LEGION Total Knee System

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Welcome to this "OR-Live" webcast presentation live from the Hospital of Special Surgery in New York City, and brought to you by Smith & Nephew Orthopaedics. In just moments, you'll have the opportunity to see Dr. Steven Haas perform a total knee arthroplasty using the LEGION Total Knee System. The comprehensive and seamless system empowers surgeons to address straightforward primary to complex revision total knees. The LEGION System includes simple solutions to for addressing the increasingly diverse needs of your patients. Now let's join the doctors. "OR-Live," the vision of improving health.

Welcome to Hospital for Special Surgery. This is the first of four webcasts with the LEGION Total Knee System from Smith & Nephew as part of their "Power of Simplicity" tour. I'm Dr. Mamen [PH]. I'll be moderating the session today. Dr. Steve Haas will be performing the surgery. We just want to remind everybody that there is a button on your screen labeled "Ask a question" that you can click on throughout the case. Dr. Haas is now going to run through some introductory slides with us. Dr. Haas.

Hi. I'm going to just go through a few of the background, as far as the implant system we're going to use, as far as the LEGION, tell you a little bit about the patient and why we selected the specific implant type for this patient. David, you can move onto the next slide. A little bit of history about LEGION. LEGION, what it does is essentially builds on the Genesis II system. The Genesis II system came about in about 1996 and essentially has evolved. And the sort of beauty this for us is that it has 10-year follow-up results, which we know are successful. And we've taken that and essentially continued to build upon that as far as adding oxinium, which are new bearing services for the femur, adding revision systems, adding new femur and new tibia options. You can go onto the next slide, Dr. Mamen.

So essentially we have multiple options. You can go all the way from a cruciate-retaining knee, a deep-dish knee, which is about equivalent to a total condylar in its geometry articulation, or you can go the posterior stabilized route, which is my preferred method, and you can go all the way from a PS to a high flex, to a constraining, all with the same system without having to change and put on augment stems, adaptors. And the same, you can go onto revision and combine the same cuts onto a revision implant if you need it if that case or the revision surgery in general. Additionally, now there is the addition of crossing polyethylene. The crossing polyethylenes are available in both the high flex versions of the essentially cruciate retaining and posterior stabilized. David, you can move on.

The revision options are as with a comprehensive revision system, you have stems, augments. You have offset couplers so that you can offset stems. You have multiple different augments, and sort of the beauty of the LEGION revision is the instrumentation, which we can go into a little bit in the next slide. So I think so important is instrumentation. When people actually ask me about implant systems, I tell them, "Well the implant is a part of it, but the instrumentation, how it was put in is really a major component of it." And having the ability to have minimally-invasive type instruments, which I think are helpful whether you MIS or any less invasive surgery or any type or standard surgery. There are standard instruments available as well, and there are now patient specific. There are Visionaire instruments, which I'll show you a little bit. We're not going to use it on this case because we wanted to show you how the instruments work as a set. But I want to show you a little bit about the patient specific instruments or Visionaire. I'll show you that a little later. The next slide, please.

Lastly, I want to talk a little bit about this patient. This patient is a 55-year-old woman. We need this knee to last a long time. The question asked, is it going to last her a lifetime? I can't be sure

it will last her lifetime, but we want to do everything we can do to give he a fighting chance that it will last her lifetime. We have newer materials that we can use, and the newer materials on both sides of the articulation. David, if you could go onto the next slide. As you all know we've had oxinium available, which is essentially oxidized zirconium. It's a ceramic metal composite, where essentially the surface layer of the zirconium is converted to zirconia ceramic so you get the properties as far as the hardness and smoothness of ceramic, and that reduces the poly wear by over 50 percent in itself. But again if we're doing 45-year-olds, and 50-year-olds, and 55-year-olds, we want to try to do even more, and so the combination of a crossing polyethylene with the oxidized zirconium surface is sort of the dream team of articulations.

I show you that slide because what this slide shows is that the issue of what happens to components when they're in vivo, when they're in patients or, in fact, there's scratching of the femur, and if you look at crossing polyethylenes, they are, in fact, quite sensitive to that scratching. So if you look at polyethylene and the graphs along, you can see that can see if you take a pristine femur and rub it against a crossing polyethylene, you will see the bars to the left. If you rub it against a retrieved or scratched femoral component, you can see that the polyethylene wear goes up significantly.

The beauty of oxinium is that it doesn't scratch. And we have the first retrieval study, in fact, showing that in a controlled study looking at chrome cobalt versus oxinium and have shown that there is much less scratching, and that much less scratching is so important when you use crossing polyethylene. So with the combination of the crossing polyethylene and the oxinium, you can reduce the wear rates over 95 percent. So with much lower wear rates, I feel more comfortable giving this patient the ability that maybe we're going to last her lifetime. Let's go on and do the surgery. Okay. That's what you all came for.

We're going to be doing a minimally invasive approach. Let's wrap another tourniquet. And I'm going to doing anterior cut first, instrumentation. There's instrumentation for distal cut first or anterior cut first or, as I said, custom instrumentation that are patient specific. I use both sets of instruments but I generally, for the MIS, prefer is anterior cut first. We're going to use a tourniquet. We have an epidural anesthesia for this patient and a femoral nerve block. Raise the tourniquet to 275, please.

The incision length is actually the least important aspect of it. It's really we're going to do a mini mid-vastus approach. Okay. Are we good? And I'll try to take you through some of the tips as we're doing it. The incision is going to from just above the patella to about mid tibial tubercle. It's going to go over the medial border of the patella or the medial third of the patella.

Now if you see my assistant hit me on the head, it's because I stuck my head in the way., and that's okay. They're used to hitting me. And if you have questions along the way, you know, send them off to Dr. Mamen, and he can either answer them or pass them onto me. You're going to see David, here, is going to mark off how to line the quadriceps tendons up. We did a study a number of years ago looking at whether you can do the operation closed it in inflexion on extension, and it doesn't really matter. Let's start distally and move proximally first, okay.

So I'm going to start the arthrotomy, you start about five millimeters off the tibial tubercle. We're going to go up. You can go from proximal to distal or distal to proximal. It doesn't really matter. We're going to go up to the tendon. The top of the patella is right about here, so I'm going to go up to the top of the tendon -- top of the patella, and then I'm just going to go a little snip to the VMO, and then we'll just spread them open.

Now you can do any approach, really, that you're comfortable with. This is the one I'm most comfortable with and do routinely. In larger males, I will actually go up in the quad tendon farther, but in the women, who are generally pretty flexible, I will just do the mid-vastus approach.

Dr. Haas, I know you're done some studies looking at whether with this approach that vastus spreads further while you do the case. I think that's one of the concerns that people have with the mini mid vastus. Can you just tell us a little bit about that. Yeah. In the fact it can spread a bit. It's somewhat self-controlled. But, in fact, the studies that have been looked at, two things have shown. One is that you don't spread it generally more than somewhere about three to four centimeters, and in addition to that, that the studies have even looked at this with a standard mid vastus, not even a mini mid vastus without the patella everted, show that any denervation issue is really of no clinical significance. We didn't actually find much in the way of denervation in the EMG study we did. And, in fact, most of the issues as far as EMG changes were, in fact, proximal to the split. So I think a lot of the, you know, EMG changes were actually stretching, and the study by Vince Fellagrini [PH] showed that they all reverse by the time you're out a year.

So you can see with a relatively small arthrotomy, we have gotten actually good exposure of this knee. Now I want to show you something that we're not going to be using here but just to give you an idea of what kind of things can be done. I think an exciting technology that is available is the idea of patient-specific instrumentation. And what this is is essentially people will get a MRI of the knee preoperatively, and a long x-ray preoperatively. And essentially you can essentially computer navigate the knee preoperatively and then it translates back into the patient by getting a custom-built instrument.

So if I had done that for this case, what we would have is an instrument. This was another patient's that we re-sterilized to show you. Essentially you would get a patient-specific instrument that essentially would have a reverse-glove fit. I don't know if you can show that on the camera. And essentially this has built into it we know the size of the implant, we know the angles that we're going to use, we know the anterior lateral position and the rotation, and all I would do is just lay this on the patient. It only fits one way on the patient's bone. It really is a glove fit, so you cannot change the position. It would fit on it. We make these essentially holes. We pin it in place. We make the distal cut. And with these holes, that sets our position for the AP cutting blocks. So we don't need to invade the intermedulary canal. We don't need to guess about size. We don't need to guess about rotations because it's all taken from a preoperative MRI. So that's an exciting technology that is, I think, available, and I think, going to be very useful. Same thing for the tibia. This just shows the tibia part.

I think another thing to mention with that is some of the early results with patient-specific blocks did show some issues with alignment.

Right.

But it's important to recognize that these are using an MRI as well as long-leg films to make sure that these are lined up appropriately.

That's a very important point. You know, it's interesting. The first patient-specific blocks that were made, essentially what they did, which I personally think is a crazy concept, was half right. The patient-specific instruments were a good idea, but the idea of saying that you don't care about alignment, I think in my mind, flies in the face of, you know, 25 or more years of research that shows trying to line these mechanically neutrally is better for it. I would say essentially you can't outlaw the laws of physics, and essentially if you're going to load the knee multiple times more, that makes no sense. So the idea of patient-specific instruments make a lot of sense. The idea of mechanically align them also makes sense. So I think you need to combine those two.

And the beauty of it, I know, David you're a navigator, and that's also available. I didn't talk about that because I'm not a navigator other than through patient specific. But to me the idea of navigation is a great one, but essentially the idea of preoperatively doing it and getting all that equipment out of the operating room and make the operation simpler is appealing to me.

Yeah. You know, there's no question computer navigation gives you incredible accuracy, but there are issues with navigation in terms of the equipment and the bulkiness of it and time factors in the operating room.

Now going back to what we're doing here, I essentially use white side line to line up the rotation, and I find that very accurate to do, and I'm also looking at the posterior condyles as well. But essentially we're going to reference this anteriorly. I'm sitting on the anterior distal femur and essentially referencing -- I don't go to the highest point. I'm going to go to sort of halfway up the ridge on the lateral femur. If you go to the highest point, you're going to tend to leave too much bone. I like it nice and flush on the anterior cortex. And I like to do this. I think it just makes it a little easier for MIS surgery just because it opens up some space by doing that and it gives me a nice platform to work with. But you can do the distal cut first. It's really a dealer's choice. Let me just take a little bit of bone right here, which I'm going to get. There we go.

And this instrument allows you to use either AP access, epicondylar access, or posterior condyles.

That's right. You can use any one of these. You can use AP access or white size line. You can use the epicondylar access, or you can use the posterior condyles. There are posterior paddles that are available that can reference the posterior condyles, which I think many people do when they're doing especially a varus knee.

And this distal cutting block that you just put on has multiple holes in it so that you can take more or less bone. I didn't see at the beginning of the case, but this patient didn't have a flexion contraction, did she?

No. Five degrees, so not huge flexion contraction. And a couple issues here, I put headless pins on, because if it looked like I was taking too little bone. Now keep in mind if you're thinking about two millimeters extra bone, you're talking about the fact that you should be taking off a certain amount of bone. Sometimes they'll be sitting on osteophytes and you'll be taking less than the desired amount. If you think about the desired amount, you're really going to want to get somewhere around nine millimeters off the medial side and about seven off the lateral side in the average patient. So essentially if it looks like you're not taking enough bone -- and a good way to check that if you want to check it, is essentially look down. Your cut ought to be going through about the trochlea. If it's a total air ball on the trochlea, you're probably unresecting the femur. So it's key to look at the cuts.

Don't just rely on instruments. You should know what the cuts ought to look like. We emphasis that a lot in our training, that you really need to know what the cuts should look like. And actually it's one of the nice parts about the patient specifics. Since you've done it on a computer before the operation, you know the exact measurement of each cut, so if you're doing something wrong, the cut will just not match what your computer said it was supposed to. Very good.

I think what you said there with cut depth is very important; that you need to know the implant that you're using and you need to know how much bone you should be resecting off the medial or lateral sides.

Excellent. Okay. Take that off. Now what I do is I take the pins out, but I'm going to mark these holes because it's quite easy to go back and put these pins back in if I needed an extra two millimeters of resection, it's quite easy to do if you find one hole, it's actually easy to find the second one. So I mark them and that way, later on, I can go back and I can just put the pins back in, put the guide back on and cut two millimeters more bone. It's quite easy to do. Can I have a large Rongeur. We're going to go down, and now we're going to do our tibia. And so it's very important I take all the osteophytes off essentially the medial side. I'm going to make sure the anterior horn of the lateral meniscus is divided. That way I can reference because we're going to run a reference from the lateral side here. All right. Can I have the tibial cutting guide, please.

Now you can use intra or extramedulary tibial alignment. I like extramedulary alignment, and I think that whatever you're used to is what works for you. You get your pattern. Now what I do is -- no, we're going to do 11. I generally shoot for up the good side somewhere between 9 and 11 millimeter off the good side, which is the lateral side. If it's a valgus knee, it will usually be 9 off the medial. If it's a varus knee, it's going to be somewhere between 9 and 11 off the lateral side.

Can you just talk a little bit more about that, because I know often people talk about taking two off the worn side or 10 or 9 or 11 off the normal side.

Yeah.

And I'm a big proponent in taking just what you did, 10 or 11 off the normal side so that you're reproducing the joint line.

Right. You know, many people will take extra femur and then under resect the tibia. We had done that years ago. I think that I prefer, and I think if you want to get the best function and motion, I try to keep the joint on. I think two millimeters probably doesn't matter off the femur, but I try not to vastly elevate the joint line. So I really like to reference off the good side because I think of what we're doing is a resurfacing. If you think of it in terms of resurfacing, then you have to think about how much metal and plastic you're going to put back in and how much bone you're removing. And in general, if there isn't ligament laxity you ought to have the same bone out as metal and plastic you're putting in.

I'm just dividing the PCL. I prefer posterior cruciate substituting implants. We can have a discussion about that if anybody wants to. I think that kinematically they're more normal and that they essentially are easier and more consistently can get good motion.

So notice the guide. I think this is a very important point on this guide. You'll notice that the guide wraps around the medial part of the tibia. I don't know if we have the traditional guide here, but the older guides that went on the lateral side -- or many of the systems didn't even have lefts and rights, and if you had that your guide would often be hitting the soft tissue. On the lateral side you never were cutting on the lateral portion of the block because the tendon is always in the way. So a guide like this, which was better than some, essentially is bulkier. It doesn't wrap around the medial side, and this lateral part you couldn't use anyway. It's just in the way, so you couldn't really use that.

So, Dr. Haas, we have an e-mail question for you. The question is, "Does the LEGION System give a better result as compared to other systems that you may have used in the past?"

Yes, I believe it does. Let me -- before I start cutting away on this -- I'd say it certainly, I think, does. I think there are a number of things that I think. I think the amount of flexion we get is much greater than we did in prior systems that we had years ago. I have to be honest that for the last few years, that's all I've been doing or do mostly. I will selectively use different implants. But I know years gone by when I was doing other implants, we did not get the amount of flexion, and we didn't get the patella tracking, and we'll talk in a minute about patella tracking in a few minutes, because I think that's a key element here that makes me work so well.

Now I'll leave a little bit of bone because I'll leave some bone here and I'll leave a cortical bone in the back because we obviously don't want to get into the bad stuff that we don't want to get into, which are in the back of the knee or up where the tendon is or where the vessels are in the back. So I'll leave a little ridge, and also on the medial side where the MCL is rather than trying to get every last bit of bone out, even if I have to take the tibia out in not one piece, I'll be happy to do that.

Now one of the things that people have been -- or there's been some concern on MIC blocks on the tibia is if you're cutting from the medial side. If you get any bend of your blade as you're coming across to the lateral side you might get an error in your varus-valgus alignment. Can you tell us what you do to avoid that?

I can say we've published on it, and our results are actually quite good. Part of what we do, I must say, is there's two things. One is we use a thicker blade. We have another blade that is a typical blade that people use. If you can see this, it's a thinner blade, and the thinner blades are essentially more flexible and they're more likely to have that happen. If you use this blade, while it's tapered in this plane, it's actually thicker in this plane, so it, in fact, is less likely to deflect. The second thing is actually what you're using is the cut surface as a guide. Once you have cut along the medial side first, cutting the lateral side, you have a slot that is the entire thickness of your cut surface. Now we have some bone out laterally, which I'm going to just take out here.

I think using the thicker blade, also knowing the thickness of the slot in your cutting block and making sure that you use a blade that fits your cutting block appropriately.

Yes. That's, I think, a very important point. Here we go, that's the lateral piece that we hadn't gotten before, and I think we look good. So what we're going to do -- now I don't always do this, but I often do. Since you can see the lateral side best in extension because the extensor is so relaxed, essentially we're going to take out the lateral meniscus at this point because I'm looking right at it. Okay. Can I have the Bovie. There we go.

And this is a relatively well-balanced knee to start with, with a small varus deformity to start with. But if you had a larger deformity, at what point do you do your ligament balancing?

Good point. Can I have a forceps. I would often -- if it was a valgus knee, I would start off by at this point in time doing some releasing, because you know that those ligaments, especially the IT band, is going to be so tight that if I look at it and I put the laminate spreader in here and I see that the thing is so tight, I'll release that now. Now I won't necessarily do -- the best way to say it is I'll do some fine tuning later on. But I'll do some of the releases right now. I'm just getting the back horn of the lateral meniscus out. A little bit more to go. Okay. Good. Okay.

Now let's go up and size our implant. And now I can look at it and also look at it and look at the anterior cortex and say, "Boy, this looks good. My anterior cut looks just where I want it to be." Okay. So now I'm going to show you a couple things here. And by the way, the key element here is I only have the knee flexed about 70 to 90 degrees. If you hyperflex the knee you won't see anything. It will close your window down. Now you should also know your system and know the sizing of it. We're going to size the implant. We're going to put the sizer in. And one of the things with the anterior cut first, I can just size right off of my distal cut surface, so that makes that pretty easy. If you were doing -- so it looks like it's between four and five. We'll like at the four and five. I think it's probably going to be -- it's between four and five. I may use a four.

So you bring up an interesting point. If it is between a four and a five, how do you decide which you're going to use?

Generally with the anterior referencing I'll downsize if it's close, unless it's just under the five. And I actually think -- and see this guide would be if I was doing distal cut first. And when you do the distal cut first is essentially you would use your posterior condyles to reference rotation and you could change the rotation by adjusting this. You would put pinholes in here if you want to set for your AP cutting blocks, and you can move this up and down if you're in between sides to shift the holes anteriorly if you wanted to or, in fact, posteriorly to adjust so you would notch. You can move it forward. So that way if you were in between -- if you're in between the and don't move the holes forward, you're going to notch if you downsize. You can shift this so that you essentially take a little bit more off the back and are flush on the anterior cortex.

I tell people that allows me to middle reference instead of anterior or posterior referencing.

In fact, that's really what I do. I don't think I am doing straight anterior, because I will adjust it if I find that -- I think the five is going to be probably not bad. It's not bad. It was a little under five. Let me look at the four.

And, again, I think key to this is knowing your system and knowing your implant, knowing the thickness of your posterior condyles of your implant so that you know how much bone you want to resect.

Yeah. I think it was just a little under the five, and I think we're going to go with the five. Let's see. Let me use the distal cut first, and I'll size it with that. We'll see what it looks like on that.

Also while you're doing this, can you talk a little bit about what you do with the patella and when you decide to cut the patella first or if you ever cut the patella first in your small incision.

Good point. I will cut the patella first -- there we go. And I'm going to go up to the cortex, which I like. I'm measuring with that, and it's just about right in the middle. It's just in between four and five. So we're going to really go down. There's only three-and-a-half millimeters in between sizes. So if you think about split the difference, I'm going to make the flexion gap about two millimeters looser by doing that, but I think that's what I should do because I don't want to up size this and make the flexion gap tight. Now let me take this. One other thing, I've got a little high spot right here, which I'm going to take down. You can feel that. Okay. Got it. Okay. So there we go. I think that's the right answer here.

I don't like to up size my implants. The only situation, if you have a large flexion contracture then I have a lower threshold, essentially I don't like to downsize as much. But in the general, I would rather downsize, given, again, the implants are only about three-and-a-half millimeter incriminates to four-millimeter incriminates, so you're not talking about the older implant systems where they were five or six-millimeter incriminates. I'm going to make sure this is under the MCL so we won't injure that, and I'm going to cut. I also don't like to upsize them and have them crowd in the front. There are many people that don't mind doing that, but I prefer not to. I think it stops the patella femoral joint and leads to patella femora problems and also tighter knees, and I like knees to bend.

So after you finish these cuts, I've got a couple of e-mail questions for you.

Okay. Now the other thing is, I always say that, you know, you have to look at what the cuts ought to look like as far as sizing. If you were perfectly sized, if you had a perfect fit, you ought to know what the cut will look like. It ought to be flush on the anterior cortex and you ought to, off the medial side, basically have nine-and-a-half millimeters of bone off your posterior medial femoral condyle. If that was a perfect size, that's what it ought to look like. So we're going to look at our cuts, especially that medial side, and see what that looks like. And I'll bet you that it's going to be pretty close. Half-inch curved osteotome. There you go. Poker clamp.

And because I downsized, it's probably going to be a little bit thicker. So you see that's probably going to be -- we could measure it, but I'll bet you that that's about 10 or maybe 10-and-a-half, 11 millimeters. It measures -- it's exactly 10. So essentially, we were a little downsize to it. It was a little over a four, and it's a little less, it's going to be about two millimeters less on the lateral side.

The first question for you, "Is this is a female knee?"

Yes. Well the answer -- the quick answer is yes.

I knew you were going to like that question.

Yes. You know, people ask, and honestly, I tell people, well, gender is not the most important aspect of design. Being anatomic is important overall. Gender is one element, and so in the LEGION essentially gender was incorporated in the design, and the FDA has approved the gender knees. As you know, there's only been two systems that have been approved as gender specific, and essentially this is. The size one through five are FDA approved gender specific for females. The size six and above are gender specific for males. So it got specificity for both, and that's both the cruciate retaining and the PS, and in the revision system as well. And really it just meant that essentially you have taken into account the differing proportions and, in fact, women are narrower than men. And you will see that this will have a good ML fit at the end.

But I'm going to show you a thing which, in fact, I think the irony of it all is that I think at the end of the day talking about millimeters, when we talked about earlier, instrumentation matters so much. I'm going to show you a little bit later my favorite part of the instrument, which essentially -- now I've just taken out the medial meniscus. I'm going to take out the PCL, because I think when we get our balance we want to remove the PCL. We want to remove the PCL so that it doesn't interfere with our balance, because it does -- in some patients it affects flexion gap more. Not always though. Some people it does not. The valgus knee it tends to a little bit more. But in either case -- I'm going to go in your way. The camera is in the way because I need to look around the corner here.

So the second part of that question is, "What is the clinical history of the LEGION Total Knee as compared to other knees currently on the market?"

Well if you think of the LEGION as essentially the updated, modernized version of the Gen II, which it really is. Now there is actually some wonderful research out that has ten-year results. Bob Bourne has published this. And also, for what it's worth, Bob Bourne had a study looking at the affects of gender and found that it actually did quite well with women. Again, not that I think it is -- because the Gen II also received an FDA approval for gender specificity. So in either case, the fact is that there is ten-year results showing how it's done quite well over that period of time. And things, you know, objective things like range of motion, patellar femoral pain, lateral release rates of, you know, three, four percent, so there have been good results, and this is then -- let me do some around the medial side. Okay? Thin band Homen. Remember, I left a little bone here on the medial side. I want to get that while I can. Now it's easy to protect the medial MCL, which I couldn't do in the early part of the case. So I'm just going to cut that little bit of bone off. There's a little osteophyte here, which I want to get.

And so the next question we have -- and you can answer this one or I can answer this one, whatever you prefer. "You mentioned with the Visionaire system is based on mechanical access. Other systems use anatomic alignment to resurface and rebalance the knee like is done in the unicondylar knee. Why wouldn't this philosophy work in total knees as well?"

Oh, as far as leaving it in an unmechanical -- mechanically malaligned? Well the reason why it works in a uni in part because you have the entire knee -- you've got the rest of the knee you're relying on, so you can't really alter those things. The question is not whether it's desirable in the uni. From a biomechanical point, even in a uni, you'd rather have it aligned well. The problem is is if you align it by the mechanical access, you essentially are deviating from -- you're overloading or stressing other parts of the knee.

The camera's on you.

Yeah. So essentially you are loading other parts of the knee or stressing them in another way. You're really just resurfacing one portion of the knee, so you uni does not allow you to mechanically align it. The problem is is if you look at simply physics and if you look at there are multiple studies looking at this, and if you essentially malalign the knee by five degrees or more, you start loading a significant amount, and you can go up to 50 percent or even 100 percent. So

certainly if I said a patient weighed 300 pounds versus 200 pounds, we would imagine that the 300-pound patient would be putting more load through his knee, and that's a bad thing.

So if biomechanically we do the same thing by malaligning the knee, why don't we expect the same outcome? So you have no choice in a uni. It's not necessarily desirable. And, in fact, that's one of the reasons they fail. The poly wears out. So I think that we have the ability. We know a track record, again, of 20 or 30 years that it works. And if you look at studies like Merrill Ritter did a long-term study and found that malaligning these, especially on the tibia, have bad results.

I think that what has been, I think, wrong is we have a window, and people sometimes misinterpret the data. They say, "We looked at a study, and we saw three degrees malalignment didn't affect outcome." Mark McDonald has done a study that showed that at 15 years. And that, I think, is probably true. Probably it's not three degrees, but that doesn't say that you can malalign the knee by eight degrees and get away with it. So I think, you know, they've done well because they are forgiving within a range. I can't tell you it's six degrees or it's four degrees. But certainly aligning them better is generally biomechanically better for your joint. Was that a long answer?

No. No. No. I think that's a good answer. And I think, you know, the other part of that answer is when we use anatomic alignment for knee replacements we try to put the knee in five to seven degrees of valgus, which is essentially trying to put the knee in neutral mechanical access but using instruments that can measure anatomic access. So we're trying to do the same thing.

Right. As you can see here, this is my mechanical method. I use an old metal spacer block and a rod that's pretty rigid. And I want to line up with the second ray. And I think that's right. But you know you do make some compromises. A good example is in obese women I'm willing to accept a little less valgus, so I'm willing to accept in an obese woman maybe four degrees or three degrees, which you would argue biomechanically is not as good.

I may need to take some more tibia. I got a feeling that we're going to be a little tight after all that. I probably didn't get my 11 millimeters, or that or more femur. We're a little tight in extension, so let's lift up and see. Yeah. It seems a little snug. I think we're a little snug. We might get by in flexion. Let's see it in extension. Maybe not as bad. You could argue a little bit more tibia. I think we're going to be tight, and so I think what we want to do is take a little more tibia, so I underresected our tibia. So now we're going to do a little bit more tibial resection. Okay. So can I have my tibial cutting guide back.

So with this system the polyethylene liners start at 9 millimeters and go up in increments of 2 millimeters. And what I try to always do is aim for an 11-millimeter polyethylene. I feel like aiming for an 11-millimeter polyethylene, if I then am a little tight, I can go down to a 9-millimeter polyethylene rather than accepting a knee that is too tight. I think that if you aim for 9 millimeters all the time, you're going to end up a lot of knees where you're too tight.

I couldn't agree with you more, Dave. I think that's a very, very key point. Go for it. If you tell me that you always put in a 9 poly, I know that sometimes you're putting a knee too tight. I rather shoot for 11 and put in 9 sometimes because you at least have somewhere to go. Leaving these tight, people are miserable if the knee is over tight. So I'd rather have an extra -- have some 13 polies in rather than having all 9s in. Okay. Let's come around. Okay. That looks good.

I think one of the concerns with overresecting the tibia that as you get further down the tibia, the tibia obviously gets smaller, and then you get mismatch between the femur and the tibia. But taking a two millimeters doesn't do that.

I think taking that amount of bone, which really is nothing, and it doesn't even take that long. I mean I think at the end of the day for the extra five minutes or less that you'll spend doing that,

you will be well served. Believe me, you'll spend a loss less time in the office listening to the patient and the therapist or the manips and everything else. So leaving these tight is not a good thing.

Now when you did that, did you use headless pins and just slide back into your old pin holes, or did you put it back on again?

You could. I don't do that on the femur, as we talked about. I don't do it on the tibia because I find that what happens is a couple things. The headless pins, by the time I'm done, they've wiggled around and they don't hold the bone. The tibia bone is kind of soft there, whereas the femur is a bit more rigid, so I have the ability to, I think, put the pins back in. I found it unfulfilling to find those holes on the tibia and put them back in. Although, it's certainly an option if the patient has good enough bone. I just find putting the guide back on and re-cutting is pretty easy to do.

And I think I saw you had two pins in the tibial cutting block?

Right.

I see you use two-headed pins; correct?

I use two-headed pins. I think it holds the block nice and rigidly. Now if you were using intermedulary alignment, that's a good point, you have to use three pins. But if you're using extramedulary, the stalk itself holds it, so you only need to have the two pins.

And when I navigate knees, I find that using headless pins gives me accuracy. So I actually put three pins in. I put that oblique pin in from the medial side as well.

And that's fine to do. I find the headless pins. Now that feels much better. Now I have a little looseness here. I might need to go after the semimembranosus to get it perfectly balanced if I need it. I'll wait until later. That's great. You see, and, you know, I just think that's the best thing to do. Let me have my metal spacer block one more time so I can see it and make sure we didn't bugger our alignments. So we're on, we're seated, and there you go. And you can see that. I don't know if you can pan that out. But second ray, you lock the ankle. This is actually pretty accurate.
If you take the ankle and lock it up you're going to be accurate. If you don't lock it up you can wiggle the foot anyway. But if you just take your hand and push it up, you're going to get a nice accurate tibial cut.

And you look like you're right down the center of the tibial crest as well. That's right. I'm right on the crest, yeah. And I'm just looking, and you can see that the ankles -- you can see it splits the ankles. You can see that really the second ray is the best. And, again, if it's an obese woman, I might go over to the third ray, because in that case you don't like to leave obese women, especially if they're bilateral, with too valgus with a knee. They will be very, very unhappy people. I would rather leave them in four degrees than leave them in nine degrees or even eight degrees, because, you know, you might say well biomechanically it's better, but they'll say, my legs bump together, and I don't like you.

Yeah. They're not very happy when their knees are bumping together and their feet are a foot apart.

Shall I give them my true HSS rating scale? You all have probably heard of the knee society rating scale and the HSS rating scale. I'll give you what I think is the most relevant rating scale, and that is an excellent result is you're happy and the patient is happy; that's an excellent result. Okay. A good result is the patient's happy, you're not guilty as happy, but the patient's happy. That's a good result. A fair result is you think it's really good but the patient doesn't. That's only

fair. And a poor is when you both think it's a lousy job. So I think that, you know, you really want to keep patients happy, and I think that within reason you have some and it goes back to that.

Now, again, going to the system, you can ream the patellas, cut the patellas. I personally like o -- I'm an old fashioned guy. I like to cut the patella. You have the ability to have -- essentially different patellas are available. A little bit more. Dick Laskin always would ream the patella, and he liked to do that, and I think that it's a good option. There are oval patellas available, which I actually may try the oval patella, as we've been talking about that. Traditionally I have done the round patellas and like them very much.

I'll show you a little maneuver I do, because, as you know, the patella in most cases is an oval, yet we resurface it with a round component. And I usually medialize it, so I'll show you a little trick that I do, which I think is fine to do, but I thought maybe the oval patella, I wouldn't have to do this. And that trick is that I take the patella clamp and essentially put the clamp -- is this 29? Yeah. See, it's a small patella. I think I want to use a 26. There are great options available. But you have 23, 26, 29, 32, 35 and up on the patella. So you get a lot -- she has a very small patella, and I like to leave a little bit of bone around the patella, and I like to medialize it, so that's going to be perfect.

So we have a few more questions.

Sure.

The first one is "Through this smaller incision, do you find it harder to balance the soft tissues before you set femoral rotation?"

No, I don't. You know, you're setting it mostly in extension, for the most part, at first, and then I'm setting the rotation anatomically. If you want to do flexion gap balancing, you can do that, but I don't have as much experience with doing that. Now here's what I was telling you about what I do because the patella is an oval. I actually do a little champer cut. I mark where the patella ended, and then what I'm going to do is just do a little champering of that bone out here. I don't cut the bone off as much as I make a little champer, because you don't want to have that bone rubbing against the femur if there's any -- remember, that patella is moving around.

And I want to talk a little bit about the trochlea. Maybe when I get the trial up. A couple important issues I think are related to the patella. First of all, if you're talking about -- I'm just checking the patella. It looks good. Okay. We'll take this off, and now we're going to finish up and do our tibia and femur.

There are different philosophies on how you do trochlear groove. You'll see some implant systems that have essentially very constrained trochlear groove. It's a very high lateral border, very ridged, just a very, very deep and constrained groove. And while that -- people say well, that can keep the patella in. I'm not sure that the idea of what you want to do is overly constrain your patella to keep it in. And I think if you look at the results of those, you'll find that many of the people will have patella femoral pain, even if the patella looks pretty good in the tracking. And the idea of the LEGION is essentially that the trochlea itself is offset by over three millimeters. So essentially, if you're looking at the trochlea, you're going to see -- now I'm just putting my tibia on, and all the tibia is a very key element. I think for MIS it wasn't built originally for coverage. Very helpful in MIS or tight knees of any type is having an asymmetric tibia face plate. To me it makes no sense to have a symmetric tibia face meat because it never sitting properly on the tibia.

Yeah. I think that really helps with avoiding posterior lateral overhang.

Rotation of the tibia, people talk about is it hard to get rotation. Well, no, because it looks like the tibia. You put it on, and if you put it on in a way that fits the tibia, it's going to be rotated, basically, appropriately, and then I'm going to check my tubercle in the front, and then we're

going to be fine. Just push it out a little bit? No. I think I'm going to -- I think the three is probably the better answer. Let me look at the two.

You can go two sizes away with the poly. Maybe we'll go two. I think the two might be the better choice. There we go. Okay. So essentially I drill, I punch.

Next question, when you have a second.

Okay. Is, can you talk a little bit about your patient selection criteria for VERILAST versus cobalt chrome femoral component.

That's great. I'll get to that and I'll talk about that trochlear issue again. We didn't quite finish that. Because the whole issue here is this lady is 55 years old. It's really age and activity. I will do oxinium in basically patients that are 60, 65, gray zone, everybody under 60, unless they're really sedentary, will get oxinium; 60 to 65, most of them do, but not all of them do, and over 65, really very active, metal allergy, so I'll use the oxinium. And it's really -- when I use the combination of the crossing polyethylene -- I mean one could argue to use it all the time, but I don't. I try to select these things out, and I think the more active, so when your in your mid, young 50s, and certainly anybody in their 40s, I want to combine those technologies.

Can you also talk a little bit crossing polyethylene in knees. You know, one of the initial concerns of crossing polyethylene is is it going to hold up with locking mechanisms in total knees, and what's going to happen to the post that sees stress in total knees. So can you talk a little bit about the evolution of crossing Ethylene for these knees

While there are some -- now by the way, can I get back to that. I want to talk about one technical issue here because of the instrument. We talk about ML fit, and yet when you try to get the ML fit, okay, when most knees are placed, posterior stabilized knees, the ML position is a guess. A big block is put on and you sort of say, it's about the same size as the implant, and you guess the ML position of the implant. With this system, with this instrument, which I think was one of the best design innovations in instruments. I unfortunately had nothing to do it with it, but it's a great idea.

The idea here is that you can line this up, set your ML position, and then ream right through that trial. And to me it's a win-win. It saves time because I don't have to use a separate block, it's much more accurate, and it gets your ML position. Look at your ML position here. So you can have whatever implant, you know, dimension if you put it on in the wrong place ML it's going to overhang and potentially cause problems. So the idea here, you can get a good fit and adjusted exactly where you want it and once you're happy -- and I can adjust it. You saw me banging on this way so I can get it exactly where I want it to be, and essentially then what I'm going to do -- give me one pin so we make sure this doesn't move. There's a pin, you can use it. I probably don't have to with this patient, but I will.

That pin just prevents the implant from coming off while you're reaming.

Yeah. It holds things on better when you're reaming it. And you'll see once we reamed it another issue is that for those who are cruciate retainers who have now seen the light and gone to posterior stabilized, you'll see that -- to me it's much more comforting in the fact that we have not left two separate free floating condyles but, in fact, have essentially a bridge of bone up in front, which I'll show you when we take the implant off. Rongeur.

So the issue with crosslink polyethylene, I think there are some concerns of crosslink polyethylene, and especially when you try to go up into the higher megarad. So the idea here is everything in life is a balance, and the idea if you can eradiate or crosslink the poly so highly to make it more wear resistant, but you can then make the fatigue properties in other biomechanical properties weaker. Here it was moderately highly crosslinked, not as high as the 9 or 10 that

some implant systems use. But when you combine it with the oxidized zirconium surface, in fact, you get the wear rate to be even lower.

That's right.

And so the mating of them actually works the best, since crosslink poly is so sensitive to scratching, getting rid of the scratching really makes a difference.

And this is a 7-and-a-half megarad radiation.

That's correct. That's correct. So here is the trials. I could trial this all the way from deep dish CR, PS, constrained, everything would fit into this. Why don't you -- I'm going to show -- later on, I'm going to show you when we do this, I'm going to show you how we can actually, if we wanted to switch we could switch. Obviously this woman doesn't need that. She's getting it for the crosslink poly and the oxinium surfaces. That's why this implant is working so well with her and why I chose it for her.

So that looks quite good, and flexion looks quite good, so even that re-cut. But we'll look at an 11 at the end, but it's going to be -- see, if I was here with that other knee, I'd be saying, "Oh, 9." You'd be sitting there going, "Oh, get it straight." You know, give yourself some space for that extra little cut. You make your life much better. It's well worth it. All right. Now we're just going to check our patella tracking. And, again, to go back to tracking, the trochlea itself is offset, and if you were to measure the angle where, you know, somebody will talk about the trochlear angle is five degrees, six degrees, seven degrees. If you were to measure the trochlear angle with the LEGION, it is between 11 and 12 degrees. So it is highly offset and actually lateralized.

You know if I -- do we have enough time? Are we on time? Here, we're almost through, because I want to make a little drawing here. Okay. If this is the trochlea, I'm going to try to draw upside-down here. Okay? Do you have a new marking pen? Because I think this is a really important issue that I think gets lost. Somebody give me a new pen, if they could, marking pen. Because I'll show you on the implant, but it's much easier to draw. Ah, Dave is giving me -- oh, there we go, Evelyn is giving me a real pen. Okay. There we go. Okay.

Because we're almost done here, and I want to show you if this is the trochlea, okay, and this is our femur that allows the drawing of the femur, this is the anterior, posterior, okay. And your trochlea, essentially if you start from here, most -- you'll say -- well what they mean by that is its essentially a six or seven-degree angle. So if you're essentially looking at this going at an angle like that. The problem with that is if you say it's six degrees, by the time the trochlea engages down here, you're already halfway back to the center. In other words, you're not very lateralized because the trochlea really doesn't get tension in it until the higher degree, up until about, you know, 30, 40, 50 degrees. That's when you start getting some tension in that patella in the groove.

What the LEGION has done is essentially said, "Listen, when there isn't a lot of tension, instead of trying to pull the patella over to the center -- and the natural body actually does this -- is keep it lateral." So essentially it's offset over three millimeters laterally, and then when it gets deeply into flexion, over 50 degrees, you're going to start angling back to the center, so it's an S curve. And the idea there, if you look at an E-ray all you've got to do is look at a merchant view x-ray, you will see that the trochlea is going to be offset to the lateral side, and the idea there is when there isn't a lot of tension, when the muscles are sort of -- your patella is floating in those, don't try to suck it over or pull it over to the medial side. Essentially let the patella sit where it wants, bring the trochlea to the patella, rather than the patella to the trochlea. Because when you pull the patella over, you're going to tighten the retinaculum, and that can cause pain.

So let me check our tracking. We haven't done it. She had reasonable tracking pre-op but some patella femoral arthritis, and you can see that that looks great. So no fingers, no nothing. You

don't want to -- no cheating. We don't put any fingers on it, and so we look quite good there. I think we're in great shape, guys. We are going to get our parts up. And let me take a little bit of bone. I got a little bit of ridge of bone right up here in the soft tissues, in the synovium. Get that up.

Again, you can see the super patella pouch nicely when you're in extension, so I'm just cleaning out any bits of anything up there. But we look quite good. Great. All right. You know what, we did this through a small incision. I think emphasizing the small incision, you know, is not the most important element of it, and whatever technique you use, this is the one I'm using the most comfortably and the patients like. David, do you have a question while we're taking our stuff out?

Yeah. Just back to the patella again. I know I often use a fairly small incision. I find, especially in the bigger patients, I'll cut the patella first before I do anything else. Some people get concerned about that because they worry about weakening the patella through rest of the case. I don't do the drill holes at that point. I just make a cut. I just want to know what you do with the patella and whether you ever cut the patella first.

The answer is I do. You know, if you're doing larger males -- large males are very tight. In larger males I'll cut the portion of the quad tendon if I need to and often will start that way. I'll also cut the patella early. I don't like doing it in women. It does aid a little in exposure. I just don't think you need it. And the problem if you do it in women is their bone is often very soft and you crush the patella. So I think if you don't need to do it don't. If you do, do. That's sort of my feeling about it. I think we're very good on time here, so why don't we take a little time. We can get our parts up. We can talk about anything that the folks want to talk about.

I think we have another couple of questions coming in here as well.

Okay. That's great. All right.

Can you just talk a little bit about your thoughts on using augment options in a primary situation with or without a stem.

Don't do the poly yet. I'm sorry. Say that again, David. I was talk about the implant.

So just can you talk a little bit about using augment options in a primary situation, and then if you're going to use augments does that automatically mean that you use a stem?

No.

Or would you consider using augments without a stem?

On the tibia if I use an augment I will use a stem. But on the femur I will not. And the femoral augments you have the box, which I think gives a great support. You have a complex geometry of the champer cuts, the anterior posterior cuts, and the loads are all compressive. So I don't think you need to, if you use a femoral augment, certainly a five-millimeter augment, which is in the primary setting -- I don't need this. I don't need the handle for the tibia there. Or you can use it, I guess.

So I guess an example I can think of that I guess is if you're taking a unicondylar knee and revising it to a total knee where you might need small augments on the medial side, you would typically stem the tibia but not the femur.

Yeah, I would stem the tibia not the femur. I'll give you an example of some times when I've used augments. Okay. There are a couple examples of when I've used augments in primaries. There are examples where you have a valgus knee, very deficient lateral femoral condyle. You know, what we have traditionally done is cut a lot more femur off the -- you know, just cut a big amount

of femur and then essentially downsized the implant and used a thicker poly. That's really been the traditional way of doing that. But what you end up with is a joint line that's way too high and a patella that's way too low. So I think that's a bad option.

The better option is that you can essentially augment the distal femur. So instead of downsizing the femur and using the bigger poly, you can either just cut more laterally to get into the bone, because it may be a standard cut may miss the bone, or you can kind of additional five millimeters right off the back and augment both medially and laterally because that's an easy way to do it. You just augment them both and then you have positioned your femur at a more natural position, not needing to downsize the femur and put in a really thick polyethylene. The other situation is there are case where you have done a case where you referenced off the medial femoral condyle. When you made your distal cut, essentially when you made the distal cut, your resection was probably more than you needed. You don't know that ahead of time because you make that resection as a first cut, and you end up, again, having to downsize to try to catch up for a resected femur because it essentially had erosions on either both sides or the medial side, and this, again, you can augment and bring the femur more distally.

Another situation is, I've seen where there's been a large osteonecrotic lesion in the posterior femoral condyle. And, again, what you can do is just place a posterior augment. And instead of having to essentially use some other method to augment, you can just simply, with a primary knee, just place the augment and you're done. It really makes life so much easier when you can just pop an augment on the femur, make up for the bony defect, and you're done. I find that works.

How about a really bad varus knee, where to take anything off the medial side on the tibia you're going to be taking 13 or 15 millimeters off the lateral side? Do you increase your bone cut so that you take something off the medial side, or will you use an augment on the medial side?

You know, I will -- I'll leave about a five millimeter or so, Dave, especially if it's posterior. But if it's a big defect on the medial side, I'll augment and put a stem on.

All right.

Those are uncommon. Most of our patients don't get that bad. But on the other hand, that's certainly what we've done when they come in that bad. Let me go on and cement the implant. Okay? I think we can -- do you have all our parts up, okay? There they are. We're going to cement the implants, and we'll talk some more after we cement, because I want to show you some options we have with the polyethylene inserts at the end. Let me just take a feel here. I want to just make sure there's no bone. Lift up a whether I will bit. We're good back in the back. It looks great. Okay. We're going to go cement. I think you can mix both bags at once. We're going to mix them. I use Calico cement. You can use whatever you like. I like the handling properties and that it gets doughy right away, as opposed to cements that are more liquid for a long period of times. So that's why I do it that way.

Here you'll see that when I implant this, this is where that asymmetric tibia really help me, because the area that's going to be tight in the knee, and frankly, it's tight in MIS, but it can be tight in really any knee, is that lateral femoral condyle hitting the lateral tibia. And I remember years ago we used to do knees when they were one sided, you know, there were no left and right tibias. They would consistent will overhang posteriorly or laterally. And if you hit the lateral condyle you would internally hit the tibia, and internally rotating the tibia is a baddy for the patella.

So the idea of having the anatomically shaped -- I mean if it you look it there's no doubt, as we move down the road, we're going to get more and more anatomic. They started off 20 years when you didn't have left and rights in the femur. We know that having left and rights in the femur makes sense. Better for the patella. It's probably better for the kinematics of the knee as well. But it's better for the patella. Two, and the tibia, there's no real reason, other than it's less

expensive for a manufacturer not have inventory, to not have left and right tibias. It makes no sense not to other than one could argue that it you can just have less inventory, which the patient would rather you have more inventory and fit their anatomy better.

So it's simply seems to me to make sense, and I have no doubt that as we go down the road that there will be left and right tibias in just about all the implant systems. We know that the tibia is asymmetric, so there's really not a good reason not to make them all that way. And the same thing with the instruments. You know, if you look at what the advancement of MIS instruments, everybody talks about smaller. It's not just smaller, it's anatomically-shaped instruments. It's left and rights. It's making the instrument essentially more anatomic and sided like our implants are. Okay. Thank you.

Now we're going to line this up and I just drop it down. I think we're clearing everything. Beautiful. There you go. Essentially, if you go down nice and slow in the beginning you'll follow your -- essentially the fin will help you guide in you're your rotation, you will line up with your line, with is right here, so we're perfect.

The other thing is I think having a fin on the tibia just makes sense because if you have the fin it really controls the rotation so much better than, you know, a rectangular stem. Those things often when I use them with spin, and you know the hard part is the spin you've already banged the thing down and you see spin, now you have to take it out, and that can be a more difficult thing to do when you're concerned about the cement hardening.

The next question we have is, "How well does the LEGION Knee System work for revision of a Zimmer Next Gen System?" And I think the simple answer to that is that the LEGION Revision System working for pretty much any revision, and the versatility of the system with stems and augments and wedges and offset stems and multiple directions of the offset stems really allows you to do pretty much any revision that you need to do.

Yeah. You know for many years we had done Next Gen knees here, and in New York, I was a disciple of John Ensley, and so we have a lot of those floating around. And it's really not problematic. I don't think there's any system preference in revision, per se.

Now do you have my black plate? Now I like to cover the tibial plate. There's protectors so that you don't scuff the implant when you put it in. Okay. And in addition to that, you will see -- if you look at the femur, you know, many implants you'll see you go all the way through, and essentially you're left with two free-floating condyles. I really if you look at bio mechanically the structural integrity of the distal femur is so much better having the bridge in front, and really, you've removed bone. Primarily a lot of it is in the area where natural notch would be anyway.

Now you'll also see that I coat the implants when I put them in. I like to put a small layer of cement on the implant because I think that if you will get blood and -- it's one thing to get blood on the cement. I think that probably doesn't matter as much because it's such a thin layer of cement that the cement is not what's going to fatigue. On the other hand, if you get blood on the implant itself, you know, there's, at least in my mind, a potential for having less good fixation of the cement and the implant. So you'll see I coated the implant.

Do you use any antibiotics in the cement? And if you do, on which patients do you use antibiotics?

Yeah, I do. And on a higher-risk patients any patient who has had essentially prior open surgery, patients who have rheumatoid arthritis or are any way immuno compromised, patients who we're videoing their surgery, I put the antibiotics. So I have a relatively threshold on it. We know the European studies have shown that it does lower the risk of infection when it isn't used with perioperative antibiotics. What we don't know for sure is if it lowers it less than when you use perioperative antibiotics. And there is a cost issue, so I don't use it on everybody. But I think

that if you have a reason to use it, I think it makes sense to do. Sorry. Okay. Let me bang this in a little bit more, a little bit more to go. Good.

And now when you trialed your knee with the trial implants and you just trialed with the hi flex polyethylene.

That's right.

But on the instrument set you have high flex, PS, and constrained trials all there.

I want to show on the instrument set we have PS, high flex, and constrained. And I'll use whatever it takes. My standard is going to be using high flex, because I think that many patients will get high flexion. It's more forgiving if you do get high flexion. It helps restrict them if they don't get high flexion. So I think that that's my default. On the other hand, if I have a knee that's a little loose in flexion that I'm not sure I want to have them bending up high degrees of flexion, and you know, 120 would be just fine, I will use the PS.

If the I have somebody who I think has some ligament laxity, either, you know, in mid flexion of flexion or even extension, and I've done my best at balancing, and especially if they're older, then I'll use the constrained option. I'm going to show you how we convert. Let me take the 11, because it might go the 11. We're going to reduce it with the 11, because at the end of the day, I think the 11 is going to be what we get. I trialed initially with the 9, and it felt a little on the loose side, and so I think we're going to do 11 high flex with crosslink polyethylene.

So my other indication for the high flex poly is when I flex the knee, if the patella looks like it's going to impinge on the post anteriorly, which system of these people with low-riding patellas will do, the high flex poly is really taking a lot of material out of the front and can avoid that impingement.

I agree. I think that is a good point, because if you are going to get a patella Baja situation, you have that big cutout. I can remember taking implants and having, before we had this, and having to have to shave the poly on the back table in that area so that it wouldn't get a patella impingement. And that large champer that we have here in the front essentially avoids that.

Can you just hold up, when you have a second, a high flex poly next to a PS poly and show everybody the difference.

Yeah. What I'm going to do, let me just get the implant cemented, I'm going to look for any cement that I have left to take out, and then we're just about -- I'm cement the patella, and then I'll take a moment to talk about the inserts. And then I'm going to ask them to hand some inserts up, so when it hardens, I'm going to show you, I'm going to insert a couple different implants -- inserts and show you the difference of what we have. Thin band Homen.

And also a lot of systems for their constrained polyethylene have a different tibial base plate with a metal post that goes down into the tibia.

Yeah.

Can you just explain why this system doesn't have that and why you think it's still okay to have a constrained polyethylene without that metal post.

You know the idea that -- because I think it's simply not necessary. The idea of that metal post -- in fact, if anything, you make the polyethylene thinner. That metal post really does not protect that post. If you've got a knee that's so bad, that's not going to do it for you. And the philosophy here is that if you think about what is physiologic, what is normal as far as varus-valgus laxity, the normal knee does not have one degree, it's more. It's more like three or more degrees of laxity in

the normal knee. And so many constrained knees essentially have, you know, one degree or less of varus-valgus laxity. And that, in my mind, if you've got a knee that's so unstable that you can't have a degree of laxity, then a constrained knee such as that probably isn't the right type.

They may need -- the fact is that most knees can tolerate three degrees or so of laxity, and if you look at the constrained knee here, it will actually allow a bit of varus-valgus stress, a little varus-valgus motion, and I think that protects the knee. A very nice study, as you know, Dr. Mamen, done here at HSS, shows that much of stability in the knee does not come on a regular basis just from the ligaments, but the joint reactive forces help stabilize the knee. So you don't need that post with every gait cycle. You only need the post when you get a loading situation that overcomes those joint reactive forces.

So, in fact, you want the post to only engage when it's going to go beyond about two to three degrees varus or valgus laxity. So the LEGION tibial insert allows for that and allows for more rotation so that, in fact, it's not as constrained as some constrained inserts. It, I think, provides a more physiologic constraint, and therefore, it isn't being used all the time, and that helps protect the post. And I think we don't need, then, to add a post, which I think does very little to protect the implant, because the poly is going to bend no matter whether the post is in the middle or not.

Yeah. Another point there that you mentioned that I just don't want to be glossed over because I think it's important is that this constrained post actually does allow for more rotation than a lot of constrained polyethylene knees, and I think that's key to avoiding wear in a lot of these constrained posts.

Right. What I'm going to do is just show you the insert options you have that relate to the PS options. Okay? And, Greg, if you could hand me up -- I'm going to want to -- let me check to see, but for the crosslink poly one that I'm going to finally use. But I want to have a 9 constrained and a 9 PS. I'm going to show you how we put in the inserts depending on the degree actually we have.

So if you start off and you say, "Well we have the high flex." That's what we're going to use here. We have the high flex. It comes in conventional poly or crosslink poly. Essentially what you have is that will allow really quite high degrees of flexion without impingement in the back. Okay. So you can get really high flexion. You can see how it allows for the rollback all the way very far posteriorly. Okay? And the way that it's been accomplished is a number of ways. One is there's a highly champered front so that the patella tendon essentially can sit back into that and not impinge on the front of the plastic.

Can you just show us both of those side by side, looking from the side, so you can see the cutout of the post as well as the cutout of the material.

The material here as been here to avoid impingement in the back. The post is actually a little thicker to allow for more strength. And in addition, the articulation in the back, you see how a standard PS is dished in the back. What that dishing does is it causes the lateral ligaments to tighten as you go into deeper flexion. And the idea here is the high flex keeps the collateral ligament tension even as you go up to even 155. This, after 120, you're going to start to straighten your collateral. So it could restrict motion because the collaterals get tight.

Lastly, you have the constraint. The constraint is just like the PS but it has a taller and wider post to allow. But it does allow some laxity, so you will see that more in the patient. But you will get about three degrees of laxity with that despite the fact that you have constraint in the wider post. So it's constrained, but it's not so highly constrained that it feels like it's locked in there as a hinge.

So what we're going to show -- and I got to wait for the cement to harden -- is I'm going to show you the these, just the different inserts. We're going to see whether I do -- I think I'm going to use

a 9 high flex, but I'm going to wait until the cement is fully hardened and then we're going to check that.

And do you ever use ligament tensioners or ligament balancers to decide what thickness poly? Or can you talk a little bit about how you decide whether you're going to use a 9 or an 11 poly.

It's a good point. There is to some degree feel, but I'll try to quantitate it the best I can't. I want the knee to have, in both flexion and extension, about a one to two millimeter opening. I don't want it locked in. In the average patient if you have some unusual laxity I might change that, but fundamentally I want that knee to have a little opening. You see that? I can hope that. I don't know if you can get that top camera in. Can you see from above onto the knee? Yeah, you can see that.

Yeah, we can see that well.

This to me, I think, is going to be just about right. Okay. You see how that's opening? Can you appreciate that, Dave?

Yeah. Yeah, we can see that very well.

See, if you have less than that, I think you're going to be too tight. And if you get this thing and it doesn't move at all, even if you get it straight, that's going to be too tight, and so I don't think that's the way to do it.

Now I'm going to show you actually -- now I think we're nice and hard here. Just to confirm, yes, it is. Good. Okay. Now I'm going to pop this out. Now what I'm going to do is I'm going to put a couple extra poly's in just to show you if I wanted to constrain this knee, okay, all we would do -- of course I always just a little -- the trick for putting in the poly, by the way, in a small opening is essentially to stabbings in extension and just move to extension. So I'm just cleaning the dove tail, making sure it's nice and clean. Give me the constrained poly. This is the constrained. This is the PS. Okay?

Before you put one of those in, can we get the camera in over the top again so you can shows the locking mechanism in the tibial tray.

Okay. All right. Are you in there?

Yeah, we can see it.

So there's the dove tail in the back, and it will all capture in the front. I'm just making sure -- you really want to make sure there is material in that. And all you do is slide it underneath and it will sit there flush. Bring it to extension, and it will go back and just about lock. And then I'm going to use this crowbar device to lock it in. You have the device to lock the crossing poly, Greg? Now this is actually a very good point. Now notice this is a constrained insert; right? There are many inserts. If you look to the constrained and say, "Oh, you won't get anything," watch this. Doesn't that look similar to what I had with the other insert? Now I've gone down a millimeter because I wanted to make sure it was easy to get in and out. But look at that. It's still opening. Can you appreciate the opening?

Yeah. Yeah, we can see it.

So but on the other hand, it's not going to farther. It won't go farther than about two to three degrees. So having that amount of laxity helps protect the post and but yet giving you the constrain you need and makes it more like a normal knee. Now close that up and we'll see. And you can see you can still get normal flexion with that. So that would be if I wanted to constrain the knee.

So say if I had a bad valgus knee, you still want to balance your knees. You want to get them as balanced as you can. You have a 72-year-old bad valgus knee, you've got it pretty well balanced, but, you know, mid flexion doesn't feel perfect. You say, "Ah, I got a little bit too much opening in mid flexion," you can pop this insert in, and I think it's a way that you're going to make the patient more stable and without, I think, the risk of getting them into trouble.

And you know I think that's very nice for surgeons, especially in the valgus knee, where you think you're going to be able to balance it well but you're not really sure. And if you're not sure then typically you have to use implants that are going to allow you to put a constrained poly in. And for most systems that means different implants.

Right. All I had to do -- the X-ray is the same, everything is the same, essentially if it was the PS, and, again, I use the PS if I felt the flexion was a little looser than my extension and I felt a little laxity there, I pop it in again -- no I need the crow bag still. There we go. And pop it in again. And now I've got PS. Okay. Again, it's going look the same.

Yeah. You can see there's a little bit more play, but not very much.

Maybe a little bit, but it's going to look similar.

And I purposely downsized the poly so I would have a little bit more laxity. Okay. And now I think we're going to take our final one. Now you could use a conventional poly and use the high flex, but because of her age -- if she was 60, I would probably be doing that, 60, 62, for cost issues and just because, you know, I don't think there's a necessity. If she was in her 60s, I would probably do the oxinium with the conventional, but she's in her 50s, 55 years old, so we're going to combine the two together to try to give her the Ferrari version.

So are you going to use a 9?

11, 11 XLP high flex. But it's really, you know, quite empowering at the time of surgery to make these decisions once those implants are in. Because, you know, at the end of the day things are different. I've been in situations where you trial and say it's exactly what I thought it was going to be and then you get at the end and you say it's different. And, you know, if you don't have those options, you know, you're not happy. You know what, you're not going home sleeping at night. Where having these options makes it really a much more comfortable situation for you and I think a better result for the patient.

And I'll tell you, we're lucky here. If you needed something else, we could just call outside into the hallway and we'd get whatever you needed. But most hospitals that's not the situation, so it's nice having one implant where you have all the different options.

So the crosslink poly looks just like this insert. We have a different locking tool for the crosslink poly, and essentially, again, they self-align themselves as you place them in, so you don't really have to, you know, worry about the rotation. If the you lay it flat on the tray and then just extend it out and push it back, it will get ready to lock, and then use this locking tool, let's do it, and squeeze.

So the last point I want to make here is that Smith & Nephew does recommend that if you're putting in the a constrained poly, you use a stem on the tibia, although there are ongoing studies looking to see whether that's really necessary. But at this point, they are recommending a stem on the tibia using a constrained poly.

All right.

As their little disclaimer.

I won't comment on it because though there are some studies from here that have shown that you don't always have to biomechanical -- if the bone -- I should say from my surgical from my surgical perspective, if the bone is of poor quality, like you see in revision, I will always use a stem. But if you have good quality bone in the primary, I won't.

And I think that's the point, whether you're using a constrained poly or a regular PS or high flex poly. If you've got crummy bone, don't be afraid to put a stem on.

Now here we're all done, and essentially we have our poly in here. You can look. For those of you who get a side camera, we're out nice and straight. Okay? We're going to do that push test. If you pan back you can get an idea of the alignment, just the whole alignment of the leg. Try to -- is that as out as you can go? But you can see the alignment in the leg looks good. Okay? And if I look at my -- oh, there. Okay. So you can look here we're out nice a straight. Our valgus looks good.

We're going to show, now, the other, to look down, and I'm going to show you the laxity we have, again, with the real poly, and so, guys, open this up again, and we're going to show you that. You see a little bit of looseness. That's exactly what I want. You see that? Can you appreciate that, Dave?

Yeah, absolutely.

You've got a millimeter or two. If you do it in flexion, you're going to see the same thing. She's going to have about a millimeter or two. And if we do the dangle test here, this is probably the best predictor of what she's probably ultimately going to get. Okay?

You're making the camera guys work hard here.

Yeah. Now that's pretty good flexion, so and that is the best predictor if you just do the dangle test, and Dick Scott from Boston has written how that has a good correlation with ultimate range of motion. That's pretty good, you know, it bumps right here, so that's pretty good.

And lastly, you look at our patella tracking, you get the top camera to look at the tracking. So let's go up top again, keep your camera men busy. No fingers. This is the way you check your tracking. We're just going to bend the knee up, and here we go, up, you shouldn't see any lift off on the medial side. It should be flat on there and just bend it up. And also you're never going to get the camera in here, but I'm going to try anyway. You can see the high flex poly. The beauty of the high flex poly is that you're not going to get the impingement both on the front of the post or looking -- if you can see in there, this tendon is going to sit right in that groove, right in this groove. If you flex it up, you'll see that tendon just sits right in that groove. That's the natural angle; whereas, when you have a standard poly, it can impinge on it. And there will be some patients, if they have high flexion with a standard insert, you know, they may feel that.

So will you ever use a standard PS poly instead of a high flex?

Yes. I think if there's a ligament balance issue or if maybe I don't want it to bend as much, I'd like to have them a little tighter in flexion, or a patient who has a little laxity in flexion. If they're a little bit looser in flexion, especially in deep flexion, as you get up into 125, 130, I'll put the PS in. You'll see that a lot in the valgus knee. The valgus knee I get nicely balanced. I think it's good. I don't need constraint. But on the other hand, I say, "Well, you know, laterally inflexion feels a little looser so I've done a bunch of ligament releases, I'll use a PS." So if the ligaments aren't quite as good, especially in flexion, I'll go with the PS, otherwise my default position is going with the high flex.

Okay. So I think we're going to finish up and close here. We can let the tourniquet down. And do we have any final assessment? I think we're going to be getting probably evicted to cyberspace in the near future.

Yeah. I just want to remind everybody that this is going to be archived, and you are going to be able to see this later on, and you are going to still be able to e-mail any questions for us as well. So I'd like to thank everybody for joining us this evening, and you can continue to e-mail questions if you have any.

And I want to thank everybody too, and thank Dr. Mamen for being there and helping, and, you know, sifting through all the questions and also thank my team here who have done a great job, Dave and Mark and Jude here. This is my team, this is the A-team, and I want to thank them, as well as everybody who came tonight to help. Thank you very much.

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