

*Emphasis on rehabilitation, minimally invasive surgery*

## NEW KNEE REPLACEMENT STUDIES AIM TO IMPROVE OUTCOMES

New research developed at University of Colorado Denver's Physical Therapy Program could produce improved outcomes for the growing number of patients who undergo total knee replacement surgery.

The program is currently recruiting patients for the studies. Two will compare the effectiveness of relative-

ly new protocols for post-surgery rehabilitation with established standards of care. Another will investigate outcomes in patients who undergo minimally invasive knee replacement procedures as an alternative to traditional surgery.

Investigators hope the studies help patients recover more quickly from an increasingly common surgery (about half a million are performed each year; University of Colorado Hospital handles 300 to 400 cases annually) that nonetheless can result in ongoing pain, scarring, loss of strength and decreased range of motion.

The relatively large number of total knee replacements performed at UCH provides a promising pool of potential recruits. "It ranks as one of the [most]-performed procedures at the hospital," says Donald Eckhoff, MD, the hospital's medical director of Inpatient Orthopaedics.

**Deficit spending.** "We are studying interventions to counter deficits that result from total knee replacement," says Jennifer Stevens-Lapsley, PT, MPT, PhD, assistant professor of Physical Medicine and Rehabilitation at UCD's School of Medicine and director of the Physical Therapy Program's Muscle Performance Laboratory.

Patients frequently suffer long-term post-surgery muscle weakness, Stevens-Lapsley



NMES unit fires electrical bursts that force quadriceps to contract.

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adds. “Patients do recover, but not to the levels of their healthy, age-matched cohort,” she notes. “If we can return patients to higher levels of functioning faster, that could mean fewer visits and post-surgery complications.”

There is plenty of room for research that focuses on improving outcomes for these patients. A “consensus conference” of the National Institutes of Health (NIH) recently concluded that optimal use of post-op rehabilitation is the least understood area of total knee replacement, Eckhoff notes.

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“Use of prostheses and surgical complications get lots of attention,” he says, “but it has not been the same for rehab.”

**Feel the burn.** A study co-authored by Stevens-Lapsley to be published this month in *Arthritis Care and Research* concluded that patients who participated in a progressively more demanding post-surgery rehabilitation program to strengthen the quadriceps (the large muscle group on the front of the thigh) showed more improvement than patients who received conventional rehabilitation.

One of the current studies aims to build on that research. The “Progressive Strength Training Program,” which plans to recruit patients through 2013, includes high-intensity exercises and weight lifting that emphasize strengthening the muscles that help control stair descent. Patients receive home and outpatient physical therapy for 11 weeks, all the while steadily increasing the amount of activity.

“Instead of following a standard rehabilitation protocol, the program targets the progression to the maximum amount of weight and intensity for each individual patient,” Stevens-Lapsley says.

**Stimulating study.** Meanwhile, an investigation funded by grants from the NIH and the American College of Rheumatology is studying the effectiveness of neuromuscular electrical stimulation (NMES) in restoring strength to the quadriceps after knee replacements.

“We aren’t sure why, but the brain appears to shut down the ability of the quadriceps to activate after surgery,” Stevens-Lapsley says. That makes it difficult for patients to maintain strength and hampers recovery.

The NMES unit makes the quadriceps contract – and therefore “exercise” – by firing bursts of electrical signs to the muscles via a transmitter, wires and electrodes placed on the area (*see accompanying photo*).

“During surgery the knee is assaulted,” notes Eckhoff, who is the lead physician for the study, “and muscles go into a dormant phase. The idea of NMES is that we override or replace the normal signal from the brain.”

About 40 patients have so far enrolled in the study; investigators would like to attract another 30 by the end of the year. Patients will receive standard physical therapy at home and on an outpatient basis two to three times a week, plus NMES therapy that begins immediately after surgery, for six weeks.

Their results will be compared with those of surgical patients who receive only a standard eight-week physical therapy regimen.

Eckhoff, who says he has been using NMES on study patients for about a year, says “returns have been generally positive. But we still need to figure out how long to administer it, and how much stimulation to give [for optimal results]. We’re getting some long-term data with a small cohort whose treatment is now six months out.”

Another key feature of the study, notes Stevens-Lapsley, is that patients start the NMES regimen just 48 hours after surgery.

“Starting one month after surgery was too late,” she says. “We thought we needed to start it earlier if it was to have the greatest effect on recovery.”

**Smaller incisions, smaller problems?** In yet another study, researchers are studying long-term outcomes for patients who undergo minimally invasive total knee replacement, a relatively new technique that requires a much smaller incision than traditional surgery and avoids inflicting trauma to the quadriceps.

Researchers hope to determine if the less invasive approach decreases post-operative pain and muscle loss, while increasing range of motion. Post-surgery, patients will follow the Progressive Strength Training regimen, says Michael Dayton, MD, assistant professor of Orthopaedics at UCD. The study has so far enrolled about 20 patients with a goal of 50, he adds.

Orthopedic surgery has been steadily progressing toward less invasive surgical tech-

niques over the past five to seven years, Dayton says. Minimally invasive total knee replacements require a 3- to 4-inch incision (about half the length for traditional surgery) that spares the quadriceps from cutting.

“The advantages include cosmesis [less scarring] and the potential for quick recovery,” Dayton notes, “but from a physical standpoint we don’t have enough data to understand the differences [between the two techniques]. We need physical follow-up with cohorts of standard muscle dissection patients and patients who have had minimally invasive surgery.”

The benefits, Dayton adds, must be “clear-cut” because the minimally invasive procedure involves additional risk. “The technique creates an opening in the joint that is much smaller,” he says, “meaning we have poorer visualization of the anatomical structures. That could limit our ability to clean out diseased tissue. Comparing range of motion in patients will be of particular interest.”

The pay-offs, however, could be significant, he observes: shorter hospitalizations, decreased recovery time and less utilization of long-term rehabilitation as patients age.

*For more information on the studies, contact the Muscle Performance Lab at 303-724-9590 or e-mail Jennifer Stevens-Lapsley at [Jennifer.stevens@ucdenver.edu](mailto:Jennifer.stevens@ucdenver.edu).*