done under saddle (rider on the horses back): Transitions up and down at all 3 gaits, lateral work, up and down hills, backing up, pole work, slowly progressing towards caveletti work, etc

8. Educate the owner: Education regarding the horse's injury, pathomechanics, pathophysiology and treatment rationale is essential for the owner to understand, accept and participate in the overall rehabilitation process. Many of the above treatment approaches can be explained and taught to the owner for frequent application of treatment when the therapist can not be present. More frequent intervention by the owner benefits the horse's overall condition for a faster optimal recovery.

### Outcome Measures after 8 weeks of intervention:

1. Reduced audible clicking in bilateral pelvic limbs 2 or less times out of 15 steps.
2. Increase in hind end muscle hypertrophy by subjective visual estimate of approximately 50%.
3. Improved flexibility- although goniometric measurements were not taken in this horse, the horse exhibited improved tolerance to stretching program with increased freedom of movement of limbs.
4. Improved condition of horse- horse exhibited increased endurance of exercise program, able to exercise 50-60 minute intervals with out signs of stumbling, lameness or cardiopulmonary distress.
5. Owner felt comfortable and confident riding horse on all terrains, 2-5 times a week, at all gaits without reoccurrence of "giving-way" of stifles.
6. Owner understood pathology and treatment approaches. She followed the prescribed therapeutic exercise regime faithfully to achieve the success this horse experienced during rehabilitation.
7. No pain responses detected upon stifle palpation.

## Results:

This horse experienced a significant reduction of audible “clicking” of the patella after 8 weeks of the above prescribed exercise regime. The horse exhibited no pain response to palpation of stifle joints. He had no lameness. His strength and endurance had improved enough to carry his rider at Walk-Trot-Canter and on trial rides for 50-60 minute jaunts with out evidence of fatigue. The owner was delighted to be riding him again and to feel safe on her mount.

## Further recommendations:

1. Consultation with a vet:
  - a. consider taking radiographs (further diagnostic tests) to rule out degenerative changes or malformations of the stifle joint.
  - b. possible prescription of anti-inflammatory and NSAID for pain control/ reduction while horse is in rehab.
2. If equine aqua therapy facilities were available underwater treadmill and swimming would be ideal for strengthening and overall conditioning of the musculature surrounding the stifle while unweighted to avoid joint trauma.
3. Weight reduction program. Weight stresses all joints.
4. Modality use:
  - a. **Ice** would have been ideal to decrease inflammatory response and pain of the articular cartilage abuse secondary to the repeated fixations. Unfortunately the stifle is a difficult joint to apply ice to in a prolonged 20-30 minute treatment. Could try ice massage directly to the stifle for 5 minutes- ***be wary not to get kicked!***
  - b. **Ultrasound** and or **laser** to decrease pain and increase healing factors.
7. Abdominal and pelvic recruitment exercises: such as rounding response and carrot stretches in to spinal flexion patterns to further engage hind end muscle function into pelvis, back and abdominals.
8. Equine Massage: Often muscle guarding occurs secondary to joint pain and dysfunction. Massage increases blood flow, decreases muscle guarding and promotes relaxation while undergoing rehabilitation.
9. Suggest the use of nutraceutical products, such as glucosimine chondroitin, for the promotion of joint cartilage production and repair.
10. Cart pulling /driving. If a horse is tolerant and trained for driving this can be an appropriate method for strengthening the quadriceps and surrounding synergistic muscles with out increasing vertical compressive stress on joints.

## Prognosis:

The prognosis of IUFP for return to athletic function is very good in horses that respond to rehabilitation exercise. However the problem may return if regular exercise ceases. After rehab intervention, persistent joint problems are very uncommon. In this horse’s scenario there was no crepitis or obvious swelling noted, usually indicative of articular cartilage damage, therefore his prognosis was especially good.

## Discussion:

PTs have much to offer in the realm knowledge, and education, along with expertise practice for the treatments of injury and rehabilitation, promoting the best recovery of animals after catastrophic injuries. Education of the animal's owner is first and foremost significant objective to achieve. This case study scenario presented a common human error to want to stall rest an injured horse in prevention of them hurting themselves further. This is widespread misconception, especially in the realm of IUFP. The owner did not understand that the pathology of this dysfunction was specifically linked to the horse's poor condition of muscle atrophy. Therefore educating the owner about the pathophysiology was important so that she understood that constant movement and progressive exercise was essential for the recovery potential of her horse.

The role of modality use was not heavy in this case scenario. In other traumatic equine conditions modalities can play significant roles in recovery. Modalities of heat and ice are significant for the reduction of pain, swelling and muscle spasm. The role of ultrasounds, laser, electrical stimulation, are well supported by research for the potential to increase healing of all soft and bony tissues. Therapeutic ultrasound, pulsed electromagnetic fields, and low level laser therapy have been shown to increase collagen synthesis in fibroblasts, thereby increasing tensile strength of tissues<sup>2</sup>. Exercise of stretching and strengthening exemplified the significant role in this horse's recovery to wellness. In rat studies conducted by Coutinho et al, '2004, stretching has shown reduction of muscle atrophy and induced hypertrophic effects in control muscle<sup>6,7</sup>. Strengthening supportive muscle will aid in shock absorption and increase in strength and general condition that can minimize fatigue related injuries<sup>10</sup>.

The role of proprioceptive training can not be overlooked when treating the equine. The feed forward and feedback loops of facilitated neuromuscular control apply to this horse's strengthening and motor relearning progression. Deficits in neuromuscular reflex pathways as a result of decreased proprioception have been shown to have a detrimental effect on joints. Proprioceptive rehabilitation to facilitate dynamic joint stabilization is thought to improve the neuromuscular control mechanism<sup>6</sup>. The more the horse was left to stand idle in a stall the more he atrophied and the greater joint dysfunction occurred. Once this horse was in treatment, progress continued on a positive incline towards greater function, allowing this horse to not only carry himself properly without stumbling but providing a safe ride for his owner. The area of proprioceptive neuromuscular facilitation is where PT expertise is compared to no other equine practitioners, as PT's are experts in the study of movement science.

In consideration that some horses are not prescribed the proper rehabilitation treatments to address IUFP, or may not respond favorably, there will be some horses subject to sclerosing injections or surgery of the MPL. With the stifle joint of a horse's hind limb being analogous to the human knee, it can be extrapolated that stifle surgeries may induce "reflex inhibition" of the quadriceps and surrounding muscles. Reflex inhibition of the human quadriceps is known to occur secondary to edema of the knee joint and joint capsule stretch receptor responses, therefore making the muscles unresponsive to the neuromuscular efferent message to "contract", furthering the disuse atrophy. Cutting or fenestration of the medial patellar ligament of the horse of which

sartorius, gracilis and the quadricep muscles tendons attach, would certainly propose the possibility that reflex inhibition may follow and therefore could provide some delay of the horses return to optimal functional outcomes. PT intervention of modalities and motor relearning exercises are ideal for promoting a faster return of functional mobility after surgery of MLD or mild cases of UIFP. It is this author's opinion that if a horse is to be stall rested after medial patellar desmotomy or fenestration, it would benefit from receiving the regiment outlined above, to improve the outcome and prevent reflex inhibition and muscle disuse atrophy commonly associated with post surgical prescribed stall rest.

## Limitations of the Case Study:

The most significant limitation in this study is lack of objective measures. The stifle is a difficult joint to measure circumferentially due to deep landmarks submerged with in heavy surrounding muscles, making it difficult to palpate on the horse. *When working near horses back legs, one should always be careful of their potential to kick!* Therefore muscle atrophy was judged on a subjective visible observation rather than objectively measured circumference that would have been indicative to identify muscle hypertrophy. Another way to have measured this would have been by total circumferential measurement around the horse's entire hind end in the horizontal plane at the level of the stifle joint, coursing the areas of quadriceps and bicep femoris muscles encompassing the entire width of the back end. This would have to be done very specifically to keep measuring consistent. Lack of protruding land marks promotes greater intra/inter-rater error.

Horses are not applicable to perform manual muscle testing on, therefore muscle strength needed to be assessed in terms of functional biomechanical performance (such as how many times the patella fixates with in a set distance of locomotion), muscle bulk and endurance performance. Other areas of objective measures that would have been beneficial would have been to take goniometric measurements of the stifle joint and changes in stride lengths of hind limbs.

Treatment duration consisted for only of an eight week period. The owner was instructed to continue with rehab regime in anticipation of regaining all musculature return with in six months. Optimally it would have been ideal to have continued contact with this horse's progress for a six month period to document if this horse regained all muscle mass with resolution of all UIFP symptoms.

There has not been much in the realm of rehabilitation offering for animals up until the last two decades. Much of what is practiced treatment on animals has not been based on research driven evidence. Equine treatment approaches prior to the recent years has been anecdotal and based on old fashioned "folklore" of unsubstantiated remedies with out any evidence of proof as to how they may work to increase healing. There is a need for more evidence based practice in to the world of animal PT. Therapist need to incorporate the translation of evidence into the clinical practice of animal patient management. Crusading PTs that are practicing on animals need to continue to follow "the human" clinicians in the realm of developing clinical practice guidelines for management of all common animal pathologies to make the profession of PT a substantial contribution to the world of animal health and rehabilitation.

Physical therapy has much to offer the creatures of the animal kingdom. We are only now leaving the infantile stages of this developing field of animal rehabilitation and moving into an age of connecting the research of what we know is healing for humans, onto animals. There have been decades of political and territorial uproar over this movement, but as with all up heavals, views are now changing towards acceptance. Many states are adjusting their practice acts by utilizing non-specific human references (thus allowing all species to be treated), and developing educational requirements and practice regulations. These positive changes in each state's PT practice acts should support PT liability coverage when working on animals. Now is the time to for PTs to pursue research studies to bring the evidence to support the practice: practice evidence based physical therapy on animals to support beliefs that we are providing them the best treatment possible. Animals get hurt and have the potential to heal as well as humans. Why shouldn't we be treating them to promote their optimal recovery free of reoccurrence, chronic pain and disability?

## Conclusion:

Many horses struggle with stifle dysfunction. There is a wide variety of reasons for these problems. The most common of these is muscle weakness due to lack of conditioning and poor conformation. The best approach for addressing this debilitating condition of muscle weakness of the hind leg is to utilize an interdisciplinary team of equine practitioners especially an experienced PT. The PT plays a pivotal role with in this team as a rehabilitation expert, providing the optimal treatment for a horse's recovery from biomechanical stifle dysfunction. The most rewarding aspect of physical therapy is working with patients, humans and animals alike, to help them regain their pre-injury health status and return to function. In the case of the equine this means both the owner and practitioners involved feel confident in the horse's well being, in the absence of signs of distress, pain or dysfunction, allowing the owner confidence to ride/work the horse for pleasure or competition.

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