

## **Moving Toward Healthier Sport Horses: Lessons Learned from Human Athletes**

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Original publication date: 2020

First appearing in: Horse Network <https://horsenetwork.com/2020/05/moving-toward-healthier-sport-horses-lessons-learned-from-human-athletes/>

*In this article, a panel of experts from both human and equestrian sports was convened to provide overview answers to common questions in sport. Here, we also compare and contrast human and equine sports and look toward the future of how horses may be managed and trained.*

For the past several years, the Equine High-Performance Sports Group, led by veterinarians Dr. Mark Revenaugh and Dr. Timothy Ober, has been searching for methods to improve the health and performance of sport horses. Comprised largely of US National Team veterinarians, farriers, and therapists, the group meets once a year to discuss the latest therapeutics, rehabilitation strategies, and sports conditioning practices.

To gain an outside perspective, a handful of experts from human sports science and health are invited to the yearly meeting to share their opinions on advancements that have made human athletes healthier, able to achieve greater feats of athleticism, and have longer careers. Many of the innovations at the forefront of human sports can also be applied to the management and training of horses.

**Dr. Tim Worden** is a sports scientist and member of the Equine High-Performance Sports Group as well as Equine Analytics, with a focus on implementing strategies to enhance performance and reduce injury risk in equestrian sports.

**Dr. Mark Revenaugh** is the owner of Northwest Equine Performance, co-founder of the Equine High-Performance Sports Group, and has previously served as a US Team veterinarian on numerous occasions.

**Nathan Rolfe** is a former NCAA track & field athlete, is involved in the training and management of horses at Our Day Farm, and co-founded the Center for Equine Performance (CEP), a 501c3 organization that applies cutting-edge data analytics to equestrian sport.

**Dr. Jack Ransone** is a university full professor and athletic trainer, has previously served on three US Olympic and numerous world championship staffs, and was medical systems coordinator for the San Antonio Spurs from 2010-2014.

**Kenny Bark** is a farrier with over thirty years experience shoeing jumping and dressage horses, co-founder of Equine Analytics, and is the US Show Jumping Team farrier.

### **Introduction**

Being an athlete is physically and mentally demanding. By definition, sports are competitive and many professional athletes have a strong incentive to find any legitimate advantage they can. In the equestrian world, recent veterinary advances have allowed for faster recovery time after injuries and new methods to suppress inflammation to keep horses “in the game”. However, as we compare

management strategies for professional *human athletes vs equestrian athletes*, there are some striking differences. Additionally, a direct connection exists between training/conditioning and injury prevalence. This article is intended to highlight some of the most salient differences between management strategies to maximize performance and minimize injury with human vs equine athletes. By doing so, the authors hope to expose new opportunities for trainers, riders, and care teams to improve management strategies for their equestrian athletes.

### **Why do injuries occur?**

In both humans and horses, an injury occurs when the force experienced by a structure (e.g. ligament, tendon, muscle, or bone) exceeds what that tissue can withstand. This excessive force causes trauma to the cells, leads to inflammation, and damages the overall structure. Injuries can be broken down into three categories:

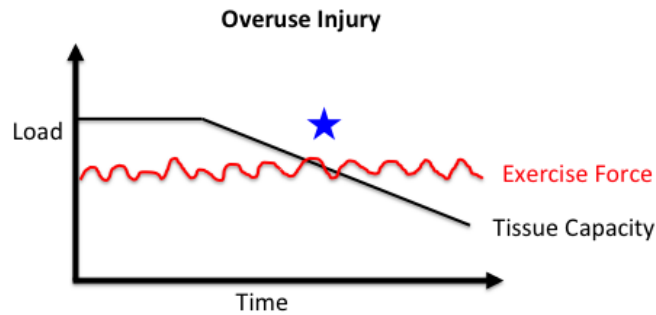
**Acute injuries**, often referred to as *accidents*, result from some unexpected event that cannot be planned for and exposes the body to a massive amount of force. For a human athlete, this would be a situation such as a runner being hit by a car that failed to stop at a crosswalk. No matter how fit and strong the runner is, the impact of a car will cause significant trauma to the body.

For horses, an example of an acute injury could be a horse that is galloping in a field and steps in a hidden groundhog hole. The flexor structures of the leg will be exposed to massive forces and significant damage will result. Fortunately, accidents tend to make up only a small proportion of musculoskeletal injuries that sport horses experience.

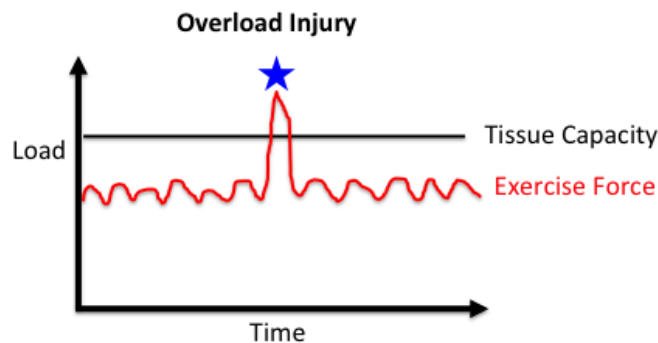
**Overload injuries** are caused by a large force (load) exceeding the capacity of a structure at a specific instant in time. For example, a horse getting into trouble in a combination during a jumping course may experience an injury due to a single forceful action performed while trying to jump out of the combination. Here, the structures in the horse's body are not strong enough to withstand the force, resulting in damage. This is why it is critical that a horse has strong ligaments, tendons, bones and muscle. Stronger structures can withstand greater loads and are, therefore, less likely to experience an injury.

As we train, it is normal for tissues to experience a small amount of damage – this is what actually stimulates the body to adapt to become stronger. In a healthy athlete, the body will repair this damage on its own with adequate recovery time between similar workouts.

**Overuse injuries** arise due to an imbalance between the amount of work done and the amount of recovery allowed (if the tissue does not have the opportunity to regenerate between consecutive workouts it will gradually become weaker). For example, prolonged sub-maximal efforts, such as during a series of consecutive intense flat workouts, could produce an overuse injury. Proper recovery times allow structures to regenerate so that they maintain their strength and do not weaken to the point of injury.



*In an overuse injury, the structure (e.g. ligament, tendon, bone, etc.) is exposed to a constant force during exercise. However, due to overuse of the tissue and not enough recovery time, the structure slowly begins to weaken until it can no longer withstand the exercise force.*



*In an overload injury, the structure (e.g. ligament, tendon, bone, etc.) is exposed to a peak force during exercise that is larger than what the tissue can handle.*

### **Why do some horses become injured while others do not?**

There is a spectrum of musculoskeletal health in a human or equine athlete. On one side of the spectrum, you have athletes that are at little to no risk of injury. Here, the trainers and coaches have done an excellent job of ensuring the athlete is performing movements safely and that the body is conditioned for the work it needs to do. The amount of work being performed is in balance with the amount of recovery the body receives, allowing the individual to grow (i.e. developing strength, endurance, coordination, speed, flexibility) and perform at the desired level.

On the other end of the spectrum, you have a situation where the body is severely damaged and significant time (weeks to months) and rehabilitation will be needed before the athlete is ready to return to their sport. This damage is the result of an imbalance between what the body was capable of doing and what was asked of it. If the body is not fit enough to perform an activity, or if not enough recovery time is given between workouts or competitions, an injury will eventually occur.

As you go from a healthy to injured athlete or horse, there is a typical progression in how a structure (i.e. bone, tendon, muscle, ligament) begins to become damaged and eventually injured. Over weeks to months, a structure will begin to breakdown faster than it recovers, leading to weakening of the tissue and eventual failure. It is very rare that an injury will appear one day without any

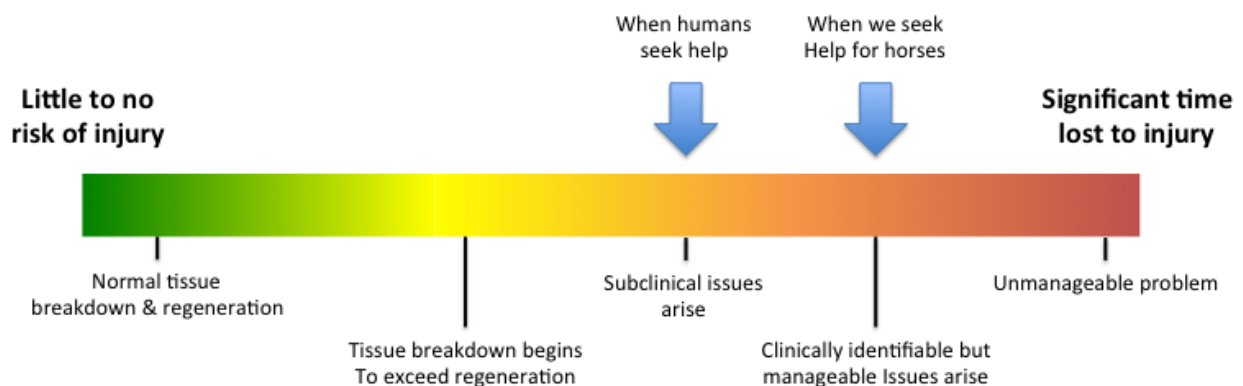
foreshadowing. Instead, there are typically warning signs along the road that leads to a significant injury. These signs can be inflammation, pain, a reluctance to work, behavioral issues, and so on. The injury will first be subclinical in nature before it becomes noticeable and significant.

For human sports, an enormous focus has been placed on injury prevention – training athletes so that work and recovery is kept in equilibrium to avoid degeneration of tissues. Additionally, athletes and coaches are taught how to identify early injury warning signs and will always back off from training and address these issues. If a human athlete has a minor injury or issue, that athlete will not work hard until the issue is resolved. To train in an ‘at-risk’ state is viewed as reckless and likely to injure the athlete – either in the short or long term.

In equestrian sports, we need to find innovative ways to detect issues earlier. Many trainers have an amazing ‘eye’ and can small changes in a horse’s movement (well before a significant lameness is present). It is critical that trainers trust their eye and judgment. They ought to reduce the horse’s workload and seek out an assessment before returning to strenuous work if an issue presents. To keep a horse working through the pain will undoubtedly contribute to increasing tissue damage and eventual injury.

**When should an athlete or horse seek intervention from a therapist or medical professional?**

As mentioned above, in every human sport a major focus has been placed on injury prevention. If you can detect a minor issue before it becomes major, it is much easier to fix the problem and return to training and competition in a timely fashion. Thus, a targeted approach to identifying very subtle changes in an athlete has been adopted. When an issue does arise, the athlete is immediately limited or removed from training and they receive additional massage, recovery time, Epsom salt baths, and so on. By taking this approach, elite human coaches can avoid major injuries and are able to keep their athletes competing throughout the season. It is better to back off for a few days than to try and push an athlete and end up with a significant injury.



*In human athletes, issues tend to be identified and addressed earlier than in sport horses. Early injury identification allows the issue to be addressed when it is still ‘minor’ and the athlete is able to return to training relatively quickly. When identification and treatment of an issue is delayed, it is a lot harder to have an athlete return to training in a safe and timely manner. Instead, invasive, expensive, and time-consuming interventions are needed.*

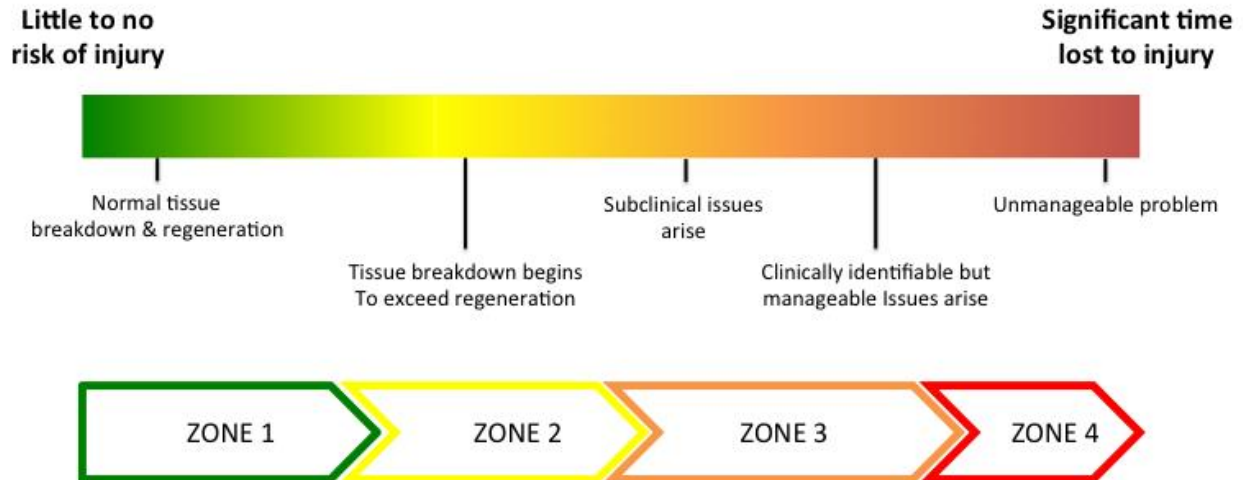
Conversely, in equestrian sports, issues tend to only be addressed when they become a major issue (significant lameness). At this point, the veterinarian, chiropractor, farrier, physiotherapist, etc. are contacted to assess the horse and to fix a major problem. Importantly, these professionals should be brought in earlier – when the problem is still minor – and this would undoubtedly reduce the severity of many issues. Additionally, it would be beneficial to back off training for a few days to see if some additional recovery time will help the horse regenerate. Continuing to train when the horse is not functioning at 100% is playing with fire, and more likely than not the trainer/rider/owner will be burned.

When athletes train at a high level, the body is exposed to stresses that are greater than what an average individual would experience. These stresses are needed to stimulate the body to grow and adapt, so that it can become stronger, faster, more coordinated, and so on. However, if these stresses exceed what the structures (i.e. bone, muscle, tendon, ligament) in the body can handle, injury will result.

Unfortunately, predicting injuries remains challenging and there is no golden method that is perfect. However, there are approaches in human sport that have proven very effective in reducing injuries. These include monitoring the amount of work athletes complete from day-to-day (ensuring the proper amount of recovery is given for the amount of work performed), monitoring fatigue during workouts, using fitness wearable devices to monitor the athlete's state of readiness, monitoring for stressors in the athletes daily life, and staying vigilant for signs of pain or inflammation.

In human sports, it is acknowledged that injuries are either due to bad movement mechanics (the athlete moves in a suboptimal way that exposes the body to large forces – **overload injury**) or poor programming (how training sessions and workouts are planned and executed – **overuse injury**). Therefore, coaches place a large focus on making sure their athletes are always moving in a safe and smooth way. Typically, jerky and strenuous movements with bad posture are more likely to result in an injury; so coaches keep an eye out for this and stop the athlete from exercising if these movements appear. Additionally, coaches pay close attention to the amount of recovery that occurs between workouts to ensure the body is regenerated before exercising again. These concepts can also be applied to horses.

Another way to think about training an athlete or horse is to think about the spectrum of musculoskeletal health. We want to train athletes or horses in Zone 1, where the body is healthy and capable of meeting the demands of the sport. Occasionally it may be required that the athlete or horse trains in Zone 2, where the amount of work done is exceeding how quickly the body can recover. But this should only ever be done for short periods of time (e.g. an Olympics where the horses must complete multiple rounds within a few days) and additional recovery will be needed after this time. Athletes and horses should never train in Zones 3 or 4 – the likelihood of a significant injury is too great.



*Most of the training should be performed in Zone 1. Short amounts of time can be spent in Zone 2, but additional recovery will be needed afterward to help the body recover. Training and competition should not be done in Zones 3 and 4.*

In horses, it is also critical to consider if the body has other risk factors for injury. Poor conformation, nutritional deficits, improper shoeing, stress, obesity, bad footing, ill-fitting equipment, and so on, all increase the risk for injury. So critically evaluate your horse's environment as well as health and look to make any possible changes to remove or attenuate some of these risk factors.

**Is a fitter athlete or horse less likely to be injured?**

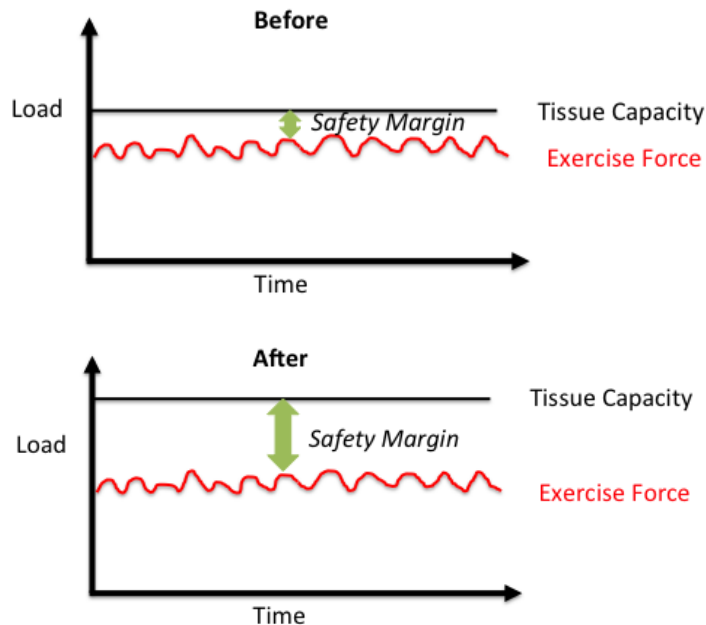
A human athlete that is more fit will be less likely to be injured. If trained correctly, an athlete will have the strength, speed, flexibility, endurance, and coordination to perform whatever activity is asked of them in a safe and effective manner. There is a mountain of evidence suggesting that, like human athletes, horses are also less likely to be injured if they are fit and trained to perform their specific sport.

An athlete's 'fitness' is driven by the body's ability to adapt to the increases in stress placed upon the individual. The purpose of training for a sport is to provide targeted stresses to the body that will stimulate the body to adapt and grow to meet the increasing demands of a sport as the skill level improves (i.e. from novice to expert). This adaptation occurs at the microscopic level, where changes in gene expression, cell signaling, protein function, tissue structure, and so on will influence how the body performs at the macroscopic level. Expert coaches are incredibly valuable because they can provide the correct training stimuli at the proper times to develop an athlete and ensure they have the physical skillset needed to succeed. Conversely, as highlighted above, doing too much work or providing improper training exercises at the wrong time will surely lead to injury. We control the demands placed on the horse, and thus are responsible for how the body is impacted with training.

A fit horse will have a i) stronger musculoskeletal system that can handle the loads placed on the body for a sport, ii) the coordination needed to move the body in an efficient and safe manner, iii) the endurance to produce energy at the level required for the workout or competition, iv) the speed needed to safely execute movements, and v) the flexibility needed to ensure the horse can move its'

body in the correct manner. Like the weakest link in a chain, if a horse has a deficit in any of these abilities, an injury becomes likely.

The graphs below demonstrate how training alters the load capacity of tissue. The stronger a structure becomes through training, the greater the load it can tolerate - resulting in a larger safety margin between what is asked of a tissue and its capacity. If the safety margin is large, a sprain, strain, break or tendinopathy will become less likely.



*Summary*

Injuries are a reality for both human and equestrian sports. To fight this issue, human sports have adopted numerous strategies to minimize the risk of injury – and this has, undeniably, led to healthier athletes, better results, and longer careers. In the future, equestrian sports must follow in the footsteps of human sports and adopt similar methods to improve the health of our equine partners. Everyone in the equestrian community wants happy and healthy horses, and by making changes to how horses are trained and managed, we will achieve this goal.