



*Claude T. Moorman III, named president of Atrium Health's Musculoskeletal Institute earlier this year, has been involved in regenerative medicine for orthopedics for five years and has performed hundreds of stem cell procedures.*

ORTHOPEDIC CARE .....

# ORTHOPEDIC REVOLUTION

The science of taking care of our bones, joints and muscles has advanced by leaps and bounds.



*Atrium Health's Joseph Hsu examines Bo Jones, a decorated veteran, after surgery to save Jones' arm.*

Three years ago, Claude T. Moorman III of Atrium Health's orthopedic department in Charlotte performed the first mesenchymal stem cell procedure in the United States, a process that purifies and isolates healing cells to help with joint preservation.

The therapy from fat- and marrow-derived cells is used to help heal cartilage and other tissues. In July, Moorman was the first to use the procedure in Charlotte.

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At EmergeOrtho in Asheville, Robert Boykin uses a treatment called PRP injections, which separates the platelet-rich plasma from a patient's blood and repurposes it to help joint cells heal, multiple times per week. Five years ago, he may have done it twice a year. "It's what we refer to as an autologous blood product, and it has high concentrations of growth factors that help in healing while reducing inflammation," he says.

At Carolina Orthopedics' branches in New Bern, Kinston and Jacksonville, physician partner Raymond Jay Bradley Jr. recently added Cartiform to his work, a way to take frozen, articular cartilage from a donor, thaw it and use the resulting living cells to treat cartilage lesions.

"We've figured out how to thaw out Han Solo," he says. "They've figured out how to take articular cartilage from a donor, freeze it in a medium and be able to thaw it out, and the cells are still alive. We can now be in the [operating room], and if we discover a lesion in cartilage in real time, we can remove a living graft from the freezer and I can implant that and use PRP or stem cells to augment that graft and help it take root."

The work these physicians do is called orthobiologics — using sub-

stances naturally found in a body, such as harvested blood and stem cells, to improve healing of bones, muscles, tendons and ligaments. Part of this combination of continually evolving scientific research and applied medical treatment is regenerative medicine, the engineering or regenerating of human cells and tissues to return an area to its normal function. Used extensively in Europe for several years, orthobiologics is inching up the ladder of options in the U.S., though regulating forces such as the Food and Drug Administration and insurance companies often are one rung behind.

In the increasingly complex world of orthopedics, orthobiologics is the pursuit of medically allowing the body to heal naturally.

"I've been involved for over five years with regenerative medicine. In orthopedics, PRP has been the most-studied form," says Moorman, named president of Atrium's new Musculoskeletal Institute in February and a former executive director of the James R. Urbaniak Sports Science Institute at Duke University Medical Center. His research published by the *Duke Medical Journal* investigates outcomes of regenerative procedures. "However, it is by no means

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the most promising," Moorman says. "While it has been carefully studied, benefits range based on patient populations. For instance, patients with certain tendon injuries would benefit more than, say, a patient with advanced arthritis in the knee." Moorman says he's performed hundreds of mesenchymal stem cell procedures.

The Andrews Institute for Orthopedics & Sports Medicine in Gulf Breeze, Fla., which researches regenerative medicine, received a \$1 million grant from the state of Florida in July to support its research and education foundation. Boykin collaborates with Andrews surgeon and sports medicine specialist Adam Anz, who has called regenerative medicine "a foggy place."

"There are a lot of unknowns and unsupported claims," Anz says. "We need to be a driving force in clearing the fog so that we know what works and what doesn't work."

Bradley, who annually speaks at the Cherry Blossom Seminar sports medicine conference in Washington, D.C., uses stem cell medicine at Carolina Orthopedics.

"Stem cells are important because they are pluripotent, meaning they can become anything," he says. "They can grow up and do any job when they're older."

Bradley says a current Food and Drug Administration trial is weighing PRP injections versus cortisone.

"There are a lot of regulations with cell-based therapy that are present to make sure we're doing it safely," says Cristin Ferguson, an associate professor of orthopedic surgery at Wake Forest Baptist Medical Center who was awarded a grant from the National Institutes of Health to support her research in designing bioengineered meniscal replacements. "And there are some things done outside the U.S. that we can't do here. It's an evolving field, and we're working to expand



*Jason Guevara of FirstHealth's Pinehurst Orthopedic Group says people are now able to get back to work in two to three weeks after total joint replacements, thanks to advances in procedures and rehabilitation.*

that knowledge across the country and unify our data to sort this out.

Ferguson says basic research into orthobiologics and PRP has become stronger, and doctors are learning what patients can respond to. But that understanding is not complete.

"In the next five or 10 years, we may have a better understanding," she says.

One key concept of orthobiologics, Ferguson says, is slowing down diseases like arthritis by treating patients earlier in the disease process.

"There are some surgeries where we use tissues to rebuild a portion of the joint, but that healing process isn't always optimum, so that's where the biologics can feed in and make the technique better," she says.

Boykin, whose research has been published internationally, says PRP treatment can cost a patient \$500 to \$1,500, depending on the number of injections. As a consultant to the Royal Spanish Tennis Federation for hip problems in the sport, he sees overseas treatments coming to the U.S. in what he calls "destination medicine." But he stresses the science-meets-medicine aspect.

"Everyone was preparing PRP a little differently. Do you take the white cells with it? Do you leave the white cells out? So we look at the data without leukocyte-poor PRP, and it seems to work better with arthritis rather than white-rich PRP.

"In 2018, we are kind of on the cusp of understanding biological treatments. We've understood using the patient's own body to treat them, and what we're seeing now is some of the scientific data coming back to help the medical data. We're on the brink of what will be a major change in how we treat diseases.

"It's about trying to interpret the science and understanding the scientific research, and the medical aspect of how these treatments work, and their applications, so we can use them to treat diseases in our musculoskeletal patients."

Ferguson says she expects orthobiologics to better the chances of surgical success as research advances.

"In five years, I'd predict we'll have a better understanding of some of the procedures," she says. And Orthobio-

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logics could bring improvements to more than surgical procedures, she adds. The treatments could help in preventive medicine and rehabilitation.

“With risks for having joint problems, we can use orthobiologics to prevent them,” Ferguson says. “It’s not just surgery and injection. It can help with muscles, rehabilitation and blood flow restriction therapy. That’s going to be a big rehabilitation improvement.”

In-office work also is evolving. Bradley uses a process called mi-eye2, a needle equipped with a tiny camera to perform in-office diagnoses that previously required an MRI. The device’s light source allows images to project onto a screen while Bradley steers the camera to explore injuries in and around joints. The mi-eye2 has found uses in operating rooms to help with Cartiform work.

“I had a patient who thought he had a meniscus tear, and we used local anesthesia to numb his knee,” he says, “and I put the scope in and started looking around, and he was watching the screen as I did it. He did, indeed, have a meniscus tear. And for about \$400, we were able to do the same for him as a \$1,500 MRI charge,” Bradley says.

Advances also are present in pediatric orthopedic practices.

Christian Clark is a pediatric and sports-medicine specialist with OrthoCarolina in Charlotte. He’s seen non-sports patients as young as 2, has done anterior-cruciate ligament work on a 5-year-old and stresses the risks of muscle and joint overuse in young athletes. “There are parts of pediatric orthopedics where we have new instrumentation and new implants that are changing,” he says. “Now we have companies that are coming out with new versions of the implants we use because children have growth plates and we have to respect and protect those areas.”



*Robert E. Boykin of EmergeOrtho performs arthroscopic surgery. Boykin says medicine is on the cusp of changes in disease treatment.*



*The putting green at CarolinaEast’s rehabilitation hospital is part of the therapy.*

With young athletes, he says, the practice sees the complications of ligaments being too tight.

“When you grow, your skeleton grows and the ligaments get stretched and sometimes that little piece gets pulled off. You see a lot of kids with the same injuries,” Clark says. One is elbow issues with baseball pitch-

ers whose arms haven’t developed. “If you’re playing baseball and get Little League elbow, you’re too tight and need to take a break,” he says. “If you want to be the next Major League pitcher, don’t pitch in Little League because you don’t want to wear out your pitching arm and have it hurt you later.

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“We just have to make sure we’re not setting our kids up with an adult injury. We have three goals: to make you feel better, to keep you in your activity and [to keep you from doing] anything today that you’re going to pay for five or 10 years from now.”

The rehabilitation process after an injury or major surgery is becoming increasingly specialized.

CarolinaEast Health System in New Bern has a 20-bed rehabilitation hospital where an intense therapy schedule aims to get patients home sooner.

“We evaluate and admit patients who were previously high-functioning individuals and for whatever reason had a decline in function due to an acute medical issue, such as a stroke leading to weakness on one side, a brain or spinal cord injury, hip fracture or an amputation,” says Milan Patel, a physical medicine and rehabilitation specialist.

Patients undergo about three hours of rehab work each day with an interdisciplinary team of physiatrists, social workers, therapists and nurses.

Patel says a physiatrist oversees the patient’s medical status, making sure blood pressure remains under control. The three hours of work can be split between occupational and speech therapy. A physical therapist helps patients with balance, coordination, walking and stairs, while nurses help with daily living.

Adaptive equipment at the rehab hospital can help patients compensate for lost abilities.

“In orthopedic patients, like if you have an elective hip replacement, those patients can bounce back without any issue,” Patel says. “More often, we see patients in the rehab who have had hip fractures, or other traumatic injuries that put unplanned stress on their bodies. The main focus is to get you back to the life you were living before the accident or injury or medical event that occurred.”



*The rehabilitation process after surgery is becoming more specialized. The goal is to get people back to work in two to three weeks.*

Like the post-op approach at CarolinaEast, Vidant Health System in eastern N.C. emphasizes a team approach to care, with orthopedic surgeons collaborating with sports medicine doctors. It also has a free-standing outpatient center in Greenville for total knee and shoulder replacements.

“The new thing in total joint [operations] is recovery and getting people back to work in three or four weeks after a total hip or knee, which has never happened before,” says Jason Guevara of FirstHealth’s Pinehurst Orthopedic Group.

He uses a product called Exparel, an anesthetic that numbs the body to relieve pain during surgery, and Depo-Foam, which releases over a period of time. “It’s an injection into the knee or hip, and basically after the surgery the little fat bubbles pop and

release the anesthetic and patients are pain-free.”

It’s like tires on a car, he says, “If your joint is worn out, don’t drive 20 miles before you fix the tire. We have people who are active in different sports and they’ve waited too long. If you have a flat tire, let’s fix it.”

Guevara says he would be comfortable sending a substantial number of his patients home on the same day as surgery.

“I could probably send a third of my patients home the same day right now, but it takes time to set up the home health agency,” he says.

For Gerald King, an orthopedic surgeon specializing in joint replacement and surgical reconstruction at Western Carolina Orthopedic Specialists in Clyde, going home quicker after an event is a priority.



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"The newest thing is we're managing people's pain better and getting people out of the hospital very quickly. Most go home the next day," he says. "I think what's changed for me is the implants are user-friendly, a little easier to put in, and they're not wearing out as quickly. I believe the implants will last significantly longer, and they're going in much younger people. When I started, you wouldn't see putting an implant in someone 50 years old, but that happens now."

King says his Haywood County patients generally are retired, and he hasn't dipped much into regenerative medicine or orthobiologics.

"Wait and see if that pans out," he says. "But we're always modifying. I learned to do total hip replacements differently than the way I do them now. So hopefully as we get older we learn new things. New things are happening all the time. If I was doing what I was doing 40 years ago, I'd be bored to death. Orthopedics is changing, and that's what makes it fun."

"Overall," says Carolina Orthopedics' Bradley, "we are able to solve problems that seemed insurmountable when I started. So there's new things on the horizon. We're keeping incisions smaller and looking more toward regenerative medicine rather than relying on surgery."

"It's a paradigm shift," Boykin says. "If you look at PRP now, based on the current evidence, I would imagine five years from now other insurance companies would come onboard and receive the data as we get more approval from the FDA. It's something I've been passionate about because it's going to help a lot of people. There's been a lot of hype about taking this to our patients, a lot of hype about stem cells. But we want to stringently look at the research and offer treatment that's evidence-based, safe and effective."



*Wake Forest Baptist Medical Center's Cristin Ferguson examines a patient's knee. She says she expects to learn more about orthobiologics within the next five to 10 years.*



*At Carolina Orthopedics' New Bern office, Raymond J. Bradley recently added Cartiform, a way to take frozen, articular cartilage from a donor, thaw it, and use the resulting living cells to treat cartilage lesions, to his work.*

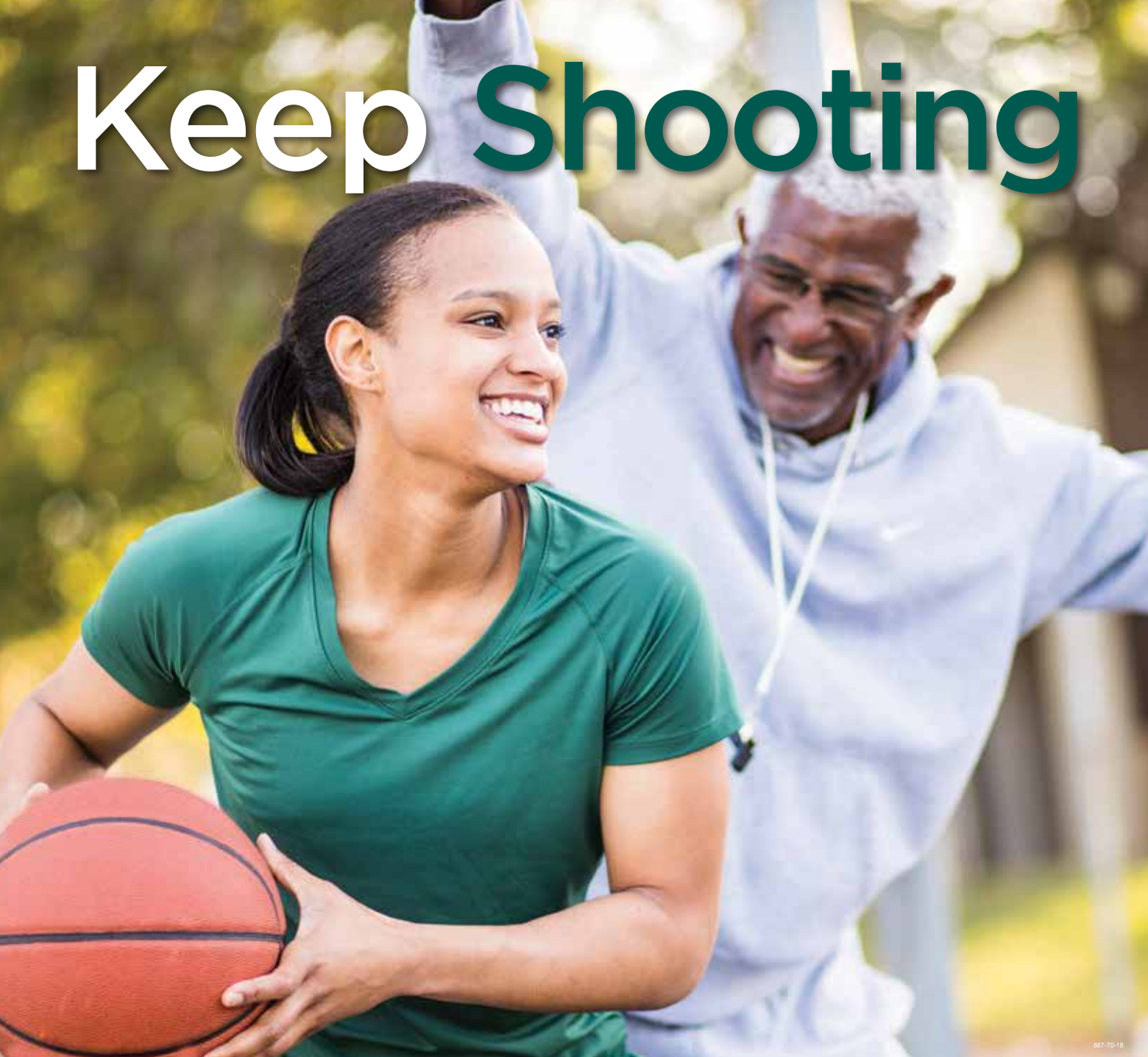
Moorman's Musculoskeletal Institute is the third-largest orthopedic trauma program in the country. "The lessons learned from our most complex cases are directly translatable to our more routine patients," he says. For his work with mesenchymal stem cell therapies, Atrium Health is helping accelerate research. "We're setting up a regenerative medicine program to pull together work being done across teams. Through a new patient registry, our teams will perform cellular analysis and investigate safety and specific patient profiles.

This is a unique opportunity in that we are building the largest clinical research entity in the United States. With a network of over 200 physicians using the same registry, we will be able to study data and outcomes to answer clinical questions and support various therapies."

"I wish we could save the world," Ferguson says, "but you have to be patient with the process. And work toward that common goal." ■

— Kathy Blake is a freelance writer based in eastern North Carolina.

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