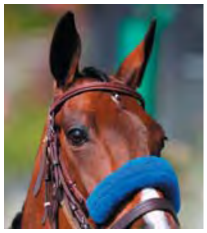

A Special Report by the

Center for Equine Health

School of Veterinary Medicine
University of California, Davis

Can Racetrack Surface Reduce the Risk of Musculoskeletal Injury in Thoroughbred Racehorses?

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Musculoskeletal injuries are the major cause of death or retirement in racehorses. Many factors can potentially cause or contribute to these injuries, including:

- Age, sex and performance quality
- Training and racing history
- Hoof management
- Horseshoe characteristics
- Pre-existing musculoskeletal injuries
- Racetrack characteristics (geometry, condition, surface)
- Race features (class of race, purse)

Factors that can be controlled deserve careful study for how they might be changed to reduce the risk of injury. One of these factors is racetrack surface. The materials used for racetrack surfaces—typically dirt, turf or synthetic tracks—can affect the risk for injury by altering the load transfer from the ground to the hoof and the spread of forces to bones, tendons and ligaments of the limb.

Many studies of racetrack surfaces have been conducted, but the results have been conflicting and inconsistent, possibly due to differences in experimental design, analytical approach, injury and case definitions and other variables. Consequently, we do not yet have a clear understanding of the ideal surface material properties for preventing musculoskeletal injuries.

At UC Davis, a research team comprised of veterinary orthopedic specialists, biomedical engineers and mechanical engineers recently conducted a study to clarify the relationship between different racetrack surfaces and specific effects on hoof acceleration and ground reaction force (impact). In this study, hoof accelerations, ground reaction forces (GRFs) and horse speed were measured on dirt, synthetic and turf surfaces at the Keeneland Race Course, Lexington, Kentucky.

Data on these parameters were collected from three 3-year-old female racehorses. All horses were clinically sound, with no observed gait abnormalities. Horse speed was limited to trot and canter to minimize fatigue during data collection. The dirt track was freshly harrowed; the synthetic surface consisted of a proprietary mixture of wax-coated silica sand, polypropylene fibers, and recycled rubber; and the turf track had long grass (approximately 4 to 6 inches in height), and no special maintenance was performed before testing.

The horses were instrumented with an acceleration measurement package (a tri-axial piezoelectric-based accelerometer) and a force-measuring shoe (a dynamometric, force-measuring horseshoe). Acceleration and force signals were recorded using custom software.

The fillies wore an acceleration measurement package (a tri-axial piezoelectric-based accelerometer) and a force-measuring shoe (a dynamometric, force-measuring horseshoe). Acceleration and force signals were recorded using custom software. Instrumented horses were walked, trotted and cantered through the data collection corridor during three to four trials each of trot and canter.

The synthetic surface had the lowest values for most peak acceleration and mean vibration variables. The synthetic surface maximum acceleration during hoof landing phase of stride was 81% of the dirt surface maximum and 66% of the turf surface maximum. Hoof forces contribute to forces incurred by bones, joints, tendons and ligaments of the equine forelimb. The synthetic surface also had the lowest peak ground reaction forces and load rate. Turf surfaces had the highest landing decelerations, probably due to the digging in of the hoof when landing and pushing off.

The relatively low accelerations, vibrations, maximum ground reaction forces and load rate associated with the synthetic surface evaluated at the track used in this study indicate that synthetic surfaces have significant potential for reducing musculoskeletal injuries in Thoroughbred racehorses.

In this study, only forelimbs were evaluated and at speeds that were significantly slower than racing speeds. Although the results may not be identical at racing speeds, it is reasonable to expect that trends will be similar. However, the researchers state that, based on significant differences between footing materials, weather and maintenance programs among tracks and regions, "extending the results of this study to encompass all synthetic track surfaces should be done with caution. We are just scratching the surface with this study, but the comparative results do look promising to start."

The racehorse industry recognizes the potential benefits of synthetic surfaces. Dirt surfaces have been replaced with synthetic materials at several racecourses over the past several years. Early anecdotal observations indicate a lower incidence of fatal injuries with the introduction of synthetic race surfaces in the United States. However, variation within racetracks with ambient temperature changes and variation between racetracks with different synthetic surfaces have been reported anecdotally. The development of standards for race surface materials is now needed to ensure consistency among racetracks, optimize horse performance, and minimize risk for injury.

In an effort to provide additional reliable data, UC Davis researchers are continuing this and other studies on several racetracks in California to evaluate both forelimb and hindlimb hoof-to-ground surface parameters at higher speeds, and in the laboratory 'track in a box' to evaluate surface characteristics.

Hoof accelerations, ground reaction forces, and horse speed were measured on dirt (top photo), turf (middle photo), and synthetic (bottom photo) surfaces at the Keeneland Race Course, Lexington, Kentucky. Instrumented horses were walked, trotted, and cantered through the data collection corridor during three to four trials each of trot and canter.