(Retyped from Burrelles' transcript)
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New joints to stay active:
Improved devices, minimally invasive surgeries boost trend

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(Accompanying video of Dr. John Des Jardins as he shows a knee-replacement implant and discusses its unique function. He is a researcher at Clemson University's Frank H. Stelling and C. Dayton Riddle Orthopaedic Research and Education Laboratory in Greenville).

It's a Friday morning and Barbara Cleveland is celebrating her 66th birthday by stepping over 6-inch hurdles at Proaxis Therapy. There is a countertop for support, but her gait is firm. The hand only lightly grazes the counter giving her reassurance that help is available if she falters.

Its understandable Cleveland should be hesitant, given that her right knee was replaced just a month ago.

"It was bone on bone," Cleveland said about the pain she'd withstood for years. "I just couldn't put up with it anymore."

Cleveland is not alone, both in the rehab center and among Americans. A surge in total knee replacement surgeries within the past decade means more than 4.5 million Americans have new knee joints, according to the American Academy of Orthopaedic Surgeons. Credit baby booms – and improved devices along with more minimally invasive surgeries – for the increase. Boomers began reaching age 65 on Jan. 1, 2011, and a large population in that demographic group is oddly both highly active and overweight. Many are also stricken with osteoarthritis, one of the main causes of knee pain and eventual joint replacement.

Academy statistics show 4.7 percent of U.S. residents age 50 and older have undergone a total knee replacement, higher that the rate for congestive heart failure, the leading cause of death in America. "People don't put up with a disability like they used to," said Dr. Brian Burnikel, an orthopaedic surgeon with Steadman Hawkins Clinic of the Carolinas. "They want to get rid of the pain."

Joint replacement is the last step in relieving pain and regaining function. In the knee, a person's age, weight, repetitive activities, trauma and infections can lead to deterioration of cartilage, which acts as a cushion between bones. The result is pain and stiffness. As Cleveland lost cartilage, cortisone shots and other therapies offered her some relief for years but could not completely resolve her pain. "It slowed me down a lot," she said, and surgery soon became her only option. "A couple of my church members had the knee surgery so I wasn't scared. I had to have it."

Arthritis runs in Cleveland's family. So, heredity, rather than obesity, is the culprit for her. While it seems a no brainer that people who are overweight put high stress on their knees and hips – and in effect wear them out sooner – that may not be the case. The American Academy of Orthopaedic Surgeons, studying the effect obesity has on knee arthritis and the ability to recover from surgery, found that bariatric patients – those undergoing surgical procedures to lose weight – had improved knee function and less pain as they lost weight.

“The knee does get the most stress, and the hip, not so much,” Burnikel said. “But there was a recent study, a pretty good study with a lot of patients, that showed obesity had no correlation to joint failures.”

Yet in his own practice, Burnikel said he has found “a very high number of obese patients” who need replacement surgery and a trend toward younger and younger patients.

That twofold increase may have its explanation in a massive study released in 2011. A Harvard Medical School professor looked at trends in total knee replacements during 1997-2007, when the surgery doubled in number. Data showed the proportion of obese persons could explain about 20 percent of that increase. However, a trend toward younger patients – who had the surgery for three reasons: sports-related injuries, obesity, and as a consequence of early onset of osteoarthritis – is the likely explanation for the dramatic increase in knee-replacement rates in the United States. Baby boomers drive demand.

On May 6, Mike Riggins plans to run a 50-kilometer (31 miles) race. A couple of days later, he’ll have his right shoulder replaced. Like many boomers, he’s active, but in Riggins’ case its activity in overdrive.

“I’ve done 25 ultras (running races longer than the standard 26.2 mile marathon),” Riggins said, noting that only a couple of those were before he had a partial knee replacement on one knee and a full knee replacement on the other. “After they did the first knee, the doctor said no more running,” Riggins said. “But he didn’t listen.” The 55-year-old Easley resident runs with a passion. Thick in chest, thinning on the head, and sweaty all over, he runs as if he’s chasing life or away from death. In a way he is. Looking at him now, it’s hard to believe he was once overweight. Running helped him lose nearly 85 pounds, and surgeries weren’t going to send him back into obesity.

“After they replaced it, I was thinking, ‘why did we wait so long,’” he said. “The pain was gone. The arthritis was gone.”

Pain-free and mobile again, Riggins found a new lease on a life of activity. Burnikel said that drives many boomers these days. It’s not uncommon for them to have a sports injury in their past that slowly degenerates over the years until it becomes too problematic to ignore.

“They’ve had an injury, 25-30 years ago, say a torn ACL, and the cartilage is now gone,” he said. “The patients we have now are younger. Ten years ago it was 63-64; now it may be 60.” The number of operations is rapidly increasing, too, Burnikel said. “In the next 15 years, we’re looking at a 650 percent increase in knee replacements,” he said, citing figures from the American Association of Hip and Knee Surgeons. “For hips, it’s 180 percent.”

Building a better knee in the fourth-floor lab at Greenville’s Patewood medical cluster are offices of the Clemson University Biomedical Engineering Department. There, John DesJardins, a Ph.D. researcher, leads colleagues on projects designed to test the components that make up replacement knees, hips and other joints.

“The fundamental function is to replace the knee or the hip,” he said. “But there are hundreds of different designs.” Yet, while designs are different, that’s not where major innovations have occurred. It’s the components themselves. There have been problems in the past with joints wearing out. The bearings in the joint can war, the prosthesis can loosen from the bone, the prosthetic itself can fracture, and the joints that pivot against each other can wear down. Innovations in the components that make up the basic design of knee implants have helped alleviate problems. The goal is always to lower friction, and that is achieved as the metal components are improved through finer polishing techniques, more durable metals and improved metallurgy and casting.

It's clear now that older-model implants had problems. DePuy, a subsidiary of Johnson & Johnson, recalled its all-metal hip in December 2010. At issue were metal shavings that were poisoning the bloodstream of some patients. The British medical journal The Lancet found 6 percent of metal hips need replacing within five years, compared to 2 percent for those with plastic or ceramic joints.

While the longevity of today's implants might not be known until 20 or 25 years from now – when they could theoretically start failing – Des Jardins said machines that mimic human movement found knee joints last the equivalent of 45 years in lab testing with minimal wear.

These days, the chief culprit in failures is wear where metal components pivot on plastic parts, said Melinda Harman, an assistant professor in the Clemson University Biomedical Engineering Department.

The plastic shavings from the artificial joint surfaces can cause an inflammatory reaction as they are absorbed by the surrounding tissues. The inflammation then triggers cells that eat away bone, causing the implant to loosen.

Even as materials improve, huge advancements are being made in the surgery itself. Minimally invasive techniques help speed recovery. MRIs allow surgeons to minimize misalignments and incorrect insertions. Computer- and robot-assisted surgeries are being used in some cases to allow even better precision. And rehabilitation – even pre-habilitation – prepares patients for surgery better and gets them back on their feet sooner.

It wasn't long ago that surgeons waited as long as possible to replace a knee. The thinking was that an artificial knee would not last longer than 20 years and you could only do a knee a single time. Age is no longer an issue.

Burnikel said his youngest hip replacement patient – so far – has been a 15-year-old. He's performed a knee replacement on a 25-year-old.

"But they do war out," DesJardins said. "They can't last forever."

Even though he might be the uber-baby boomer taking the desire to continue an active lifestyle to the max, Riggins believes activity has actually helped him tolerate the implants better than most.

"That fired me up when he told me I couldn't run anymore," he said. "He told me, you're going to take a knee that should last 20 years and wear it out in two or three. I have to go back for X-rays every year to see how it's doing. It's been five year and there's no wear so far at all. "They don't know whether to tell me to slow down or keep going."

With knees, it's not so clear where the line on activity should be drawn. As with anything to do with joint replacements, the issue has been the subject of repeated studies. Doctors frequently tell their patients to engage in limited or no "high-impact" sports or activities. "If you had an artificial heart put in," said Clemson's Harmon, "your doctor wouldn't say continue doing marathons."

Yet Burnikel said most boomers do want to get back to the golf course. They want to play with grandchildren, walk pain free and resume a "normal" lifestyle.

For those with higher demands, there are knees built for "high demand" or high flex," Harman said. While specialized joints can cost double or triple a standard implant, the "high-flex" knees made by prosthetic giants Zimmer and DePuy offer flexibility of 150-155 degrees. Hobbies such as gardening or golf, and even daily activities such as climbing stairs or kneeling, can require greater bending than that

offered by standard knees that are designed to flex up to 125 degrees. The high-demand knees often come with extras, such as artificial anterior cruciate ligaments and posterior cruciate ligaments that are frequently removed during traditional surgery. Other such knees both rotate and wing, unlike a traditional hinge, giving more flex and a more lifelike function. Beyond artificial knees, hips and other major joints, the largest advances in the field may come from afield and in the surgical suites themselves.

"The implant companies realize that. The surgeon's skill is critical," DesJardins said. And there are ongoing experiments to "grow" artificial cartilage that could be implanted to replace the worn-out tissue.

"That's a grand vision," Des Jardins said. "That's a very promising field."

As Cleveland toils in therapy; others are going through pre-surgery condition, building strength even before their operation so they'll recover more easily afterward. In fact, one of the latest advances for the success of joint replacement surgery takes place before the patient enters the operating room.

Burnikel is clear that while the joints themselves are improving, so is everything else around the surgery. "It's how we put them in," he said. "What we do afterward. The pain management."

Since the surgery is elective, patients are enrolled in comprehensive pre-surgery classes. Besides receiving basic information, patients can learn about strengthening exercises, infection prevention, pain management, prevention of complications, and physical and occupational therapy. Before surgery, Cleveland's strength, range of motion and balance were tested.

The main goal after surgery is to return her to her "normal" levels, said Jackie Del Giorno, a physical therapist at Proaxis. "That's so important," Del Giorno said. "If a patient only has 90 degrees of flexion before surgery, we're not going to push them to 140 degrees after."

Physical therapy initially focuses on strength and everyday tasks. "We do a ton of walking," Del Giorno said. "With Barbara, the biggest thing is she's willing to work hard." At home, Cleveland said, she's trying to be as normal as possible.

"I'm determined to get better," she said. "No matter how sore I am, it's worth it. It hurts, but it's a good hurt." Cleveland is retired, but when she's fully healed, she wants to actively volunteer, in the hospital and at a nursing home.

"When my knee got so bad, it slowed me down a whole lot," she said. "It was all taken away. But now, today is a month already. And I'm better this week than last week."

The American Academy of Orthopaedic Surgeons maintains a website with information on healthy knees, arthritis, surgery and more. Visit www.saveyourknees.org.

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