



MOVING PARTS

HARNESSING NEW TECHNOLOGY THAT MEASURES THE BODY IN MOTION, THE CENTER FOR MECHANICAL MEDICINE AIMS TO BOOST ATHLETIC PERFORMANCE AND DECREASE PAIN AND INJURY.

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As a European kickboxing champion and the stunt double for Dolph Lundgren, Tony Messenger knows how to throw a punch. Even so, the Manhattan Beach resident strives for greater speed, balance and power. At the Center for Mechanical Medicine, Messenger has found new tools for honing his skills.

"I can measure my speed, my power, my reflexes and see if I can increase them," he says. "I've been training for years hitting punch bags and sparring with people. Now suddenly I can find out how fast I strike, how much power's in a punch or kick."

Dr. William Mealer, an orthopedic surgeon at Beach Cities Orthopedics and Sports Medicine, uses the same equipment as Messenger but for a different purpose. "We can look at the whole patient in a biomechanical fashion ... to pinpoint gait patterns, muscle strength patterns and how the joints work," he says.

The recently launched Center for Mechanical Medicine uses motion capture and other state-of-the-art technology to measure how the body moves and reacts. The goal is to help athletes perform better and more effectively and help patients recover from or prevent injury.

CEO Dr. Allen Selner, a podiatrist with an undergraduate degree in engineering, explains the center's novel approach. "Orthopedic medicine relies on tests like MRI, CT and X-ray, which can't show what happens when patients are walking, running or playing sports. Mechanical medicine asks, 'What are the forces acting on the joints, and how can we help

people adjust those forces?'"

A combination gym and lab, the facility contains sophisticated tools such as the Motion Capture Platform, which uses 10 motion capture cameras stationed around the approximately 2,500-square-foot space to create a 3D record of the body in motion. The same technology used to create avatars and animation can reveal how an athlete throws a fastball or an orthopedic patient favors one side when walking.

The Senaptic Sensory Station measures reaction time and coordination skills using tests such as how quickly the user can touch moving dots as they appear on the screen. Results can be compared to performance data for athletes in the same sport. They can also help indicate an athlete's readiness to play following concussion.

The Force Platform, two bathmat-sized panels on the floor, measures force and movement when a user stands, steps or jumps. The wall-mounted StrikeMate works similarly, measuring the power of a punch or kick.

"As an engineer and a doctor, I've always been fascinated by biomechanics," says Dr. Selner, who used bioengineering techniques to develop a new method for bunion surgery in the '90s. He's been fascinated by athletic performance too, and he served as a sports medical reporter for KABC as well as medical director for the U.S. Amateur Confederation of Roller Skating.

In the early 2000s, Dr. Selner built a lab in his office in order to look at biomechanics. But the technology was still too crude for his purposes. "I

could change the way people walked, but I couldn't measure it," he says.

Finally the technology caught up. But once motion analysis tools became available, they were costly and generally were found only in research institutions. So Dr. Selner spent about a year and \$1 million of his own money to create the Center for Mechanical Medicine and bring biomechanics to the public.

Located in the Beach Cities Orthopedics and Sports Medicine facility in Torrance, the center began seeing a limited number of orthopedic patients starting in October. Dr. Selner recently recruited a researcher from the Department of Veteran's Affairs (VA) Long Beach Healthcare System, Dr. Brian Ruhe, to help analyze and quantify the data generated by the center's tools.

"We're looking at how we can collect and package the data so that it's understandable by a consumer, a doctor, a physical therapist or a coach," says Dr. Ruhe, an assistant professor of orthotics and prosthetics at Cal State Dominguez Hills.

According to the American Association of Orthopaedic Surgeons, female athletes who participate in jumping and pivoting sports—such as soccer—are two to 10 times more likely than males to sustain a knee ligament injury, such as an anterior cruciate ligament (ACL) injury. Teen girls are especially susceptible: They are eight to 10 times more likely to tear an ACL than their male counterparts.

The center offers an ACL Risk Assessment using 3D motion capture and the force platform. Eventually Dr. Selner hopes to develop ways to help athletes modify their movement to reduce the risk of injury.

Dr. Mealer, the orthopedic surgeon, says the center's technology has been helpful in treating his patients with patellofemoral pain syndrome, the most common cause of knee pain.

"It's so important to know: Is the body balanced? Is walking normal? How is the body positioned?" he says. "That knowledge can help us attempt to correct and improve a range of debilitating problems."

Dr. Selner estimates that around 30% of chronic foot, knee and back pain stems from mechanical problems. "A doctor will take an X-ray and say, 'You've got some arthritis.' Well how did it get there? What were the

forces that caused it? If you're wearing one part of your joint and I can shift you to another part, you can be made pain-free ... just by shifting the load."

He created an adjustable orthotic that can shift the angle of the foot, tweaking posture and changing the forces moving up the foot, knee and leg. A dial mechanism built into the orthotic tilts the foot inward or outward.

"It's about alignment, not support," he says. "Support is a static concept. Alignment is a dynamic concept."

A microchip in the orthotic—currently in development—will analyze

the wearer's position and indicate the setting needed to achieve proper alignment. It will also provide fitness data such as number of steps taken.

The Center for Mechanical Medicine officially launched in May. Kickboxing is among the first athletic areas of focus. That's where Tony Messenger comes in. He has been advising Dr. Selner since the beginning of the project, helping test the machines and providing an athlete's perspective.

Messenger finds the Motion Capture Platform, Force Platform and Strike Panel among the most helpful tools. "You throw maybe 10 punches and look at the graphs," he says.

"You look at the positioning of your feet and hips. When the positioning of your feet and hips is correct, the punching power and kinetic force goes up considerably."

The center also plans to offer a pitching performance test, analyzing the pitcher's form and coordination using 3D imaging, body statistics, motion capture and visual and neuromotor tests. A golf assessment would work similarly.

Dr. Selner emphasizes that the center's role is to provide data, not training. "We're never going to replace the coach. They have the body of knowledge. What we can do is measure how effective they are at what they do and give them data and numbers to make them better."

Summing up the essence of what the center offers, Dr. Selner says, "To measure is to know." ■

