

TOTAL KNEE REPLACEMENT
SHAWNEE MISSION MEDICAL CENTER
MERRIAM, KANSAS
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00:00:09

ANNOUNCER: Welcome to this OR-Live webcast presentation, live from Shawnee Mission Medical Center in Merriam, Kansas. During the program it's easy to make referrals, make appointments, or request information. Just click on the buttons on your webcast screen and open the door to informed medical care. OR-Live: the vision of improving health.

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BURREL C. GADDY, JR., MD: Hello, and welcome to our surgical webcast. We're coming to you live from the state-of-the-art operating suites at Shawnee Mission Medical Center in Merriam, Kansas. Over the next hour, you'll see an orthopedic surgeon from Shawnee Mission Medical Center perform a total knee replacement with pain resulting from severe arthritis. More than 600 total joints are performed annually at Shawnee Mission Medical Center, of which over half are total knee replacements. During the surgery, we'll be glad to answer your email questions. To send a question now or at any time during the webcast, just click the "ask a question" on your webskype -- excuse me, your webcast screen. Additionally, an archive of this surgical webcast will be available at this website later in the evening.

00:01:22

I'm Dr. Burrel Gaddy, an orthopedic surgeon here at Shawnee Mission Medical Center, and I'm your host for the program. Joining us in the operating room as surgeon is my partner, Dr. Robert Sharpe, currently at the operating table. Dr. Sharpe is also an orthopedic surgeon at Shawnee Mission Medical Center and will be performing today's surgery. Now without further delay, let's join Dr. Sharpe. Hello, Bob. We're live with our webcast audience. Can you tell us more about the case we'll be seeing today?

00:01:51

ROBERT C. SHARPE, MD: Thanks, Dr. Gaddy. Welcome to Shawnee Mission Medical Center for our webcast. Tonight we'll be performing a total knee arthroplasty or total knee replacement, which is one of the most common orthopedic procedures that's performed in the United States. Annually more than 400,000 total knee replacements are performed. Here at Shawnee Mission Medical Center, we perform between 300 and 400 knee replacements every year. One special feature of tonight's knee replacement is that we'll be doing a mobile bearing, or rotating platform total knee replacement, which allows for more natural motion of the patient's knee in flexion and extension as well as in rotation. Before we get started tonight, I'd like to introduce the folks that are going to be helping me here in the operating room, our surgical team. At the head of the patient's bed, our physician assistants, Chris Welch and Ken Filsinger. To my right is one of our surgical techs here at Shawnee Mission Medical Center, Scott Shuler. Our circulating nurse tonight is Ziba Ramnaley, and our anesthetist tonight is Kurt Engler.

00:02:59

A little bit about our patient tonight. This patient is a 74-year-old female who's had a long history of progressively worsening right knee pain. She's had significant difficulty over the past years getting around walking and doing just her normal activities of daily living. She's

also lost a significant amount of motion in her knee secondary to her arthritis. She has difficulty bending and straightening her knee. If we can bring up her x-ray films. As you can see from her radiographs, her right knee, which is on your screen to the left, shows severe degenerative changes primarily on the outside part of her knee or in her lateral compartment. She also has significant bone spur osteophyte formation and loss of joint space. You can see the dramatic difference between her right knee and her normal left knee, which is on the right-hand side of the screen, and the well-maintained joint space in her left knee.

00:04:07

We'll go ahead and get back to the surgical procedure now. We have already started with exposing the knee joint. And we can take a look here in the joint itself and look at her anatomy. Do you have something to point with, Scott?

00:04:19

BURREL C. GADDY, JR., MD: It's a nice picture.

00:04:25

ROBERT C. SHARPE, MD: This is looking at her knee. We've exposed her knee through a midline incision, and then we've performed what we would call a median parapatellar arthrotomy where the kneecap or patella has been flipped laterally to expose her joint. You can see the severe degenerative changes in her knee. The articular cartilage has been completely worn away on the outside part of her knee, primarily but also on the inside part of her knee and underneath her patella, or kneecap. We're looking here at her distal femur, her thigh bone. As well, you can see the top of her tibia, or shin bone. We've removed the ligaments in the middle of her knee, called the cruciate ligaments. We maintain what are called her collateral ligaments, which are the ligaments on the sides of the knee that provide stability. The next steps in total knee replacement are going to be preparing the bone surfaces by cutting them to remove the remaining portion of the diseased cartilage and bone in preparation for placement of the metal components.

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All righty, if I can switch spots with you here, Ken, we'll take our femoral guide. Plus two.

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BURREL C. GADDY, JR., MD: Bob, as you're placing your guides here, if you could point out there's a bone spur that's on the side of the femur there that I think people oftentimes see by x-ray and wonder why their knee gets larger. I wonder if you could just show that to us on the side of the -- on the side of the femoral condyle that we see.

00:06:18

ROBERT C. SHARPE, MD: Yeah, you can see this large area of what's called an osteophyte, or a bone spur, here laterally. And as people's knees start to wear out, the bone starts to lay down actually new bone on the margins. That new bone is what's called an osteophyte or a bone spur. It's the body's attempt to dissipate the stress in the knee joint. We see that radiographically as well, which is a classic finding of osteoarthritis. We're going to go ahead and start making our cuts now here on the distal femur. Do you have a malleable?

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BURREL C. GADDY, JR., MD: I'm sorry, say that again. The distal femur. Do you think the audience knows that, or do you want me to have them clarify?

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ROBERT C. SHARPE, MD: Can I see that pin?

00:07:28

BURREL C. GADDY, JR., MD: Oh, can I narrate as he does this? Bob, as you go through this, I'm going to try to take our audience through what they're seeing as you do it. As we pan back out, toward the bottom side of the screen is where the foot is, and towards the right and top side of the screen would be where the head is. And what we see back in this close-up image, this would be the end of the femur, or the thigh bone.

00:07:57

ROBERT C. SHARPE, MD: Correct. And we use a series of cutting guides. First, we start by trying to -- by sizing the joint so that we get the correct size of implant. What's that?

00:08:14

BURREL C. GADDY, JR., MD: One of the interesting things that patients ask all the time when they're in the office is exactly how is it that we do this. The instruments are very precise, and it's very similar to how a dentist may prepare a tooth for a crown; that is, we sculpt the bone to fix the implant, and not the other way around. So that's what you're doing at this time, right?

00:08:38

ROBERT C. SHARPE, MD: That's correct. We're measuring the end of her femur, or thigh bone.

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BURREL C. GADDY, JR., MD: Bobby, you probably have templated or prepared prior to entering the operating room to get an idea of what size you're going to use, is that correct?

00:09:04

ROBERT C. SHARPE, MD: I'm sorry?

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BURREL C. GADDY, JR., MD: Prior to entering the operating room, we typically template -- that is in preparation or get an idea of the size we're going to use.

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ROBERT C. SHARPE, MD: That's correct.

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BURREL C. GADDY, JR., MD: Can you just briefly explain to our audience what that entails?

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ROBERT C. SHARPE, MD: Yeah, we get a general idea of the size of the patient's anatomy based upon their preoperative x-rays, and that process is called templating. And it gives us a rough idea of how large their bone is. And obviously when we're here in the operating room, we obtain the exact size of the components. And that's what we're doing right now.

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BURREL C. GADDY, JR., MD: So this instrument that you're using here is doing what?

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ROBERT C. SHARPE, MD: This instrument here is measuring the dimension of the end of the femur, or thigh bone, from anterior to posterior, or front to back. Says five. Do you have a screwdriver, please? Yeah, five.

00:10:07

BURREL C. GADDY, JR., MD: We have an email in from Monica, asking a fairly straightforward and somewhat simple but I think very appropriate question. That is, what exactly is a total knee replacement?

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ROBERT C. SHARPE, MD: Well, in general, a total knee replacement is where the damaged joint surface, the articular cartilage, and ends of the bone is removed and they're replaced with metal and plastic components to relieve a patient's pain.

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BURREL C. GADDY, JR., MD: The knee instrument that you just placed now is what?

00:11:04

ROBERT C. SHARPE, MD: This is the femoral guide. This guide allows us to make a series of four additional cuts to shape the end of the femur and remove the remaining bone.

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BURREL C. GADDY, JR., MD: So for our webcast audience, as we discussed earlier, he's going to prepare the end of the femur bone to accept the implant based upon the size that he used, or that he templated into earlier. So the importance is establishing the size, and once size is determined, then to sculpt the bone to fit or match that size. So here he's cutting off the bottom side of the femur. He's already cut the top side, and now

he's...performing what we call champer cuts. These are the angled cuts that will match the end of the femur to the prosthesis.

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ROBERT C. SHARPE, MD: Do you have a size five trial?

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BURREL C. GADDY, JR., MD: Knee arthroplasty has certainly advanced through the years. In its infancy, these same exact cuts were made with osteotomes, or the instrument that you see him lifting that guide away from the bone with. They were very much so just very crude cuts, trying to get the best fit possible but with very little precision. And here we can see him taking out the pieces of bone that he has cut so that we can look at the end of the femur and see how his cuts are.

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ROBERT C. SHARPE, MD: Rongeur to me. Dry lap.

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BURREL C. GADDY, JR., MD: So one of the things that I would imagine the audience is interested in would be who exactly is a candidate for a total knee replacement.

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ROBERT C. SHARPE, MD: Well, the best candidates for a total knee replacement would be someone over the age of 65, which is sort of a relative age. But we know that joint replacements don't last forever. And so the idea is for joint replacement to be done one time and only one time, and for that replacement to outlive the patient. The general disease conditions: patient have osteoarthritis, which is typical wear and tear arthritis. Some patients have rheumatoid arthritis, which is an inflammatory arthritis. And some patients will have arthritis develop because of a previous trauma, which we call posttraumatic osteoarthritis. And those are the typical candidates for a knee replacement surgery. If we look back here in the knee, we can see that we've completed our femoral cuts, with the exception of one cut, and have prepared the bone surface to essentially fit our metal trial component. And now we're going to go ahead and proceed.

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BURREL C. GADDY, JR., MD: Bob, real quick before you go to that, a minute ago you put a trial up against the bone. Is there any way that you can simply show the audience how the back side of that trial would be the same as the cuts made on the femur?

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ROBERT C. SHARPE, MD: Yeah, the trial component looks like this from the end, but from the side you can see how it's shaped to fit the end of the thigh bone. And those cuts essentially match up to this component. And so I think some patients wonder how much bone is removed around their knee, and sometimes it's felt that large pieces of bone are removed, and actually, fairly small wafers of bone are actually cut off to implant the knee component.

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BURREL C. GADDY, JR., MD: Great. Thank you.

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ROBERT C. SHARPE, MD: Can I have a knife and pickups?

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BURREL C. GADDY, JR., MD: So we have a couple of good emails here that I think we can address as we move along. Mario asks the question, "How are you going to remove any bone debris produced when cutting the bone?"

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ROBERT C. SHARPE, MD: Well, what we do is we use an irrigation device that provide high-pressure pulsatile lavage to the knee to remove all of the bone debris that's generated by the bone cuts.

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BURREL C. GADDY, JR., MD: Great, and I'll --

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ROBERT C. SHARPE, MD: And we'll show that here in a minute after we get our cuts completed and before we implant our real components.

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BURREL C. GADDY, JR., MD: And while you're there, David asked a very good question, and that is, "Why is the anterior cruciate ligament, or ACL, removed?"

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ROBERT C. SHARPE, MD: Well, the ACL has to be removed to implant the components. In some total knee replacements, the posterior cruciate ligament is left intact. There are different type knee replacements: some that retain that cruciate ligament, some that do not. In this specific knee replacement, we will be removing both of the cruciate ligaments. And the stability that's provided by the cruciate ligaments is made up for by the total knee components.

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BURREL C. GADDY, JR., MD: Great. And I think we'll see that here in just a couple minutes. One thing I might add in addition to Dr. Sharpe's comments today would be a very simple idea of trying to move the tibia, or leg bone, forward on the femur is restricted by an intact anterior cruciate ligament. And so what you see here now, he's going to make his cut on the tibia, would be difficult to perform if the anterior cruciate ligament was still intact. It'd be very difficult to slide the tibia forward, whereas if the posterior cruciate ligament, which is farther to the back, is still intact, it is possible -- although a bit more difficult, but still possible. So, great question. So, Bob, I see you've applied another device now to the tibia, or leg bone. Maybe you could just explain briefly what that's going to do.

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ROBERT C. SHARPE, MD: Yeah, this is our guide for the tibia. And there's a metal rod that's inserted down inside the bone. This is called an intramedullary guide. And it allows us to line up this cutting block, which we'll make our cut through. The cut of the tibia, or shin bone, is essentially made perpendicular to the shaft, the long axis of the tibia. And so this guide aligns up appropriately for that. We're also measuring to see how much bone we're resecting with this cut, making sure that we take an appropriate amount of bone but not too much bone. That looks good. Do you have the rotational guide?

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BURREL C. GADDY, JR., MD: One of the things that patient will frequently ask me in the office is whether I'm going to make them taller by a knee replacement. And I think they can see here that the bone we remove, we will ultimately replace with either metal or plastic. Is that true?

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ROBERT C. SHARPE, MD: That is correct. And as opposed to a hip replacement, where you actually can change someone's leg length, in a knee replacement that's typically not the case.

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BURREL C. GADDY, JR., MD: Another email from I don't know who says, "Approximately how long could a knee replacement last?"

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ROBERT C. SHARPE, MD: Um, from several long-term studies, the average life expectancy at 15 years, meaning how many knee replacements will still be functioning, is approximately 90 percent. And at 20 years, at even longer term follow-up, approximately 85 percent of knee replacements will still be functioning.

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BURREL C. GADDY, JR., MD: It's probably fair to say that a lot of that's dependent upon patient age, patient activity, et cetera. Do you agree?

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ROBERT C. SHARPE, MD: I would agree as well.

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BURREL C. GADDY, JR., MD: I think for our viewing audience, the question is a great question of longevity of the prosthesis. And what I try to emphasize to patients is it's only metal and plastic, and there has to be some change in activity if the patients are extremely active. You can still remain extremely active, but certain things have to be restricted postoperatively, something that should be reviewed and typically is reviewed after the surgery is performed.

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ROBERT C. SHARPE, MD: We're going to go ahead and make our tibial cut now. Can I have that large osteotome?

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BURREL C. GADDY, JR., MD: We have another great question from Nancy which is in line with the previous email. And Nancy writes, "What's the prognosis for individuals who have total knee replacements in their 40s? What alternatives are they facing in the future?" I think that's a wonderful question. While you're busy here, I'll just -- if it's okay, I'll answer this. The prognosis is excellent for anybody with a joint replacement. When joint replacements were initially introduced, they were typically performed on older individuals because of the fact that they did have a wear rate. What we've found is, though, they're an excellent option for all individuals. The reason that as surgeons we're reluctant to perform them on younger people is because it is metal and plastic, and eventually it does wear out. And when it's revised, it's harder -- or it's redone, it's harder to perform. So we'll pursue other options for the patients early in their disease process, although at some point the only remaining option might be a joint replacement. The alternatives that they have in the future. Uh, difficult to say. Orthopedics is expanding dramatically, and so there may be new techniques, new bearing surfaces -- that is, the surfaces between the implants -- that will have greater longevity, that'll be stronger, more durable. Although right now, the most durable and the best used still remains plastic -- very high-grade, very high-density plastic, but still plastic. Once a patient's had a joint replacement, it's also difficult to go back. At that point then, the patient has to move forward with revisions and changes from there. So another great question.

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Bob, as you're doing this and we're talking about total joint replacement, I have an email question from Ron, who asks, "I've heard that there's a new technique involving only half a knee replacement. What determines which type can be used?"

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ROBERT C. SHARPE, MD: And what he's referring to is a partial knee replacement, or a unicompartamental replacement, which essentially addresses a knee where only half of that knee is worn out, either the medial or the lateral compartment, and the other compartments of the knee are still in good shape. And for the appropriate candidate, it can be a very good operation, can be done through a smaller incision or with a minimally invasive technique. Unfortunately, a lot of patients' knees wear out in more than one location. Frequently, the inside or the outside of the knee will wear out, but the surface underneath the patella, or kneecap, will also wear out, and they will be a better candidate for a total knee replacement. We also, I believe, have a slide of a partial knee replacement and a good comparison with a total knee replacement -- I'll take a lamina spreader -- that shows really the difference between those two techniques, what they look like radiographically.

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BURREL C. GADDY, JR., MD: If I can -- if we can go back to that slide, I'd like to talk to it just a bit more. Wonderful. Thank you. So if we look here again, on the right, on our viewer's right, we see what is a total knee replacement. We see a femoral component on the top, a tibial component on the bottom, and those are the two darkest white structures. On the image on the left, what we see is a partial knee replacement. And so what we can

see is, is that instead of the cuts that we've made sculpting the entire end of the femur -- that is, we've cut across both sides -- in this operation, as you can well imagine, those cuts would be made only to the affected side -- that is, on the medial or inside; in this particular case, on the femur and the tibia. So I think those are wonderful slides.

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ROBERT C. SHARPE, MD: Osteotome again. And now what we're doing here is cleaning out some additional bone spurs from the back of the knee. This is one of the really important steps in this procedure. Oftentimes patients that lose motion in their knee, their joint capsule, the lining of the knee will become very tight in the back of the knee. And so to improve their motion, primarily their straightening or extension, these osteophytes have to be removed and their joint capsule has to be mobilized for them to obtain good motion.

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BURREL C. GADDY, JR., MD: Bob, can you actually move your hand for just a second and maybe use some instrument to point out -- that's a great picture of an osteophyte that forms in the back of the knee that will oftentimes keep the patients from straightening fully.

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ROBERT C. SHARPE, MD: Yeah, here you can see way in the back of the knee, this is the lateral side of the knee, the patient has this osteophyte or bone spur, which extends around behind the knee. And what we've done is we've removed it and are getting ready to take it out of the joint here.

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BURREL C. GADDY, JR., MD: Great. That's a great picture, thank you. And again, the reason that you're trying to remove the tissue, the bone spurs, the osteophytes from the back of the knee is what?

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ROBERT C. SHARPE, MD: To improve the patient's range of motion, also to allow for the appropriate fit of the femoral component. You can also see, if you can get the monitor in here, this patient has significant what we would call loose body in the joint. And oftentimes these loose bodies find their way to the back of the knee and they're removed obviously at the time of surgery. You can see that large thing. Great.

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BURREL C. GADDY, JR., MD: We have an email from Stacy, who asks, "What's the different diagnoses that constitute a complete knee replacement?" And I might just touch again on some of the things that you mentioned earlier.

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ROBERT C. SHARPE, MD: Knife and pickups, please. I'm sorry, Dr. Gaddy?

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BURREL C. GADDY, JR., MD: We have a question from Stacy, who asks, "What are the different diagnoses that constitute a complete knee replacement?" And earlier, if we can go back to one of your earlier slides, it addressed a few of the diagnoses or indications for the surgery.

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ROBERT C. SHARPE, MD: Yeah, the classic indications are for patients that have what we would consider tricompartmental -- meaning their arthritis involves all three compartments of their knee: the inside, the outside, and the joint underneath the kneecap. Those patients typically have what we would call osteoarthritis, which is the typical wear-and-tear arthritis that we get as we age. Some patients also have rheumatoid arthritis, which is an inflammatory genetic arthritis that will result in the knee joint wearing out in all three compartments.

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BURREL C. GADDY, JR., MD: Great. Thank you.

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ROBERT C. SHARPE, MD: Okay. You can take the lamina spreader out. Let me have a 10 spacer.

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BURREL C. GADDY, JR., MD: For our viewing audience, I might remind them that if we have a question, just click on the "ask a question," and we'd be delighted to answer it as time permits. We're getting some great email questions in. I'll read another, perhaps from Stacy again. It says, "What is an insert?" And I think we'll defer that question just for now because we will be addressing that in a couple minutes. But Andrea does send a question which I think is probably very important, and that is, "How much is weight a factor after the knee replacement?" Before you answer that, Bob, what you're doing is something that's really very important in a knee replacement, and I think if you could just take a second or two to show the audience, that'd be wonderful.

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ROBERT C. SHARPE, MD: Yeah, definitely. This is a part of this procedure that we call soft tissue balancing, and it's one of the most important parts of knee replacement. After the bone cuts are made on the end of the femur and the tibia, what we need to make sure is that the ligaments on the knee are balanced on the medial and lateral sides of the knee. And this is important so that the components fit correctly and so that the stress in the knee is appropriately divided and so the patient can obtain their range of motion. We have these what are called spacer blocks, which are these metal blocks that go in between the bones. And what we want to make sure is that the blocks fit with both the knee straightened or extended and with the knee flexed. And that really tells us if the knee is balanced. And you can see that with this block in space, this patient's knee fully straightens. And then we can show it again in flexion. Do you have a lap, dry lap? Keep holding that. There, we got it. And then we bend her knee as well. And we want to make sure that the same-sized spacer block fits in, which it does, and there's good balance to these ligaments on the side of the knee: the knee is not loose or wobbly. And that's perfect.

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BURREL C. GADDY, JR., MD: When you say good balance, you mean that there's no more opening or bending to one side or moving to one side than the other side, is that correct?

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ROBERT C. SHARPE, MD: Correct. That is correct.

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BURREL C. GADDY, JR., MD: And I might comment just a bit further, to me this is the art of the total knee replacement. This is the part of the knee replacement that I think is critical to the good outcome. Without adequate and appropriate soft tissue balancing, this is where patients might have early wear, might have instability, might have discomfort, et cetera. So I think that's a great point for the webcast viewers to see.

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ROBERT C. SHARPE, MD: Good.

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BURREL C. GADDY, JR., MD: We have another email from Shannon. I think this email predates me, but I think I'll answer -- I'll try to answer it. The question is, "How does this cut" -- and I think we're talking about the initial cut made for the surgery -- "How does this cut differ from a cut for someone who has had previous knee surgery and has the traditional S-cut?" And I might -- I think I'll just answer that. Nobody uses -- or at least not much anymore -- the S-cut that a lot of patients have that have had previous surgery. We'll give him just a second here. That old-fashioned S-cut was an incision that was used a number of years ago. Most people now use a midline incision because it's a much more versatile incision. The S-cut incision that was utilized, although very useful, was difficult later when other surgeries had to be performed. So I wouldn't say it's different; I would say that we now use a straight midline, as we call it, incision. Bob, one thing that I wanted to ask you about, earlier we talked about the anterior cruciate ligament and we talked about the

posterior cruciate ligament, and you said it would be stabilized by something that we're going to see in a second. But if you could just explain what you've done just now, I think the audience would begin to understand how that works.

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ROBERT C. SHARPE, MD: Yeah, let me take this off here. Do you have a bone tamp? That final cut that we made on our femur is what we call a notch cut. And if the camera can come and zoom in here, you can see that this cut has made a groove or a notch in the middle of the femur.

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BURREL C. GADDY, JR., MD: I'm going to wait just a little bit longer because I want to show him when he's actually ready.

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ROBERT C. SHARPE, MD: And what this notch allows for is for the femoral component, this femoral trial, to fit appropriately. And this box is part of what makes up for the stability of the cruciate ligaments. The other component of that is the polyethylene, or the plastic spacer, which has a post which fits into this slot and provides the anterior to posterior stability of the knee.

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BURREL C. GADDY, JR., MD: Great. I think we'll see that again in a minute, so I'll touch back on it once we actually put implants in. One of our viewing audience asked a question, which is a great question, something I think we assume. And he says, "I'm surprised there's so little bleeding. Why is that, since I've heard that blood transfusions are often necessary after total knee replacement?" For our viewing audience, it's not seen in the image, but there is a tourniquet [indistinct] and actually stops all blood flow to the extremity. The extremity can tolerate easily two hours and sometimes two and a half hours of no blood flow, which then allows a bloodless field for us as surgeons. So although there is no blood, or little blood, and most of what's seen is marrow elements, the tourniquet is up, and once deflated there will be bleeding. The second half of the question is a very good one. Autologous blood donation is not used nearly as commonly as it was in the past, and that's because studies have shown that transfusions are more necessary, if you will, when preoperative blood donation has been given rather than none at all. Additionally, one of the advances in technology allows us to actually capture the blood. Drains will be placed, and that blood will actually be captured and then given back to the patient. Not all physicians use them, but it has become much more popular. And so patients don't have to give blood, because we can actually reuse what they have. So another great question.

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ROBERT C. SHARPE, MD: Do you have a Frier back?

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BURREL C. GADDY, JR., MD: Another question that's asked is, "I've seen a number of different designs of knee joints on the Internet. How does a patient determine which would be best?" This is where I think the patient has to rely upon the surgeon's decision making. There are various different implants. The implant that you're seeing is a mobile bearing implant. It's made by DePuy, Johnson & Johnson. I think that decision is really more a surgeon decision. Each surgeon has their preference. Becoming familiar with the instrumentation, et cetera, is probably the most important factor of all. As you can see, there's a variety of different steps. Becoming facile at each one of the steps is probably an important goal. Robert sends us an email that I think is a great email to respond to something that our webcast audience is curious about. He says, "How long after the operation do you have the patient start walking, or what is the goal time frame?" And I think we might expand that question and just simply say if we could touch on some of the postoperative treatment for the patients that are watching today.

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ROBERT C. SHARPE, MD: Well, specifically, the answer to his question is that we start them walking sometimes the very same day, sometimes -- or definitely by the very next day. Most patients are typically in the hospital three days. They get physical therapy every day while they're in the hospital. They typically begin walking with a pair of crutches or a walker, which they use for anywhere from two to four weeks. And then they advance to a cane, and ultimately to nothing, usually by the end of six to eight weeks. Dermal trial.

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BURREL C. GADDY, JR., MD: Great. Thank you.

00:38:22

ROBERT C. SHARPE, MD: Go ahead.

00:38:23

BURREL C. GADDY, JR., MD: Another great question comes to us from Don, and he says, "Dr. Gaddy, it's recommended that if you suffer from osteoarthritis in both knees, should you have knee joint replacement in both knees at the same time?" And I might just touch on this question. I do have lots of patients that ask if their surgery can be performed on both sides, and the answer to that is absolutely yes. Certainly the patients have to be medically able, the patients have to be interested and willing, because it is a big deal for the patient. It is difficult to get up, it requires quite a bit of rehabilitation, but it's certainly sensible for the patients to have the procedure performed such that both needs are taken care of at one time. So another great question.

00:39:14

ROBERT C. SHARPE, MD: All right. We have our femoral and our tibial trials in place and our trial plastic in place. We have one more part to prepare, and that's the kneecap, or the patella. You can get a fairly good shot of what those components look like in place. These again are the trial components. We'll select our final components here in just a few minutes. All right, do you have the patella counters?

00:39:43

BURREL C. GADDY, JR., MD: We have a slide, Bob, that I think we'll have put up here so that our audience can see what these look like. Additionally, I've taken the liberty of actually having implants here in the operating room for the audience to see, and I'd like to show those. What we see here, this is the femoral component. This is the component that Dr. Sharpe showed initially. And we can see the curvature that he's established. This is the area that he took out to substitute for the missing ligaments. This would be the tibial component. This would be that area that essentially substitutes, if you will, for those missing ligaments. And then this would be the tibial component. And we're going to talk in a second about the difference between a rotating platform, or a mobile bearing prosthesis, versus a fixed bearing prosthesis, and I'm going to go ahead and take the opportunity to show that.

00:40:55

ROBERT C. SHARPE, MD: We're getting ready to make our patellar cut. We've assembled a guide that helps us make the appropriate thickness of cut, and then we have a reaming device that removes the damaged joint surface. Go ahead. The 3835.

00:41:18

BURREL C. GADDY, JR., MD: Bob, some of the time, or oftentimes patients will ask me, "Did you replace my kneecap?" And it's difficult for them to understand that we actually utilize the kneecap, replacing only a part of it. But after you remove the jigs here, I think if you could show people how the kneecap is actually what we call resurfaced and not actually removed. While you're doing that, we have an email question which I think is certainly appropriate. Shannon writes, "Are patients ever allowed to be awake during the procedure?" And then she says, "Spinal only." The patients are -- excuse me -- given one of two options. Patients can either be completely asleep, a general anesthetic in which a tube is inserted into the throat, or the patients can be given what's called a regional block. At Shawnee Mission Medical Center, we often use spinal anesthesia, that is an anesthetic such that the

legs become number, and an epidural catheter, which can also be used for postoperative pain control. It can be used also for the anesthesia, but the benefit to the patient, in my opinion, would be that postoperatively it can be utilized.

00:42:31

ROBERT C. SHARPE, MD: Well, we've removed the surface of our patella, and we can now show what Dr. Gaddy was talking about. You can see this side, which is the joint surface side, we've essentially worn away all the old cartilage. This yellowish surface is the underlying bone. We've essentially cut this kneecap relatively speaking in half, not necessarily completely in half. The remaining portion of the bone, the portion that the patients feel externally is still theirs. But the undersurface will be replaced by what we call a plastic button.

00:43:07

BURREL C. GADDY, JR., MD: Great. Thank you. I think everybody watching the webcast has noticed that you are dressed in a strange-looking outfit, and Charla writes, "It looks as though all of the appropriate measures of infection prevention are taken, but what would happen if the total joint becomes inflamed and infected after surgery?" And I might want to just touch again on some of the things that you mentioned. The hoods that you wear, we wear to prevent any potential infection, that is anything that you breathe out is then exhausted down below your ground to the floor. Although the viewing audience can't see it, we're in a room that's called a laminar flow room, that is the room turnover, the air in the room is turned over five or six times a minute through a device that runs from the ceiling, down through the floor, and then out through the walls, again reducing the incidence of infection. The patients are given antibiotics preoperatively, and the procedure itself is performed under very strict and sterile conditions. So another great question. The second half of the question is, if it becomes enflamed. And unfortunately, this is the worst nightmare for the patient and for the physician. If a knee replacement becomes infected, it depends on whether it's an acute or what we call a chronic infection. Acute infections are typically infections that occur within three weeks. They're typically treated with aggressive irrigation, opening the knee, washing it out, retaining the implants, but removing and changing the plastic, the hope being to retain the implants themselves, that they not be lost. Patients that have chronic infections, on the other hand, are those patients that present after three weeks with what we call varial in organisms, or other problems, and in that case, the entire implant has to be removed. Typically, a temporary implant is placed with what we call an antibiotic spacer that gives out a lot of antibiotic, and then the surgery is performed again at six or eight weeks or once the infection has been eradicated. So another great question.

00:45:10

Mario asks us, "What about postoperative pain?" And I think that goes along with the question that we asked earlier, the email asked earlier, and that was spinal anesthesia, et cetera. Patients that have general anesthetics, that is they don't elect for the regional anesthetic or the spinal, are typically given a self-controlled or what we call patient-controlled analgesic button and they can control their own pain control. Patients that have the epidural, it can be given that way. So either way does have good alternatives.

00:45:47

ROBERT C. SHARPE, MD: The extractor for this.

00:45:56

BURREL C. GADDY, JR., MD: What we're seeing right now is Dr. Sharpe is removing the trial components. And so now we are back to our native knee. The trial components are simply used to determine appropriate size, allow the procedure to be performed. However, now everything is prepared, and so we're actually ready to implant the actual components. And if we can, I'd like to switch back to me. I'd like to show the patients exactly what this patient is going to get. So what we see, again, this is our total knee replacement. Here's our femoral component, just so everyone can see one more time. And here's our tibial

component. So what we see here is a component in which the plastic, or the polyethylene insert, as we call it, which is the bearing surface, can actually swivel, swivel, or is mobile, if you will, on the fixed tibial component. So he will cement this component into the bone, he'll cement this component into the bone, and this tibial tray will be placed in here. But when in place, what we can see is it allows an element of rotation. What that does is it more normalizes, if you will, the kinematics, as we call it, or the motion of the knee, and it also reduces the wear on the polyethylene. That would be in comparison to our fixed bearing component that is held in place, and that's what we can see here. So this component, this piece of plastic can't move, it can't swivel, and it locked in place into the tray. All right.

00:48:03

ROBERT C. SHARPE, MD: And now what we're doing is preparing the last steps here before we implant our final components. We've used that power irrigator that we talked about earlier to clean off the bone surfaces and to remove all the bony debris. You can see the clean bone surfaces. And we're preparing what is called bone cement, which is the way that these components are fixed to the patient's bone. I don't know if we can get close up enough to see, but these portions of the bone consist of what we call cancellous bone, which has a lot of small holes in it, and the bone cement essentially functions like grout to go into these spaces to hold the components in place. We ready?

00:48:54

BURREL C. GADDY, JR., MD: Bob, can you put your finger down in the tibial -- in the tibial site so that the audience can see where that keel, as we call it, on the tibial component will drop into the tibia?

00:49:09

ROBERT C. SHARPE, MD: Yeah, it's in this circular shaped area that's been cut out here on the tibia. That component fits directly in there.

00:49:15

BURREL C. GADDY, JR., MD: Great. Is there any way we can get a view of the cement that's being prepared?

00:49:20

ROBERT C. SHARPE, MD: Yeah, this is the bone cement. And it's very doughy when it goes in. And over time, the chemical reaction causes it to harden.

00:49:37

BURREL C. GADDY, JR., MD: And if you could just show us how you've packed it down into that hole, that's great. Kevin writes, "The bone seems to be soft when cutting. Can you tell us how soft the bone is?" I think it's sort of deceptive to the audience that the bone seems to be soft when we're using sharp tools and sort of an aggressive approach.

00:50:04

ROBERT C. SHARPE, MD: Yeah, but it varies from patient to patient. This patient is 74 years old and her bone's a little bit softer than a younger patient's bone would be. We also see patients that have severe arthritic change and their bone actually becomes hard and reactive, what we would call sclerotic in certain areas, even at an older age. But in her case, her bone is about average for her age.

00:50:35

BURREL C. GADDY, JR., MD: Great. Andrea writes, "How much is weight a factor after having a knee replacement?" While you're putting the components in, I think I might just address that question. Weight is certainly a factor, unfortunately, in joint replacement. As I said earlier, it's metal and plastic, like anything it begins to wear, and unfortunately, patients that are overweight certainly are going to exert greater stresses upon it. So we encourage patients to lose weight. It will benefit the patients in many ways, not the least of which is in longevity of the prosthesis. In all fairness, however, I think that it's only fair to say to patients that studies show that there is no increased morbidity or problems for patients that are overweight. So although it is ideal that the patients not be obese or

overweight, it is also not fair, at least at the physician's discretion, to withhold the joint replacement for that reason. So, Bob, back to you now. Now what are you doing here?

00:51:35

ROBERT C. SHARPE, MD: Now we're cementing the femoral component in. This is our final component.

00:51:40

BURREL C. GADDY, JR., MD: I noticed you put the glue only on the end of the femur and not into that boxed or cut out area. How come?

00:51:47

ROBERT C. SHARPE, MD: Well, we don't want it to leak out into that portion of the knee and potentially affect that box mechanism there. Good. This system, though, has a closed box area, so really the cement can extrude into that portion of the knee. It can extrude out into the back of the knee. How are we down over here? Can I have that other impactor?

00:52:14

BURREL C. GADDY, JR., MD: Eric writes, "About how long does the procedure actually take?"

00:52:20

ROBERT C. SHARPE, MD: How long what?

00:52:24

BURREL C. GADDY, JR., MD: Does the procedure actually take.

00:52:25

ROBERT C. SHARPE, MD: Usually the procedure takes between an hour and a half and two hours.

00:52:31

BURREL C. GADDY, JR., MD: We as surgeons measure our time based upon tourniquet time. Once the tourniquet has been deflated and the blood is returned to the knee, the procedure essentially is over with the exception of the closure. Let's jump back to you, Bob, real quick. Before you push that in, if we could just show the audience, just pull that off once if you can. I want them to see that, because I think it's important for them to see this is sort of what determines where we are now.

00:52:55

ROBERT C. SHARPE, MD: Yeah, we've implanted our metal components and we're getting ready to put on our -- this is a trial component that we'll put in until the cement fully hardens, and then we'll put in the real spacer. Okay.

00:53:10

BURREL C. GADDY, JR., MD: And the purpose of those trial components is because we can dial varying thicknesses, which allows us then again to adjust the soft tissue balance, is that correct?

00:53:19

ROBERT C. SHARPE, MD: That's correct.

00:53:24

BURREL C. GADDY, JR., MD: Great question from Dave, which I figured would be coming sometime soon: "Why aren't all replacements the rotating type?" Want to address that, Bob?

00:53:39

ROBERT C. SHARPE, MD: Well, I think the...there's a couple of reasons, I think, in general. Number one, I think that in long-term studies, it has not been necessarily borne out that a rotating knee is any better for longevity of the implant. Right now it's sort of a theoretical factor. It may be better, but at least with this specific knee we don't have 15-20-year follow-up studies. Other surgeons have concerns because the plastic is not rigidly fixed to the tibia that it can rotate out or dislocate, what they call spin out, and can lead to problems with the knee and need for revising the knee replacement. That complication is very rare, but it has been reported. Meniscus. Can you hold this?

00:54:41

BURREL C. GADDY, JR., MD: One of our viewing audience asked what the insert, or the spacer, as we call it, is made of. And as we can see, if we go back to that close-up view, we'll see in a second, underneath that clamp off to the left, we see a piece of white, and that's the actual piece of plastic that's placed on the patella, or the kneecap. That is made of what we call ultra-high molecular weight polyethylene. It's basically plastic, but plastic at a grade that really is not seen anywhere else but probably the airline industry. That has an incredible potential for wear, or lack thereof, it's very durable, it's very lightweight, and it's really the standard for the implant spacers, at least at this particular time. Some of the audience may have heard about other spacers, including ceramic and including metal, but at this particular time, plastic remains the only accepted and approved spacer for total knees. So there is no ceramic spacer, there is no metal on metal implant in the United States.

00:55:49

Francois asks, "What would happen if the knee replacement were to loosen?" Well, besides me crying, unfortunately, it has to be redone. When patients present later with pain after a knee replacement, plain x-rays might oftentimes show signs of loosening. And when that's the case, unfortunately, the procedure has to be redone. The implant is removed and a new implant replaced. First and foremost is establishing why the implant is loosened, and that can be any various reasons, infection being the most important, but simply time. But once established or determined that it is loosened, unfortunately it does have to be revised. Another great question that I see. Mary says, "Are prophylactic antibiotics still recommended for dental procedures after having a knee replaced, and if so, for how long?"

00:56:53

ROBERT C. SHARPE, MD: We recommend that for at least the first two years after joint replacement that people receive prophylactic antibiotics, even for routine dental cleaning. And then after two years, we recommend for any invasive dental work -- root canals, tooth extraction -- that the patient receive prophylactic antibiotics. And there are other procedures that we recommend it for. Most commonly people will have colonoscopy or sigmoidoscopy on an outpatient basis. And typically they would not receive antibiotics, but if they have a joint replacement, we recommend it for that. Most other invasive surgical procedures, the patient's going to receive antibiotics that will cover their joint replacement.

00:57:36

BURREL C. GADDY, JR., MD: Great. We have an interesting question here from Robert. He says, "As far as the patellar reflex is concerned during the operation, how is it suppressed and regenerated?" That might be something that you could show us, sort of going back to your exposure, how it is that we sort of move around the envelope of the knee, the soft tissue envelope, rather than actually violating it except in specific areas.

00:58:00

ROBERT C. SHARPE, MD: Yeah, we actually do not detach the patella or the patellar tendon, which is responsible for the reflex.

00:58:05

BURREL C. GADDY, JR., MD: Can you show us that, Bob? Can you show us the patellar tendon, please?

00:58:08

ROBERT C. SHARPE, MD: Yeah, let me take off this clamp here. If we flip this portion of the knee over, here's our patella. And then here distally is our patellar tendon as it attaches to the shin bone, or tibia. And that tendon is not cut. The incision that's made to get into the joint is made just medial or just to the inside of the patellar tendon. And then when we close the knee, we repair that soft tissue to the patellar tendon to close the joint. And so the patellar tendon reflex is really not affected by this procedure. During the procedure itself, the anesthesia really inhibits the reflexes. The patient has either a general or a spinal anesthetic, and their reflexes are absent while we're operating, and so that it doesn't affect the procedure. How are we doing?

00:59:04

BURREL C. GADDY, JR., MD: Mary asks, "Are prophylact--" I think we already asked this, but I don't think I answered the question. Prophylactic antibiotics are joint replacement is an absolute must for two years. The American Dental Association and the American Academy of Orthopedic Surgeons have gotten together and recommended prophylactic antibiotics for two years for any invasive type procedures. So dental procedure the most common; however, any type of surgical procedure, it is absolutely necessary. At that point it's really to the discretion of the surgeon as well as to the discretion of the dentist whether the patients want to continue on with it. How's our cement doing there, Bob?

00:59:49

ROBERT C. SHARPE, MD: It's almost done. We're just waiting for it to get completed.

00:59:54

BURREL C. GADDY, JR., MD: We'll just take another question or two. Gracie says, "I'm having surgery in about two weeks. All I have to sleep in when returning home is a waterbed. Is that going to be possible? It does have padded sides." What do you think of that?

01:00:15

ROBERT C. SHARPE, MD: Well, I think it's going to be relatively difficult for her to get out of bed with a waterbed most likely. I think a firmer mattress, or unfortunately, sleeping on the couch would probably be easier. This is going to limit your mobility pretty significantly, and unless you have a lot of help getting in and out of bed, the waterbed is probably out for quite a while. I think we're good on our cement. Do you have the Z retractors?

01:00:46

BURREL C. GADDY, JR., MD: We'll just take a couple more seconds and watch you place the actual spacer here so the audience can see. And then I think we'll be about to the end of our time. So this is our temporary spacer, or our implant. This is our trial. And you're going to remove that, and then we're going to place the same exact size but one that is continuous. This is two pieces, as the audience can see, but what we're going to place is one piece.

01:01:30

ROBERT C. SHARPE, MD: Do you have a burlier?

01:01:39

BURREL C. GADDY, JR., MD: I think the audience can see real well our components except for the insert: our femoral component on the top, the tibial tray that we just see in profile, and then the patellar component, which is the plastic.

01:02:00

ROBERT C. SHARPE, MD: We're just checking to make sure that all of our bone cement is out from around the knee and there's no soft tissue structures that would -- let me have a small rongeur -- prevent this plastic from going in the right way.

01:02:16

BURREL C. GADDY, JR., MD: Besides just making an x-ray look good, what is the risk of that cement being in there, especially if it became loose?

01:02:22

ROBERT C. SHARPE, MD: Well, it could -- if there were large enough fragments, it could cause potential wear of the plastic components. It could damage the joint surface. So that's the main concern with this. This is our final plastic component. I know you've shown them the model of the this. But this has a peg that goes inside the stem on the tibial component and then is allowed to rotate in there. It's a very smooth plastic. And again, here's this post mechanism that goes up into what we call the box, and this provides the stability from front to back to prevent that instability from cutting out of the cruciate ligaments.

01:03:06

BURREL C. GADDY, JR., MD: That's great. One thing just as you put that in and before we end here, I think it's important for the audience to see we're very careful with the actual

components in terms of potentially scratching them, and the reason being that it is plastic, and a simple scratch in that metal can lead to significant wear, especially early wear of that plastic. So everything done with the original or the actual components is very careful in order not to damage them.

01:03:34

ROBERT C. SHARPE, MD: Yeah.

01:03:35

BURREL C. GADDY, JR., MD: So if you could range that just a couple times, Bob, so that they can see now how things move.

01:03:39

ROBERT C. SHARPE, MD: Yeah. We'll move the kneecap out of the way and you can see how the metal and the plastic rub on one another. It's hard to see the plastic rotate, but it does rotate very slightly when the knee is bent.

01:03:52

BURREL C. GADDY, JR., MD: Great. And if you could just do it once with the patella flipped down.

01:03:54

ROBERT C. SHARPE, MD: And the other important thing that we haven't mentioned much tonight, but it's very important for our kneecap -- you can take your thumb out of there -- to track appropriately when you bend the knee. The kneecap should ride in this groove on the end of the femoral component, and you should be able to bend the knee without touching the patella and it should not dislocate or move to the outside part of the knee. And so that tracks perfectly. And the patient has good, full extension or straightening of her knee, which is critical.

01:04:22

BURREL C. GADDY, JR., MD: Wonderful. Well, it looks like we're about out of time. I'd like to thank our audience for joining us this evening and for what I hope was a very informative webcast. I'd like to also extend a special thanks to our patient, who certainly without their cooperation and generosity, none of this program would have been possible. Additionally, I'd like to thank all the OR staff, all the production staff who made the webcast a success. I'd remind our viewers that an archive of this webcast will be available in the future at shawneemission.org. Dr. Sharpe, any final thoughts or questions before we leave?

01:04:58

ROBERT C. SHARPE, MD: No, I just want to thank our patient again for allowing us to perform her procedure tonight, and thanks to the production staff and the operating room staff for helping us out this evening. Thank you.

01:05:10

BURREL C. GADDY, JR., MD: Wonderful. Well, this has been a total knee replacement live from Shawnee Mission Medical Center here in Merriam, Kansas. I'm Dr. Burrel Gaddy. For Dr. Robert Sharpe and for all of us here at Shawnee Mission Medical Center, we'd like to thank you for joining us, and have a wonderful night.

01:05:29

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01:05:50

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