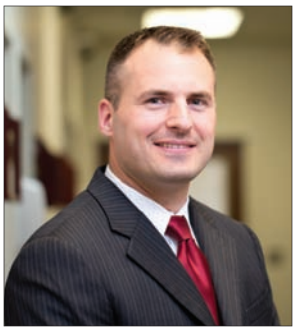


Chris Gorczynski, MD

The first reported total shoulder replacement was performed in 1893 by a renowned French surgeon named Jules Emile Pean, to treat a patient with tuberculous arthritis of the shoulder. The primitive prosthesis he created employed a humeral joint made of rubber coated with paraffin. The joint, we're told, performed reasonably well, but lasted barely two years before it had to be removed due to massive infection. There's no further mention of a shoulder replacement in the medical literature for more than 50 years after this original attempt.

Shoulder replacements were first performed in the US in the 1950s, predominantly to treat people with severe shoulder fractures. It wasn't until the 1970s that total shoulder replacement (TSR) began to be used for the treatment of arthritis damaged joints. Today, shoulders are the third most common joint replaced—after hips and knees—with approximately 60,000 TSRs being performed each year.

"There are many nuances and a fair amount of art involved in getting a long lasting total joint replacement. The procedure requires much more than a simple recipe… cut this, cut that. There are angles you can tweak a little bit, incision placements that can be minutely adjusted, all to enhance the chances of success. All of these things factor into our patients' outcomes."

In our practice, management of an arthritis-damaged shoulder begins with consideration of non-operative treatments. Sometimes there's a role for injections, physical therapy or medication. Generally, a patient becomes a candidate for total shoulder replacement only when we've exhausted those options and they don't provide the relief the patient needs.

Early on in their care, I'll talk to my patient about the likely course of their treatment and their disease and the potential need for surgery. Non-operative treatment may alleviate some of the pain and stiffness, but it doesn't make the arthritis go away or change its progressive nature. As much as I want to stay out of the operating room, if a patient has poor quality of life because of restricted range of motion and pain, we may not be doing that patient a service by staving off a necessary operation for a year or two.

That's because the biggest correlation, as far as range of motion and shoulder surgery is concerned, is that between the pre-operative range of motion and the post-operative range of motion. If a patient has become super stiff before the operation, he is less likely to get full range of motion back than if he had been able to maintain good range of motion leading up to surgery. There are exceptions to that rule of course, but if someone is determined to maximize the outcome, one would not wait until the shoulder has gotten to the point that he can't move at all.

Anatomy of the shoulder

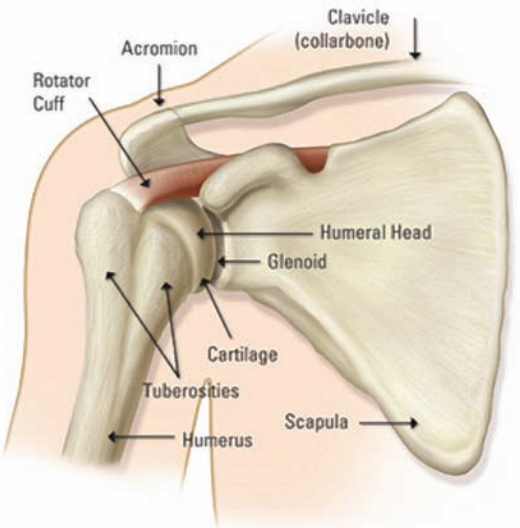
The shoulder joint is composed of three bones: the clavicle (collarbone), the scapula (shoulder blade), and the humerus (upper arm bone). The glenohumeral joint, commonly called the shoulder joint, is a ball-and-socket-type joint that helps move the shoulder forward and backward and allows the arm to rotate in a circular fashion or to hinge out and up, away from the body. (The "ball," or humerus, is the top, rounded portion of the upper arm bone; the "socket," or glenoid, is a dish-shaped part of the outer edge of the scapula into which the ball fits.)

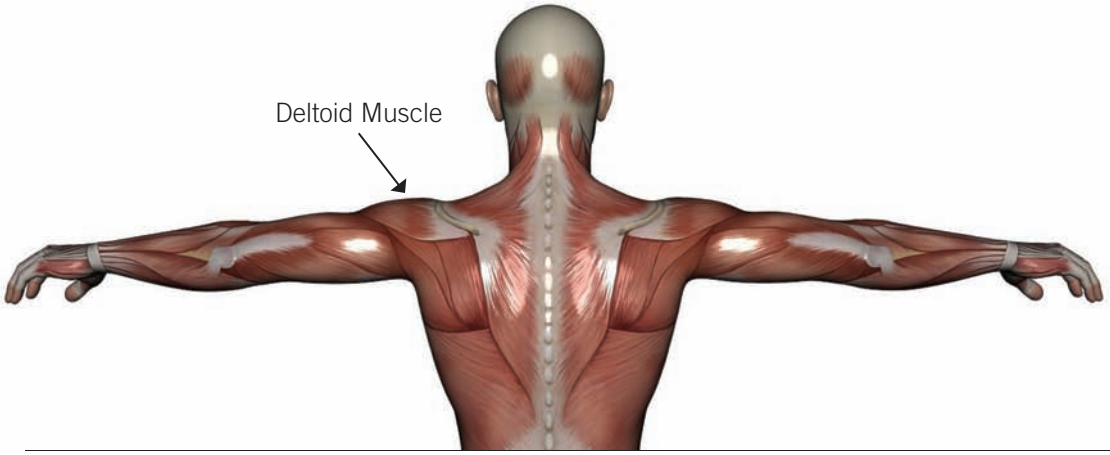
Unlike a true ball-and-socket joint (such as in the hip), the shoulder joint can best be compared to a golf ball and tee, an architecture in which the ball can easily slip off the flat tee. Since the bones themselves provide little inherent stability to the shoulder joint, it is highly dependent on surrounding soft tissues, the muscles, tendons, and ligaments.

Tendons are tough cords of tissue that attach the shoulder muscles to bone and assist the muscles in moving the shoulder. Ligaments attach shoulder bones to each other, providing stability. The rotator cuff is a structure composed of tendons that work along with associated muscles to hold the ball at the top of the humerus in the glenoid socket and provide mobility and strength to the shoulder joint. Two filmy sac-like structures called bursae permit smooth gliding between bones, muscles, and tendons. They cushion and protect the rotator cuff from the bony arch of the acromion.

The deltoid muscle is the primary mover of the shoulder. Without the constraint of the rotator cuff, the action of the deltoid would pull the ball

Normal Healthy Shoulder





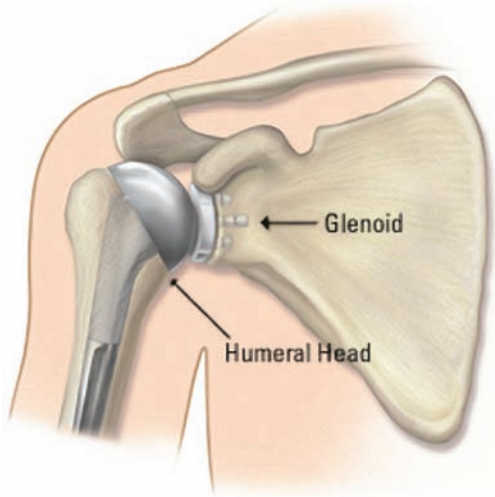
> We perform a high volume of TSRs at the Columbia Memorial Bone and Joint Center, and that helps me maintain the decisiveness that comes from repetition and to do the kind of exceptional job that comes from experience.

straight up out of the socket. Since a total shoulder prosthesis applies the same physics as a normal shoulder, a deficient rotator cuff would leave the patient with nearly as much trouble as he had with his arthrtitic shoulder. But worse yet, it could cause early loosening of the replacement and, at a minimum, increased wear of the glenoid.

This is why a key part of the pre-surgical workup is proving that the patient's rotator cuff is intact. In most cases that involves an MRI scan. If the rotator cuff is torn, TSR isn't an appropriate procedure. In such a case, we would have to perform a special partial shoulder replacement or a reverse total shoulder replacement.

Since we have the 3-dimensional study of the MRI to go by, there are rarely any real surprises when we go into the operating room. Sometimes, though, we'll be pleasantly surprised to find that the soft tissues are less adhered, or we may find the joints more or less supple than we thought. One thing that's a nice surprise is when the bone quality is better than expected.

Total Shoulder Replacement



In the operating room

The total shoulder replacements I do usually require less than two hours of actual surgical time. That includes exposure of the joint, preparation of bones, customizing and insertion of the prosthesis, and then closure.

My goal when doing a total joint replacement is to follow a consistent routine, to methodically move through the process the same way every time. When we can place the prosthesis reliably and get the joint closed as quickly as possible, it gives the patient less time under anesthesia and less time that the joint is exposed to the air of the operating room. This will generally decrease the rate of complications and infection.

To this end, I use the same type of total shoulder prostheses for the vast majority of my patients. I believe that repetition is what makes a surgeon's results reliable and reproducible. If you do the same thing every time, you know what it's supposed to look like and how it's supposed to feel when the instruments or implants go in.

The prosthesis I use is modular and we're able to build it to fit the patient during the course of surgery. In most cases, we machine the bone to accept the prosthesis with a press fit. There are quite a few decision points. The diameter and thickness of the head can change, as can the offset (position of the head relative to the shaft) and the angle of the shaft relative to the head. The socket is also sized to the patient's anatomy. The number of different combinations possible is almost infinite.

The American Academy of Orthopaedic Surgeons advises that total shoulder replacement is a challenging, highly technical procedure that needs to be performed by an experienced team. I agree: unless a surgeon is in tune to all those details, the results will be much less predictable.

We perform a high volume of TSRs at the Columbia Memorial Bone and Joint Center, and that helps me maintain the decisiveness that comes from repetition and to do the kind of exceptional job that comes from experience.

Anatomical Terms

Acromion. The part of the scapula (shoulder blade) that forms the highest point of the shoulder.

Glenohumeral joint. The joint where the rounded upper portion of the humerus (upper arm bone) joins the glenoid (socket in the shoulder blade). This is commonly referred to as the shoulder joint.

Glenoid. The dish-shaped part of the outer edge of the scapula into which the top end of the humerus fits to form the gleno-humeral shoulder joint.

Humeral Head. The rounded upper portion of the humerus; the "ball" in the ball and socket joint.

Humerus. The upper arm bone.

Rotator cuff. Composed of tendons that work with associated muscles, this structure holds the ball at the top of the humerus in the glenoid socket and provides mobility and strength to the shoulder joint.

Scapula. The shoulder blade.

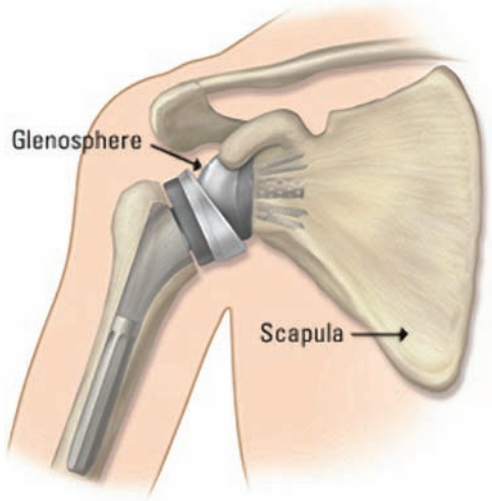
> "From the perspective of the surgeon, this is a very satisfying operation. There are very few other surgeries that can make such a dramatic difference in somebody's quality of life, and it happens right before your eyes, like magic. Before surgery, you see a patient exhibit the classic, rotator cuff deficient attempt to raise their arm up…. it just doesn't go. And afterwards, even after witnessing it many times, it still thrills me to see the patient actually raise their arm up."

REVERSE TOTAL SHOULDER REPLACEMENT (RTSR), first approved by the FDA in 2003, is a major step forward, a revolutionary solution to a very difficult problem. Prior to the introduction of this procedure, there were severe compromises involved for patients with rotator cuff tear arthropathy, that is, arthritis in the setting of a deficient or non-functioning rotator cuff.

Surgeons either didn't replace the socket side at all, or they would attempt some sort of biologic resurfacing. Patients treated in this way would often have inferior range of motion, inferior pain relief, and they certainly wouldn't consider it to be a homerun operation.

The RTSR changes the physics of the shoulder. Rather than recreating the normal contours of the ball and the socket, the socket goes where the ball would normally be, and the ball goes where the socket normally is. The implant is designed to withstand the increased forces involved by reversing the ball and socket. The socket side, which is now on the humerous, can be cemented or press fit to achieve bone regrowth, depending on bone quality. Basically, it's as simple as that, though it took about 25-years to sufficiently perfect for use in the US.

Reverse Total Shoulder Replacement



Components for a Total Shoulder Replacement

Components for a Reverse Total Shoulder Replacement

In my practice, I try to reserve RTSR for people 65 and older. The very-long-term survivorship of the RTSR remains unproven. Initially it was used only in revision situations. I believe the long term results will improve as more are done as a primary surgery. Nevertheless, if we were to employ it in a young person, someone 35 or 45 years old, we would be asking for trouble.

I have made a few exceptions. Unfortunately, I have a handful of patients who are young but would really benefit from a RTSR. Yet, I've withheld the procedure, for now. I've talked to them about it, and I've explained why I think it's best to wait, if we can. For patients younger than 65 with deficient rotator cuffs, the problem is still unsolved. I believe the implant will prove itself over the next 10-15 years. There may be modifications that will make it even more reliable and give it greater longevity.

In the operating room

When performing a reverse, rather than a regular TSR, the shaft preparation, the arm side, is not particularly difficult. We need to establish a slightly different angle, but that's relatively straightforward. The challenge is in "exposure." Instead of setting a 5 ml thick piece of plastic that gets cemented on, we're installing a ball into a place where a socket had been.

We resurface the socket and open it in a way that will allow the central peg of the base plate to fit in. In the system I use, the Exactech system, we harvest a piece of bone from the removed humeral head to be placed within the implant, so the bone actually grows through the implant, a biological

lock. Our goal is to achieve solid fixation on the socket side. We know there's going to be a fair amount of force applied in a way that the body wasn't really designed for.

It's important to understand that this procedure is not for everybody. The regular total shoulder is the ideal prosthesis for the regular osteoarthritic shoulder. It is only a unique subpopulation of patients that would be candidates for the reverse total shoulder.

Many times, at the first post-operative visit, we're surprised at how well people are able to move when just a couple of weeks earlier they couldn't raise their arms off their laps. Because of the improvement in the mechanics, these patients can experience very rapid improvement. One nice thing is that the deltoid muscle will continue to do what it would do in a "normal" shoulder. The patient doesn't need to retrain their brain. In the vast majority of cases, the muscle will power the joint without any further intervention.

In my experience, when the procedure is used as a primary surgery for rotator cuff tear with arthritis, patients actually rehabilitate from the reverse TSR more quickly and easily, and they tend to be happier sooner than with a regular TSR. It's a bigger difference when you go from having a rotator cuff deficient shoulder with arthritis to one that's able to be powered by your own muscles again.

I must say, this is a very satisfying operation from the perspective of the surgeon. There are very few procedures that can make such a dramatic difference in somebody's quality of life, and it occurs right before your eyes, like magic. Before surgery, you see the patient's classic, rotator cuff deficient attempt to raise the arm up…. it just doesn't go. And afterwards, even after witnessing it many times, it still thrills me to see the patient actually raise their arm up.

There's no better testimonial than a patient that's been through the procedure and recommends a friend. Louise Bandiera was diagnosed with osteoarthritis in her shoulder. She had some physical therapy and injections, which initially helped. But she decided she wanted more definitive treatment.

We proved that her rotator cuff was intact, so she was a candidate for regular TSR, and the surgery was very routine. Her results, however, were above average. Now she has nearly total range of motion; it's nearly undetectable if you didn't know her medical history.

A lot of that has to do with her attitude. She assumed that I would put in the implant to the best of my ability. And then it was her job to rehabilitate to the best of her ability. It's just the very best attitude you could want in a patient.

The picture tells the story: Dr. Christopher Groczynski performed the total shoulder replacement and Louise Bandiera applied herself to the rehabilitation, achieving a full range of motion.

Louise Bandiera had been plagued by "shoulder trouble" for years. Eventually, "I was bone on bone, the arthritis was pretty far along," Bandiera recalls. "I couldn't reach up into a cabinet or even lift my arm to turn on the faucet," she says. But even though she knew she needed surgery, as the main caregiver for her mother, Bandiera didn't feel that she could be out of action for the time needed to recuperate.

After her mother passed away, however, Bandiera made having her shoulder seen to a top priority. "The first thing you have to do is get a good doctor," she says, and Dr. Christopher Gorczynski, the shoulder specialist at Columbia Memorial Bone and Joint Center, filled the bill. "Dr. Gorczynski was great. He explains everything to you and makes sure you understand what you should and shouldn't do."

Bandiera had her total shoulder replacement done on November 10, 2008, was in the hospital for three days, and wore an abduction sling for about six weeks. As soon as she got the go ahead from her doctor, she embraced physical therapy with a passion.

"For me, physical therapy seemed absolutely the most important part of my recovery," says Bandiera. "If you don't do your therapy you might as well not have had the surgery. The doctor can fix you, but you have to do the work to get yourself where you want to be."

Bandiera worked with physical therapist Ann Rugh, gradually building up strength and range of motion. "The progress was so subtle, you hardly noticed as the discomfort faded and you could do more," says Bandiera.

"I'm so glad I had the surgery; the difference is phenomenal. I'm still in awe when I can reach up, without thinking, and grab something out of the cabinet."