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# A small change in how you walk may help reduce knee pain

Gait training could be an effective way to mitigate arthritis pain for some people, a small study shows.

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7 min

Summary



Emily Miller, a post-doctoral fellow at the Movement Bioengineering Laboratory at the University of Utah, walks in a motion capture lab where researchers can measure her motion, estimate the loading in her knee and give her real-time feedback to change her walking pattern. Scott Uhlrich, the director of the lab, also measures her motion using smartphone video, which will allow clinicians to prescribe personalized changes in walking patterns without a specialized lab. (Dan Hixson/University of Utah)



By [Teddy Amenabar](#)

Changing your gait may help you reduce knee arthritis pain. And the relief could be comparable to the effect of over-the-counter pain medications.

In a [study](#) published earlier this month, adults with mild to moderate osteoarthritis were trained to point their toes slightly in or out to shift

the load on their knees while they walked. That small change in walking gait helped alleviate their chronic knee pain, researchers found.

“I think this study provides a lot of hope for people with knee osteoarthritis,” said Scott Uhlrich, the lead author of the paper and the director of the Movement Bioengineering Laboratory at the University of Utah. “There are new treatments coming along that could improve their pain.”

About 33 million adults in the United States have osteoarthritis, which involves the breakdown of cartilage in a joint. Cartilage can’t repair itself like other tissues in the body, and people often don’t notice the damage until it’s too late. A subtle change in a person’s walking gait can redistribute the weight on the knee to areas where there’s more cartilage — resulting in less pain, Uhlrich said.



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After following participants for a year, the researchers found an altered walking gait may also slow down deterioration of cartilage in the knee. In practice, the change in step functions similarly to certain knee braces, Uhlrich said.

“This is not reducing the total force that goes through your knee,” he said. “But it’s just shifting some of the force from the inside part of your knee to healthier cartilage on the outside part of your knee.”

However, don’t try to alter your walking gait on your own, Uhlrich said. There’s no one-size-fits-all approach, and turning your toes in or out can end up placing more force on troubled parts of your knee. In the randomized controlled trial, researchers provided personalized, real-time feedback in the lab to point participants’ feet in the right direction.

“Not everybody benefits from the same change,” Uhlrich said. “I wish they did; I wish I could tell everyone to change it in one way and it worked for everybody. But it just doesn’t.”



Uhlrich attaches the vibrating motors that provide real-time feedback to Miller to change her walking pattern. (Dan Hixson/University of Utah)

## The study's methods

To conduct the randomized controlled trial, the researchers screened 1,582 volunteers to recruit a cohort of 68 people with mild to moderate osteoarthritis and pain on the inside of the knee, said Julie Kolesar, the senior author of the study and a research engineer in the Human Performance Lab at Stanford University.

The researchers instructed each participant to walk with their toes pointed five or 10 degrees inward and outward, and the researchers



measured how the four angles changed the load on participants' knees. The study included only people who actually benefited from modifying how they walked, Kolesar said.

Next, the participants were split into two groups, an intervention and what researchers called a "sham." The intervention group trained to walk with toes pointed in their optimal direction — whichever angle proved to be the most effective at reducing load on the inside of the knees. And the "sham" group was instructed to walk more consistently with the gait they walked before the study.

Once a week for six weeks, participants walked on a pressure-sensitive treadmill, and when they stepped out of line — two or more degrees off their assigned gait — the researchers sent a buzz to their legs through a device.

Participants returned to the lab every three months to ensure they'd maintained their prescribed gait, Kolesar said.

The control group allowed the researchers to determine whether the change in foot angle helped or whether the one-on-one attention in the lab provided the benefit.



Uhlich instructs Miller on how to change her walking pattern when she receives biofeedback. (Dan Hixson/University of Utah)

## The results

After a year, people in the intervention group reported a greater reduction in knee pain. And, based on MRI scans taken at the beginning

and end of the study, the intervention group appeared to have slower degeneration of cartilage in their knees.

In the study, participants rated their knee pain on an 11-point scale, and the researchers compared the change in their scores after a year to self-reported scores after the use of over-the-counter pain medications in other studies. The intervention group reported a reduction in pain comparable to the effect of over-the-counter pain medication, Uhlrich said.

Knee braces are considered one of the most effective forms of treatment for the joint pain, but patients can find the braces uncomfortable, Uhlrich said. People take NSAIDs such as ibuprofen to dull the aching pain, but these pain relievers can harm the gut when taken regularly.

“You obviously don’t want a 30-year-old taking pain medications four times a day for 30 years,” Uhlrich said. “If we can have a treatment that improves their pain and preserves their joint — without them having to take medications — that fills a really big gap in the current treatment options.”

A knee replacement may seem like a more permanent solution. However, these can fail over time, and repairing a worn-out knee replacement requires an even more intensive surgery, Uhlrich said.

The trial, which spanned almost three years, was relatively small, and the researchers recruited only individuals with mild to moderate knee arthritis. Though the results are promising, more research needs to be done before the treatment is available in a physical therapy clinic, Kolesar said.

Devyani Misra, a geriatrician and rheumatologist at Harvard Medical School, said the study’s findings show promise but the results are not generalizable because the researchers preselected participants who would probably benefit from changing their walking gait.

“It is exciting, except it’s for a subset of knee osteoarthritis patients,” Misra said.

The study was conducted by researchers who are now at the University of Utah, New York University and Stanford University. The research was funded by the Department of Veterans Affairs, the National Institutes of Health and the National Science Foundation.



The motion-capture technique used to make the foot angle prescription is expensive and time-consuming. By using new mobile sensing technology, the researchers hope this intervention eventually could be prescribed in a physical therapy clinic, and retraining can happen while people go for a walk around their neighborhood. (Courtesy of the Utah Movement Bioengineering Lab)

Researchers relied on specialized lab equipment to train participants on a new way to walk. But Uhlrich said some of his colleagues are also working on a “smart shoe” that can help a person train while they walk around their neighborhood. Uhlrich is also the founder of a start-up developing a way to conduct the analysis with a smartphone.

“It’s not just science fiction,” he said. “The future of this is you going into the PT clinic, they record you walking with a smartphone, and we can figure out which way of walking would be best for you.”

Still, it’s the first randomized, controlled trial to demonstrate the effectiveness of personalized gait training for knee arthritis, the researchers said.

Songning Zhang, a professor of biomechanics at University of Tennessee, called the clinical trial a “great study” and said one of its strengths is the “sham” control group. Those participants went through all the same motions as the intervention group, including time in the lab.


“That’s rare,” Zhang said. “A lot of times, the control group just maintains their daily activities.”

For now, he said, the “proven method” to treat osteoarthritis is regularly walking and lifting weights to build muscles around the knee. But, Zhang said, he stopped playing tennis recently because of knee pain, so he tried walking toe-in for a few days.

“Actually, that helped me tremendously,” he said.



By Teddy Amenabar

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