

Motion analysis helps soccer players get their kicks

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As soccer continues to grow in popularity, injuries to soccer players are likely to increase as well. Certain injuries fall into gender-based patterns and new research at Hospital for Special Surgery suggests some underlying causes that could help lead to better treatment, or even prevention for present and future soccer stars.

Data presented at this year's American Orthopaedic Society for [Sports Medicine](#) meeting in Keystone, Colo., explores the differences in soccer kick dynamics based on gender. With the use of video motion analysis at the Leon Root Motion Analysis Laboratory at Hospital for Special Surgery in New York City, researchers were able to examine the dynamics of the kicking motion.

"Prior to this kick study, there had been very little motion analysis to show what was going on during the soccer kick," said Robert Brophy, M.D., lead investigator and former resident and fellow at Hospital for Special Surgery. "We know that female soccer players face a greater risk of ACL injury and patellofemoral problems and male players are more at risk for sports hernia. We used motion analysis to determine if the two types of players have different alignment and muscle activation that might correlate to the injury patterns."

During motion analysis, the kick is looked at in two different ways simultaneously. The activity of each of the muscles involved is measured based on electrical impulse. "But you also need to know what the body is doing when you are taking the readings, is it kicking? Standing? And so

on," said Sherry Backus, PT, DPT, M.A., Advanced Clinician at the motion analysis lab and co-author on the paper.

"To record what the body is doing while the muscles are working, we attach bright surface markers to different parts of the body," said Backus. "Around the room there are eight to 10 cameras that are trained on the markers, recording what the body is doing. We merge the images from all of the cameras and create a three dimensional picture of the person going through the kicking motion. From there we can match up, frame by frame, the electrical signals we get from the muscles with what the person is doing."

The researchers found that male and female players do differ in both of these areas. Male players have more activation in the hip flexors of their kicking leg and in their hip abductors of the supporting leg compared to women. "The hip abductor may be protective against ACL injury and it is interesting that its activation was markedly diminished in women," said Dr. Brophy, now an assistant professor in the department of orthopaedic surgery at Washington University in St. Louis and head team physician for the St. Louis Athletica professional women's soccer club. In addition, the knee of the supporting leg in female players assumes a more knock-kneed, or valgus, position, putting more stress on the outside of the knee joint. These two differences, low activation of the hip abductor and the knee position, could be a factor in the increased ACL injuries seen in female soccer players.

Female players also do not activate their medial quad muscles in their standing leg, one way male players could be protecting their patellofemoral joint from injury. The hip flexor activation, however, in their kicking leg could correlate to the pattern of sports hernia seen in male soccer players. With more than eighteen million people playing soccer in the United States, according to the latest FIFA (Fédération Internationale de Football Association) survey, understanding the body

mechanics specific to the sport could potentially prevent a large number of injuries from occurring.

"It is a logical extension to think about how our data could be connected to injury patterns," said Dr. Brophy. "And what we found tells us that the role of muscle activation and leg alignment in injury definitely warrants further investigation."

"In investigating the dynamics of kicking, our hopes are to help soccer players reduce their injury risk and to assess the impact of a specific injury on a player's return to play," said Riley J. Williams, M.D., senior author and orthopedic surgeon in the Sports Medicine and Shoulder Service at Hospital for Special Surgery. "By understanding the mechanics of a soccer kick, the long term goal would be to recommend small changes in training, coaching or strengthening that could protect both female and male athletes from the most common injuries," continued Dr. Williams, who is also the head team physician for the New York Red Bulls soccer club.

For the most part, Hospital for Special Surgery uses motion analysis in a clinical setting to analyze children who don't walk normally. Clinicians and doctors identify, before surgery, which muscle is pulling a joint. The analysis allows the doctors to look closely at where motions are coming from so the surgical plan is strategic.

But as motion analysis technology has improved, Hospital for Special Surgery researchers say motion analysis can now be used to look at and analyze faster and more complex movements like the [soccer](#) kick.

Source: Hospital for Special Surgery

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