DR. DAVID ROVINSKY: Aloha from Kauai. I'm Dr. David Rovinsky from the University of Hawaii. And tonight we're going to talk about gap balancing with the NAVIO system and the Journey II Total Knee. So we'll start off with a presentation followed by a video of a case, and then we'll take some questions and answers. So let's go to the presentation.

So we're going to be talking about how you think the NAVIO system will really let us have all the benefits of the design of the Journey Knee. I'm a consultant for Smith-Nephew, as well as OrthoGrid. I'm also a 50-year-old guy with knee arthritis. And I like to do fun things like snowboarding, and surfing, and yoga. And this is why I got involved with Smith-Nephew back in 2004 working with the Journey Knee and in 2016 with NAVIO. Because patients, like me, just want to have fun. And a high performance knee isn't just for young patients.

This is one of my patients who's 80 years old. She's an avid yoga practitioner, and she really wants to be able to do her yoga practice. But if you think about it, an older patient comes to you with later disease, more deformity, weaker quadriceps. They're going to benefit significantly from a knee design that optimizes quadricep function, and makes it easy for them to get their range of motion back.

So the Journey system goes all the way from the XR where it has a bi-cruciate sparing design, letting you save the ACL and PCL, all the way up to a BCS which can be used for patients with up to 15 degrees deformity. The concept of the Journey Knee is to make cuts that release [INAUDIBLE]. We want to make a good meniscofemoral cut, and get parts of a tibia cut to restore neutral mechanical axis. And then we'll have a flexion gap that's balanced and rectangular.

The difference with the Journey Design is that you're putting back what you're taking away. With polyethylene on the tibia thinner medially and thicker laterally, and the femoral component is thicker medially and thinner laterally And the concept is to reproduce and match the natural anatomic contours of the femur with this asymmetric component. And on the tibia, you have a concavity on the medial side and it convexity in the lateral side, and this is reproduced in the polyethylene design. And the contact between the femur and the tibia will drive normal kinematics.

So if you reproduce anatomy, you can reproduce function. And as you see here in the normal

knee and in the Journey Knee, you have a medial pivot and posterolateral roll back as you go into deep flexion. And this is critical if you're going to do deep flexion activity such as surfing, where you have to flex 145, 150 to be able to stand up on the board. But at the same time, you need to have excellent stability in midflexion because the basis of activity is between 30 and 60 degrees.

So the other advantage is if you can reproduce normal ligament strain you'll have faster patient recovery. And it was interesting to get a phone call from my therapist after a NAVIO for a few months asking me if I changed my implants. Cause I got a call wanting to change from the Legion to the Journey as the patients were recovering faster. And when he saw my NAVIO patients he thought I'd changed the prosthesis again, but I hadn't changed the prosthesis. I just had changed the tool I was using.

So for our total knee goals are the same. Neutral mechanical alignment. We want to match patient anatomy. We want to have a full range of motion. And we want excellent patella tracking. So the Journey has a very precise design, and we have to look at the tools we're using to put them in. And we're very comfortable with traditional instrumentation. And this is how we prep to do our knees. But if you look at this patent of the extramedullary guide, you see how hard it is to reproduce posterior slope. Because you're looking at the anterior cortex of the femur, and that's not parallel to the [INAUDIBLE]. And you're estimating what the slope is going to be.

And gap balancing is how I was about to do these, and it's really critical. In the top right photo you see an example of femoral fiber lift off. And this is what midflexion instability feels like to a patient. And gap balancing uses a tensioning tool to make sure that your femoral component rotation is parallel to your tibia. And if you're using anatomic landmarks, you're going to be very imprecise. So we have also studied an actually a great article from last month in the Yellow Journal, the Journal of the American Academy of Orthopaedic Surgeons, found out about how gap balancing improves flexion stability.

So when we're looking at tools, I think about surfboard shaping. We can make an excellent surfboard using these very simple manual tools. But when my son gets this surfboard shape, he sits down with the shaper at the computer. They design the board on the computer aided design machine. They take a blank, they put it in CNC machine, and the CNC machine builds the board. And this to me seems a more precise way to make a surfboard.

So why should we use this knee specific technology when we're doing total knee replacement? And this is what we have with the NAVIO. We're using a computer aided design to virtually do the surgery, and then we use a handheld robotic tool to precisely execute our plan. And the system has a small footprint as a computer that communicates with the handheld robotic tool using infrared camera and reflective arrays. And these are the same reflective arrays that are used in video games, computer graphics and have been used for years with computer navigation.

The unique features of this unit is that you have the ability to make a precision plan, execute that plan precise and verify that you hit your target. You can do dynamic gap balancing, not just at 0 and at 90, but through the full range of motion. And it's useful for UNIs, PFJs, and total.

So we'll run through a case, they're showing the algorithm of how to do gap balancing. This is a big fella. He's 6 feet, 243, and he's a hockey player. Has pretty beat up knees, and he's very active. He enjoys hunting and surfing. And his knees are typical varus deformity, and he also has stiff knee with a maximum flexion of about 90 degrees. And you can see here on his x-rays, his left knee's a little worse than this right. But bilateral varus deformity, and he also has significant patellofemoral arthritis.

So we opted to do bilateral knee replacements. So in the surgery, the first step is to define the hip's center by rotating the hip. The next step is to define the center of the ankle. So we identify the medial and lateral malleolus, and a 60-40 split between the two as the center of the ankle. Because at the end of the surgery we want to drop a line from the center of the hip to the center of the ankle and have it go through the center of the knee. Just like when you put your tires on your car, you get the alignment fixed so you have the best opportunity for wear.

So this is the critical step for gap balancing. So when we do our exposure, we resect osteophyte and we do a preliminary ligament release. This is just the same as if we're doing gap balancing with manual instrumentation. We then take the knee through a full range of motion, and you can see an image on the right, the excursion of the MCL and the LCMO. So this is critical for when we do our planning step.

The next step is to do a surface mapping of the knee. So this gives us a virtual 3D model of the knee that we can manipulate in real time. The planning is critical. And some people get overwhelmed by this step, and this will take a little bit longer initially. And I'm going to give you

guys an algorithm to run through this quickly.

So the first step is picking your size of your femoral component. You want to pick the largest size that you can that does not give medial lateral overhang. And the Journey is relatively narrow compared to the Legion knee, for example. A five Journey is the same width as this four Legion. So we know our size from preoperative templating. But the computer also helps us gauge ourself. Then we position the component and center medial/lateral And then if we look at this view on the top left, we can set our distal femoral cut. We set it at 10 millimeters because we know that the thickness of the Journey implant is 9.5 mm. And then we take the component, if you look at the bottom right of the screen, an just push it as far posterior as you can so that our anterior cut is even and level with the anterior cortex.

We've then got our tibia placement. The tibia is generally one size smaller than our femur. So a six femur gives us a five tibia. And we center the tibia anterior/posterior, and medial/lateral. The top right we can dial in our posterior slope. So for a BPS knee, we want three degrees. For a CR or an XR knee, we want 5 degrees. And then we look at the top left and we start off by matching the top of the component with the patient's prime line.

Then we're going to fine tune the position of the femur and the tibia with our gap balancing screens. So if we look at the very bottom right at our flexion gap, if it's blue like this, this shows that we're loose. So we're loose in flexion, and we have a slightly triangular gap. So what we want to do is rotate the femur so that we have a rectangular flexion gap. So we rotate it by one degree and now we have a nice rectangular gap.

Well, we're loose in flexion by almost two millimeters. And we're loose in flexion. I'm not worried about tracking our extension yet, because this just predicts that we're going to have to do a little bit more ligament release to get to the proper balance of extension. And this is what would be expected in 7 degree varus knee. So if you're loose in flexion and extension, you're going to cut less tibia. So by moving the tibia up a little bit we now have a nice flexion gap and a nice extension gap.

So if you'd like this plan, this is exactly what you're going to get. So this is the algorithm for component placement. I include it in the talk, but it will be available to you from Smith-Nephew reps, or we can mail it to people who signed up for this webinar.

So the femur again, pick the biggest size you can without medial/lateral overhang. Center the femur distal femoral cut 10 millimeters. And then place the components flush on the anterior

cortex. Tibia is generally one size smaller. Center the tibia component. An initial placement of the tibia component matching the less affected joint line.

And then the gap balancing screen, you want to adjust the femoral rotation to make the flexion gap rectangular. Generally not more than one or two degree and it may be internal or external. And then extension gap, again if it's triangular you may need to release more ligaments later. And the goal is to have the gap less than a millimeter. Because we don't want to have femoral fiber lift off. And the apposition of the femoral and tibial components allows the contours of that tibia to drive kinematics.

So the BUR is used to prepare your distal femur. So we're just using the BUR to do our distal femoral cut, and to set the rotation of our five and one block. So you can see here, this is the model our distal femoral cut. And as you erase bone with the BUR, the computer model is updated. And this is a very [INAUDIBLE] step. And if you want to you can insert a block to make sure you've achieved full extension.

We then position our five on the cutting block, and we make our standard cuts as you would with manual instrumentation. And we can verify that we are on plan. So in this case we're within 0.2 degrees of our flexion extension and within 0.3 degrees of our rotation. So generally, if I'm within half a degree or half a millimeter, I consider that acceptable.

The tibia we apply and we use the verification we call it the plane checker to make sure we've set our block correctly. Then after we make our cut with the saw, we can check our cut. And this is what the screen looks like. So we have perfectly neutral cut with 0.2 millimeters variation from plan and 0.1 degree variation from posterior slope. Again, that's very accurate, and I'm accepting that level of accuracy.

And then after we've run our trials, we can check and make sure we hit our target. So as we use a [INAUDIBLE] less than one millimeter lift off or gap through the full range of motion. And it shows us also that we've restored neutral mechanical alignment from the 7 degree varus [INAUDIBLE]. So these are our post-op films. I have no hesitation bilateral knees. And these are post-op standing films. You can see the restored neutral mechanical alignment. And he's achieved full extension.

This is him walking post-op day number one. So most of our knees go home either the same day or after an overnight stay. He went home post-op day one. This is him coming back to the office post-op day number five. So the speed of recovery is really remarkably different if you

balance the ligaments correctly. And this is very important because he's a self-employed contractor. So he's back to work three weeks post-op.

So I've been using this system for two years and I've had very, very reproducible results. The question is always does this add surgical time? The answer is initially it does, because you're adding additional steps. The exposure is the same as normal, but you're placing pin, that'll take two to four minutes, collecting data, about 10 minutes. Surgical planning initially is about 10 minutes, but as you get more familiar with the system, it's now less than a minute. And then making the cuts it's pretty quick, because you know as you make the cuts that you're hitting your target. And then cementing is cementing. So it still takes about 50 to 55 minutes for a total knee.

Take home messages, our patients want to perform at high level. They want to do high level activity. We have a high performing beautifully designed implant that requires you to do a bit job putting it in to take advantage of this design. And we have an excellent tool in NAVIO to let us do precision gap balancing with bone milling and preparation.

So I've been very pleased with the results with both the Journey Knee and the NAVIO system together. And in my practice, I think it makes sense to use the best tools and the best plans that are available to exceed our patient's expectations and let them get back to doing the things they love to do.

So thanks very much for your attention to our talk. I'm at Kauai Medical Clinic and Wilcox Medical Center. We're a VSP site. We enjoy having visitors, and we're also a medical tourism destination. So we'll transition your case video. So this is a nurse from our hospital, 61 years old, and he's retired and wants to do missionary work. And at the [INAUDIBLE], we can see he has a pretty typical pattern of arthritis. He has varus alignment, and he has patellofemoral wear. And he's signed up for a Journey II BCS bi-cruciate substitute knee. So let's go to our video and we'll chat a bit after the video is completed.

And our final patient is another very active guy, and he is doing missionary work and does work in Nepal. So he needs to be on the ground. He needs to squat. So his key thing that he's looking for is a knee that has an excellent range of motion. So the Journey Knee can do that, but you have to put it in correctly. You have to have a nice balance of not only flexibility but stability. So a lot of times when you're looking at doing a knee on someone, you're making a choice. You're having to err and make the knee a little loose to get that flexibility. Or if you

have someone who's going to be very aggressive, you're going to make them a little tight so they don't have any midflexion instability, and they like how their knee feels.

So with the NAVIO we can dial it in. We can get a knee that has full extension, because he also has a flexion contracture. So we're going to move our femoral cut up a little bit to accommodate for that. And we can make sure that knee is balanced not only in extension and in flexion, but the full range of motion. So we'll give this patient the combination of stability for climbing mountains and being very active on uneven surfaces in Nepal. And also the ability to sit and squat and live on the ground. So this is a combination of features of both the Journey and the NAVIO that's going to hit the sweet spot for this patient.

Size six femur. Size five tibia. 35 patella. So this is another example of a patient, the preparation is everything. So having this [INAUDIBLE] here to hold the drape down and stay out of the way of the computer is important. Having this wrap around the proximal thigh over the tourniquet. You really want have an unobstructed view between the arrays and the camera sensor. And resect a little bit of synovium here to give us some working room. OK, good.

So, this patient has a pretty neutral alignment so go to the top here, make sure we can release some tissue. I want to expose the anterior surface of the femur so I can do a good job mapping the anterior cortex. This will avoid issues with notching and again, help us get our sizing accurate. You don't need to make a huge spot, but just enough where you have a footprint available for your femoral component.

We'll cut the patella first. Two towel clips. So what I'm really trying to do at this stage is thin out the patella, not do our final cut, but just make the rest of the procedure a little easier. 24.

So we'll mark some landmarks. I'll mark Whiteside's line. Mark the center of the knee. We'll release the anterior horn of the lateral meniscus. And we know we're going to do a cruciate substituting knee so we can take away the ACL. That helps move things around and give more realistic balancing. And then we'll mark the center of the tibia, which is generally ACL footprint between the spine.

We're going to put our trackers in. That's the next step. So two or three finger breadths below the incision you want to be out of your way and centered on the tibia. Then two or three finger breadths above and do our best not to violate the tattoo. It looks like an external fixator perpendicular to the anterior medial cortex of the tibia. Engaging or just through the posterior cortex same as what you would do with an external fixator.

So we have long pins for the femur, and we try to put this in with the knee in flexion. There we go. And for patients with larger thighs like this in the long pin-- So you want to position these so that the computer arrays are visible to the robot. And once these are locked in position they cannot change during the procedure because they are your reference points. So you want to make sure that you like them. So I'm going to look at the screen and make sure that when I take the knee through a range of motion it's still visible. So I like that position. Chamber check point. All right.

So you want to define the mechanical access of the tibia. So medial malleolus, lateral malleolus, and then we get the center of the hip. All right. Measure full extension. All right. Good. Now this is where we test our ligament excursion. So this is the gap balancing portion. So I've put a Z retractor between the tibia and the femur. And this is just give me an idea of how our ligaments-- how much flexibility our ligaments have. Very helpful when you do the gap balancing portion of the planning. And our goal here is to get these excursions to be pretty close.

So this is a pretty neutral knee. And we're very close in terms of our excursion. Knee center, so the line the computer draws between the knee center and the center of the hip is the mechanical axis of the femur. This is the posterior aspect of the femur. So from this number here, from this location, is where you get your flexion cut. This is your notch point where the saw blade is going to come out. This is Whiteside's line which I drew.

Now we do our collection of the tibia, of the femur, and this is digital mapping. Right? So we're just basically tracing first the outline of the femur. And you want to stay on the bone. I use two hands for this. I'm going to map here, rotate down a little bit the anterior femoral cortex.

So when I'm placing my femoral component, I want the femoral component to rest right on top of my anterior femoral cortex. So this lets the computer know where it is. Now I'm just coloring it in, filling in my outline. I'm looking at the screen doing this. And you want to stay on bone, but if you come off bone for a few clicks it's OK. The computer model will average it out. It'll say that's anomalous data and unweight those points.

All right let's go up to the top. So precision mapping of this area is not as critical. We really are very interested in the shape and contour of our weight bearing surface. So these data points are really important.

Tibia, so we're going to make some landmarks. Right, so the center of the knee-- so a line between the center of the knee that we define and a 60-40 split between the medial and lateral malleoli is your mechanical axis of your tibia. We're going to mark the high point of the tibia plateau. Same place you'd put your feeler. Relax here. To connect the rotation of the femur and the tibia, we drop Whiteside's line straight down onto the tibia at 90 degrees. And then we do our mapping of the tibia.

Same thing. Outline, we want to map this intermedial bone because that's where we're going to put our cutting guide. I'll show you that later. But the most important mapping is the surface of the tibia. Let's go over to the lateral side. Then we're going to look at that bottom left screen and make sure the femoral component is centered medial/lateral. Then we go to the top left, and we're going to cut our distal femur. So we know that the femoral component requires at least 10 millimeters of cut to fit and then if they have a flexion contracture, we'll add a little bit.

And then we're going to shift that femoral component posteriorly as far as we can so it's resting right on that anterior cortex. So if you look at that image in the bottom right, and you like it, that's what you're going to get at the end. So we're really trying to match the contour of the patient's anatomy.

So now we go to our tibia. Tibia's generally one size smaller. So six femur's a five tibia. We center it on the tibia. Make sure we like our position. We look then at the top left screen once we've got our tibia centered, and we're going to cut 12 millimeters off a less affected side cause 12 millimeters is the thickness of a nine millimeter insert plus the tibial tray.

Top right image will show us that we have a posterior your slope of 3 degrees, which is ideal for the BCS component. Positioning of our femur and our tibia is preliminary. Right? We're going to look at that then adjust it for our balance. The first thing I look at is the bottom right. It shows us our flexion gap, which is triangular. And we're going to externally rotate the femur so that we get a neutral flexion gap. So now our flexion gap is rectangular.

But look, we're loose in flexion and we're loose in extension. So we're going to cut a lot less of the tibia. So nine and five, I think that's going to be good. So our goal is to have a flexion gap is less than a millimeter. Our extension gaps a little bit loose. So let's cut a little less distal femur. 9 and elev-- let's go a little bit less. Even more down. So there. So this is allowing us to virtually place our five and one block. If we want to move it medial or lateral we can do that, but generally that lines up nicely.

Now we're looking at the placement of our tibia cutting block. So removing a little bit anterior, a little bit medial, so that the cutting block is over in this section of the tibia and very accessible. So now we're going to verify our checkpoint. So before you do any cutting the computer says, let's just make sure that our checkpoints are where we think they are. Make sure that our computer model is stable.

We're going to look at this, and we say this looks quite good. We're really just about at the sulcus. Small circular motions trying to keep your Burr perpendicular to the surface of the bone. The pink represents three millimeters or more. The green is one millimeter. The blue two millimeters. So we're trying to erase down the white. The red means that you're gone deep. Less than a millimeter. If look in the top right of this femur, see what's happening to the Burr is when I hit the depth that's desired the robot control will retract the Burr into the hand piece. So it's kind of coloring and you're not allowed to color outside the lines. And you have some help, so you feel very good about what we're doing.

And what's important is that I'm sitting here doing this work, and I'm looking at the screen only. I'm not looking at the patient. So my assistant is doing the retraction, and he's watching very closely to make sure that I'm not going to cause any harm to the soft tissues. And there is good evidence and long term studies that show that you don't have any increased injury or risk to the patient using this high speed Burr.

Now I'm going to mark the hole for my five and one block. Make sure I hit that target. And I go to the other side. Now the nice thing about preparing the distal femur with the Burr is that if we decided that we didn't have enough distal femur resected, but we want to resect a bit more, we just would go back to the screen and move our virtual femur approximately and come back and just use the Burr to take a millimeter additional bone off the distal femur. Pretty easy.

And you could prepare the whole femur this way if you wanted to. You could do the entire prep of the femur with the Burr. But we find it a lot easier to do it with the Burr for the distal portion, and then the five and one block for the rest. And I'm trying to hold my Burr and looking at the screen. Trying to hold it as I can perpendicular to the surface that we're cutting so that I have a nice flat surface.

So now what I'm going to do is I'm going to mark just using a probe the center of these holes so that I have my rotation set. There we go. So when I put my five and one block on-- And if you're doing a shallow tibia cut, you're going to have a keyhole appearance of the

[INAUDIBLE] for the guide. Let's go to the other one.

In this case I'm bracing my left hand against the tibia to give me a little extra control. Cause this is a very precise step. That's good. So now we use this tool now as a plane checker. So we're right in there. We're within half a degree so that's acceptable. And the cover serves as your standard journey cutting block.

So what we're going to do is we're going to make sure that we're hitting our target of rotation. So these numbers here are deviation from target. 0.3 degrees. 0.2 degrees. That's very precise. I'm going to double check one last time. I have a [INAUDIBLE] to make sure that I'm not notching. And I feel like we have a very safe cut. Let me have a double prong. And then the saw, please. So we have a very familiar looking grand piano sawing.

The essence of gap balancing is rotation of the femoral component, because the positioning of your distal femoral cut is going to be to give a neutral mechanical axis. But you have to adjust the rotation of your femur so you get a rectangular flexion gap. And measured resection won't give you that data.

Driver. Residual osteophytes. Looks good. Then we'll take a double prong. This will help translocate our femur interiorly. We're doing a BCS knee, so we can release the PCL. So one thing that we've observed is that when you release the PCL and your flexion gaps a little tight for a PS knee, and you're assessing your gaps. Prior to releasing your PCL, then that's going to end up with a nice result. So I was OK with a little bit tight flexion gap. So these are deviations from plan. Within a degree or two. Less than a degree is kind of my goal. Saw blade, please. I'm good with it.

So the nice thing about this tibia cutting block is that if I want to cut another two millimeters, I leave these pins in, just drop it down. So one nice thing about this tool is that you can make this precise plan and execute it, and then verify that you hit your target. So how do we like our cut? Well, our cut's right in there. It's within 0.2 degrees of target. I can accept that. We don't need to re-cut the tibia.

And you'll see this dance that we go through so in the exposure, my assistant's across from me, which is very helpful. When we're doing a lot of the computer robotics stuff, she needs to be out of the way of the tracker, so she comes over to my side. And now we go back doing more normal total knee stuff, you can go back into this typical position. Lamina spreader.

So this is a euphemism for periarticular injection. Everyone has their own magic recipe. Basically we want to try to infiltrate the soft tissues around the knee. We use an adductor canal block. We use multi-modal analgesia. And we use the periarticular injection to help with post-op up pain. I use a relatively dilute injection because I want I get this medicine spread around quite a bit.

So the placement of this is manual. It's not robotic guided. I want to make sure that I'm not getting fooled so just recheck and make sure I get my medial tibia osteophytes out of the way. So if you get optimal coverage, you'll generally get optimal rotation. I slide at medial and interior and some abutting the bone. Guy's got great bone.

And then we'll just double check and make sure-- there's our tubercule. There's our line medial third tubercle. And we'll pin it in its position that we like. Journey trial on. It has this up-slope posterior cardinalis. And we just have to hyperflex the femur. And then you get the condyles. And then you raise your hand to put it into position. Pretty easy. Mallet. And come to me a little bit. So, I'm pretty much as far lateral as I need to be. And that overhang-- good. They were centered nicely medially and laterally. And we don't want to come any more lateral or medial, so perfect. You need more? Slap hammer. Rongeur.

SPEAKER: Tight.

DR. DAVID ROVINSKY: Tight. I think it will be good. We've got plenty of room, it's just rotation. Here we go. Perfect. So this is where we check our work. Point probe.

SPEAKER: [INAUDIBLE]

DR. DAVID ROVINSKY: I put in a 10 poly. So again, verifying our model is stable. So it looks, this checks our range of motion. So this shows us that we regained or gained about five degrees four or five degrees of motion from pre-op, which is good. And we got him bending to 145.

And this is where we check our balance. So he went from neutral to one degree varus to neutral alignment. And this is checking his balance. So this is a perfectly balanced knee, less than a millimeter throughout the full range of motion. So this is where you can check your work, and make sure you did a good job gap balancing.

And with a BCS knee, you're depending on the geometry of the components to give you stability. So you want a gap of less than a millimeter. So this is a neutral alignment, perfectly balanced knee, comfortably gets the full extension. And just hanging gets about 135, 140. So

we're going to accept these components. And now we're done with the robotic portion of the program.

So we make sure to remove the trackers. One and two have been removed. And even though I was talking her way through it, using the robot doesn't really add a lot of time because you know your target. You can just move forward. You're not re-measuring, rechecking. You know where you're headed, and you can get there. Let's do [INAUDIBLE] now. We'll finish the patella cut.

Let's go vertical. Let's do it. All right, 35 is the number. So let's see our implants. 6, 5, 35. Good. So I can use this and really actually create compression or my cementing inside the tibia I like that extra fixation for the tibia component.

So you know you have a nice tibia cut when the cementus falls away like that. That makes me very happy. So even though he did not have a lot of deformity, he still has a fairly tight knee. So we're working hard, but we have good exposure all the way around to make sure we have good cement technique and can remove any excess cement. Go Rongeur. Small. I got it. Let's get our femur. Again, we're hyperflexing the femur. We get good exposure back there. Very good. Then hyperflexing it. And then bringing it up. Mallet.

SPEAKER: [INAUDIBLE]

DR. DAVID ROVINSKY: Another 30 We have the 11 trial ready. So with 11 he's a little bouncy. We'll go with 10 real deal. Yes, poly excreted a little bit of cement on the femur, but when we ranged it, it was too tight. Pop straight in there. Hand me the patella clamp. And it goes right back where it came from. You can have that nice sharp angle that fits in there like a puzzle piece.

So the barb suture, any variety is good to try to get yourself a watertight closure. [INAUDIBLE] So let's do our final check, make sure we like what we got. So he comes easily to full extension, and flexion. This hanging freely about 135, and he'll be able to get about 140. So nice and easy, straightforward knee. Very, very stable throughout the full range of motion. Very reproducible, efficient. He's going to love it.

Nice beautiful knee.

OK. So that was the NAVIO and Journey II with the distal Burr technique. So once again, pre-op films. Pretty neutral alignment medial and patellofemoral disease primarily. These are the

post-op films. And if you look at the AP you can appreciate that we've restored three degree varus of the tibia. We're a little bit thinner medially and laterally. And if you look at the lateral film, you see how that femoral component's sitting beautifully right on the anterior cortex, and we've matched the gam shape for the femur.

So if you match the anatomy, you can reproduce the kinematics. Long lit film shows up got a nice leg for the neutral mechanical axis and did patella tracking. And this is our patient six weeks post-op. He's back at work gardening and working on his farm. So let's transition and take a few questions from our audience.

AUDIENCE: Hi, Dr. Rovinsky, we have a question for you.

DR. DAVID ROVINSKY: Let's hear it.

AUDIENCE: How long is the typical recovery time for a complete knee replacement?

DR. DAVID ROVINSKY: So the recovery after total on the knee using Journey and NAVIO is now approaching the speed of recovery that I'm used to seeing and my total hips. And I do correct the interior hip replacement. So a total knee is still a big operation. So people are on crutches or a walker for about a week. Then by two weeks when they come to clinic, they're usually on a cane or using nothing. And as you saw by four weeks, they're pretty much over the hump.

AUDIENCE: Very well. Another question for you Dr. Rovinsky. In your hands, what does NAVIO provide in comparison to standard instrumentation? Specifically measured resection type of person versus a measured gap balance.

DR. DAVID ROVINSKY: So manual instrumentation, standard notation is a measure of resection technique. So you're not adjusting the femoral component rotation to balance the flexion gap. And that's why up to 30% of knees that are done with manual instruments, or even with computer navigation where you have nice mechanical resection, if you don't get femoral rotation you're going to have lift off. With a manual gap balancing technique, you have a better chance of getting midflexion stability and getting your femoral rotation correct. But you're only getting that data in full extension and 90 degrees of flexion. With a NAVIO, I'm getting information through the full range of motion. And I can adjust subtlety in the component position that will affect my flexion gap throughout. And I think that's a big, big advantage.

AUDIENCE: Thank you, Dr. Rovinksy. Another question for you here. What drove your interests to adopt

and use robotics for your total joints?

DR. DAVID ROVINSKY: Before I went to medical school I was in computer software for three years. And when I started doing Orthopaedics, I found it really curious that we were eyeballing a lot of our cuts. And I immediately gravitated toward computer navigation. And I used that for about 10 years. And then I transitioned to custom patient instrumentation, the Visionaire system, and it still was an improvement but didn't incorporate the gap balancing. So robotics was the next evolution. And I guess as I eluded to earlier, when I looked at my knee, and I thought, OK I'm going to need a total knee, none of the implants out there or techniques out there were something that I wanted to have for my own knee. So that's why I got involved with the Journey project and then the robotics project. Because when I get my knee, it's going to be a Journey II XR and it's going to be done with NAVIO.

AUDIENCE: Excellent. Next question for you. How did you integrate NAVIO into your practice? Was it gradually over time or did you block out sections of your day and do several cases in a row?

DR. DAVID ROVINSKY: So this is something that we've been interested in and looking at the best way to do this. And I went to Australia and we had two surgeons looking at their first 50 cases. So what we found is that for most surgeons, you have a significant drop off in time by case eight or ten. And your time continues to drop until 30 or 40, and then you hit a steady state. And what we did initially is we scheduled one NAVIO per day at the end of the day.

And it was important to get the staff engaged and tell them why we're doing this surgery, and inform them that it's going to take a little bit longer. Our first cases took about 20 to 30 minutes longer. And by about case 25, we were time neutral again. So I think that preparing your staff, getting them on board and understanding what you're doing and why you're doing it, and scheduling the timing appropriately. Like you wouldn't want to do a NAVIO in the middle of a day when you have two rooms, two teams, and the OR schedule's counting on you to do your standard time.

But then rapidly you can get back to your normal pace. And now we have two rooms, two teams and basically as soon as I've accepted my trials, and I've seen that my cuts are good, we dismantle the robot and move it to the next room.

AUDIENCE: Thank you, Dr. Rovinsky. Another question here for you. What are the different workflow techniques that you could use NAVIO? You mentioned earlier and showed in this video the

distal Burr technique, but are there other techniques that you could use with NAVIO?

DR. DAVID ROVINSKY: So this is something that we've been looking at and the question is, is there a way to use NAVIO and actually do the case faster than with manual instrumentation? So I work with a surgeon from India who does 800 knees per year. Most of them are bilateral and many of them with deformity. 20 degrees is not uncommon, and he does them all with NAVIO.

So what I observed over there is he uses the Burr for the entire femur preparation and the entire tibia preparation. So I took what I learned from him, and we've adapted that to our technique here. And if you think about it, most of the bone you're removing on the femur is the distal cuts. Say you're most of the way there. Say that Burr they were fine the anterior/posterior campers. That's pretty quick. And our flat tibia cut with a Burr is very efficient. So we'll be doing some cases coming up and for the last three months we've been doing every single phase with the all Burr technique.

AUDIENCE: Excellent. And Dr. Rovinsky, that's pretty much the last question that we've got coming in for the moment. Anything you kind of want to add before we conclude for tonight's webinar?

DR. DAVID ROVINSKY: I just wanted to share with you some of my thoughts. I think the Journey It's a well-designed knee. And I think using the robotic tool, especially the all Burr technique, is taking maximum advantage of that efficiency and performance. So please feel free to email with questions. we enjoy having visitors. We're a VSP site, and I appreciate your time this evening. Aloha.