Artificial Cervical Disc Replacement Improves Mobility
February 18, 2009
From PinnacleHealth, Harrisburg, PA

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Hi, my name is Walt Peppelman, and welcome. Today we're going to have the opportunity to watch Dr. William Beutler perform a total disc replacement arthroplasty on a young patient who has a herniated disc in her neck.

The first thing he will do is go through skin and down through the muscle that he was explaining called the "platysma muscle." This is a very small muscle, very thin, and actually as you stretch your neck out you can actually make out the definition of that muscle. He will split that muscle and look for in next muscle called the "sternocleidomastoid". This is a major strap muscle of the neck. Once he's able to find that, he's able to bluntly go down with his fingertip and actually find the anterior part of the neck.

There are some vital anatomic structures in there, but we're able to avoid these with our dissection, and you'll see that this is a very bloodless approach and gains us great access to the front of the neck with even a very, very small incision. So what Dr. Beutler is defining out, that's the platysma muscle right there. He'll divide that a little to give him a little more visual aspect, and then he'll find this sternocleidomastoid.

Now this anterior approach to the cervical spine has really been done since the late 1950s and the early '60s. And in the past has been utilized to perform anterior cervical discectomies and fusions. The fusion procedure has been the most common way to treat cervical spine problems in up to date but this new technology with the use of an artificial disc has some significant benefits over the previous procedure of the fusion, and that is, able to maintain motion of the cervical spine, and we'll catch on that a little bit different.

But right now Dr. Beutler is exposing the spine. He's able to -- he's being very careful. You can see that there's not much blood loss with this procedures and this approach. It's actually a very dry procedure, and he'll be able within a few minutes be able to get down to the neck. That kind of makes it less painful too, Walt, you know, when you're going in between the muscles. I'm not actually cutting any muscle in the here. I mean I've got the sternocleidomastoid, a big muscle down here. I've got, you know, portions of the other muscles.

The trachea where we breathe through is right here. Now I'm going to go underneath it and find the spine itself. But because we're not actually cutting a lot of muscles on the way in, it's, you know, I find that patients have very little pain after surgery.

And just for those who are viewing this, the patient is actually laying on the back. The patient is actually laying on his back and the head is facing straight up. The incision that Dr. Beutler uses is a little over an inch long, and as he dissects it out, the patient's chin is to the right and the chest wall is towards the left, and he's dissecting up and down. So the patient is actually in a very comfortable position.

As Dr. Beutler states, he's really not cutting any muscle, which makes this really a very minimally invasive approach and allows for very quick recovery. And this patient actually will only have a very short hospital stay.

We're down at the fascia, which is kind of connective tissue that helps hold things together. It's the very last layer before we hit the spine itself. That's this kind of whitish tissue. Rather than cutting it, I'm just actually using these cotton balls to push them apart gently, and that way, again, much less pain, much less bleeding, and it exposes it quite effectively. Marker pen in right now.

Prior to the procedure, Dr. Beutler planned the incision with the use of X-Ray, placing a marker external to the skin to help to delineate the exact trajectory into the disc space. So now he's found the disc space, what he wants to do is confirm it with X-Ray so that there's no confusion to take the pressure off that nerve.

So a lot of times these patients present with significant pain not only in their neck but down into their arm, sometimes even with numbness and tingling in the hands and loss of motor strength. Is that typical of how this patient presented to you?

Yes. He came in, and he had pain that shot down from his neck. His neck pain was bilateral, both sides, and then the pain shot down from his neck all the way down to his hand, very severe pain. He had numbness on the side of his hand, more toward the thumb. And I guess maybe if a model you can show the different nerves, but the one nerve, it's is called the C6 nerve, the sixth cervical nerve, is the one that was being pinched by this disc rupture.

The disc pushed backwards in his neck and is now pushing very hard against where the nerve exits his neck and goes down his right arm, so we need to get that out to make him feel better. He had weakness of his arm. He had weakness of the biceps pulling toward himself, which also matches a disc rupture at C5- 6.

Now we've done surgery for these types of patients for many, many. Prior to this new technology, we would take out that disc and then we'd end up doing a fusion. We would put in a bone spacer, whether it was the patient's own bone or donated bone, and currently we've been utilizing the anterior plate.

Obviously that procedure has worked out very well, but there's probably a lot of really significant benefits to instead of fusing this area, putting in an artificial disc.

Well it allows motion, you know, and there's been that debate over, you know, fusion. People wonder, does it cause problems at the next level up, so if I fuse this disc here, what would happen to the disc just above it or below it? Does it go bad? And there's plenty of people out there that have had that happen. We'll have 45 blades.

And so the idea of the artificial disc is by maintaining motion, by allowing the neck to move appropriately without doing a fusion, then the hope is that the next levels hopefully won't feel the stress, and by not feeling the stress, they should maintain good discs, hopefully over the lifetime of this young man. I'm putting in the blades here.

The blades are going to go -- this is a smooth one. You saw on the other side I used a toothed one. I use a smooth one on the side toward the esophagus and the trachea because they are relatively fragile structures, and I want to protect them as best I can. So we just slide those in, and I'm going to take those out. Dr. Purcell [PH] is here helping me, and we're going to put in this retractor to be able to see what we're up against, and then we're going to do much of the rest of the procedure using a fluoroscope, using X-Ray guidance.

All right. So there's our disc place, we confirmed on the X-Ray. Can I have a Kitner. We confirmed on the X-ay that it's the appropriate level, C5-6.

And, Dr. Beutler, I have a model here, and I'm going to show the visitors -- or the viewers where exactly you're at. This is the cervical spine. The stem of your brain sits in the back of your skull. And these are the cervical vertebrae. This is the second, third, fourth, and sixth, and seventh. The disc that is herniated is between C5 and C6.

So Dr. Beutler has exposed the front of the spine. He has stuck a marker into this actual disc space, and the next thing he is goes to do is stick a screw into the bottom part of C6 and into the top part of C5. And that will allow him to have exposure to this entire disc space and be able to take the entire disc space out to decompress the nerves that you see coming off the side.

An incision is made in the neck at the location of the diseased disc, and the soft tissues are moved away from the front of the diseased disc. The surgeon then performs a discectomy and remobilization, removing the diseased disc and releasing pressure on the surrounding nerves and spinal cord.

We're going to do an image right now to see where I have this awl. This is just something sharp so I can get a screw started and we'll put a screw in right there, and we're going to put another screw in just down below. I'm sorry, I moving my head, but right down here. I'm just getting a little something started there. All right. So what we're going to do is we're going to move -- I'm going to move my head because we're going to bring the fluoroscope back in.

We'll put one screw in above the vertebrae and the next one down below. And these screws will serve two functions for him. They'll help define the midline, because we want the screws to be exactly in the midline if possible, and it will also allow him to distract or open up the area for the disc space to assist him in decompressing all the way back here in the spinal canal. So that's what he's doing right now, and he's trying to make these parallel to the end plates and secure his position. That's great, Bill.

That does look good.

Obviously this new technology is not right for everybody. There are certain indications that we would not want to put these in, so patients with osteoporosis or, you know, very, very severe stenosis. What are you main indications for putting in an artificial implant versus going ahead and doing the fusion?

I think the best patients are those that we have where it's one or two levels of problems. And so let's say a person comes in, they have one level disc rupture; that would be ideal. The person has one level, two levels -- they look midline, don't they Walt. Sorry to interrupt there.

Yeah.

They look -- the screws look good just looking at the fluoro image there. Why don't you pull out the fluoro. So if I a have person come in, they have a one level disc rupture, maybe two levels of problems, I think that would be the ideal case for this. As you said, if a person has osteoporosis and the bones are thin, or if a person has severe arthritis, I'd rather do a fusion in those situations or maybe just a decompression, just removing some bone rather than actually doing an operation like this.

But by far and away, the most common problem that you and I would see in the office would be patients that have a one or two-level disc rupture, and so this is a procedure that would be useful in many patients.

And I would think more towards the younger patients, the patients in their 30s and 40s with disc herniations, than an older patient, let's say, in their 70s with stenosis.

Oh, absolutely. I think especially when you consider that the younger you are, the more years that you're going do be moving your neck. It sounds pretty obvious. And over all those years having a fusion, there is a concern. Will the fusion at this disc cause problems at the disc above or the disc below? Can I have a couple of nuts to put in there.

So what you have done now, Bill, is put a distractor piece right over the screws that you inserted, and now you're locking this down.

I'm locking it down so it doesn't wiggle out. There are times during this operation we're going to pushing and pulling a little bit on discs and other things, and I just want the instrument to stay exactly where I put it, so I just locked it all down. I'm going to open up this other retractor a little bit right now. And, you know, it's not a bad view. That's the actual disc space right there.

It's beautiful.

So I'm going to take a scalpel and I'm going to cut into the disc space, so here I am just kind of cutting straight back straight over and down, and there's the actual -- there's the disc itself. You know discs are -- a lot of people come in the office and they'll say, "Oh, it's like a jelly or something that squirts out." It's really not like that. I sometimes tell people it's crab meat. Do you do that, Walt?

Yeah, I do. We have a little pictorial up here. The disc is not just one piece of gelatin. I mean it's actually two components. It has an outer rim of what we call the "annulus fibrosus." And then the inside is called the "nucleus propulsis," which is what you said, kind of looks like crab meat when it sticks back.

And so what happens is there is a defect or there becomes a hole or a weakness in the outer rim and allows for this inner disc material to protrude out in the canal and create, at times, pressure on the nerve, and that is exactly what you're treating at this time. You're going in through the front you're going to remove the entire disc, including this piece sticking back on the exiting nerve root to relieve them of the pain.

Okay. Thanks.

Yeah, so it looks like you're through the outer rim of the disc, and you're using an instrument called a "curette" to help scoop out some of that disc material.

It almost looks like a disc rupture would be like this where a piece of disc kind of pops out like this pops out. Now if it did it up front like here it wouldn't make any difference. There aren't really any structures that it would harm in any way. But when it does it in the back of the neck, that's where the problem is. That's where we start getting patients that have a pinched nerve or a problem like that.

Dr. Beutler's views really don't show the depth that he's working at. And where he is working, right now he's entered into the spine from the front and it is all the way back here, and he's right against the ligament. Eventually he'll be able to poke his curette underneath the vertebral body and actually remove this entire ligament so he can fully and thoroughly decompress the spinal cord exist.

So he is right now working his way back. He is at the posterior end of it, and eventually he will go all the way back into the canal so he can remove all the bone spurs and all the disc material that's pinching on the nerves.

That's right where we are right now, Walt. We're working our way underneath with this curette. This instrument that almost looks like a mini spoon or something. It has semi-sharp edges on top that I'm able to slide down the disc space and then get underneath the bone and pull everything toward me.

The surgeon never wants to push down on these operations because the spinal cord is right below you. So all the motions that you're doing are towards me, towards the front where it's safe. I'm going to use a little different shape curette to reach down in there and free up underneath that bone so I can put that biting instrument and remove that.

He has a large bone spur right here. This piece of bone right here is pushing in on the spinal cord, so I want to be able to remove that. So I'm going to try to make a little space underneath it with my curette here.

Now in the past, we have used distraction of the vertebral space, along with a bone plug, to gain increased height for the nerve to come out. When you're putting in an artificial disc, you have to be more diligent in cleaning out all the material back there and resecting any of these bone spurs because we're not relying as much on the distraction as we are in the actual formal decompression of the nerves.

Well that brings up a good point, Walt. The operation is same up to this point, whether one is doing a fusion or whether one is doing an artificial disc, which is what we're doing today. But when I do an artificial disc actually technically there's sometimes a bit more of a challenge to it because you're putting something that's going to allow motion, and if it's going to allow motion, I've got to make sure that there's no bone spurs, pieces of disc, anything that with that motion is going to push against nerves or the spinal cord. So it's sometimes a little bit more work.

Well, there's the space for where that nerve is exiting right there, and there was a large piece of bone. We were fighting it as we were talking here. So it's mostly gone now. I'm going to do one or two more bites, and just checking on that. We're going to check on that nerve, make sure that it's completely freed up, and if it is, I'll check the other nerve, the one that goes down his left arm, and if both are freed up, we'll put in a piece of disc where we took out our disc right through here. Can I have a nerve fork, please.

Now in order to explain what a ruptured disc is, we already explained that the anatomy of the intervertebral disc has an outer rim component and the inside of the component. The problem with a disc as it ruptures out or as it leaves the confines of the outer rim of the disc it actually can squirt out and put pressure right here on the nerve root. And so a lot of times there's no containment at all left for the disc. It can actually float out into the foramen of the nerve.

So that's what Dr. Beutler's job is right now, is to remove all this material back in the canal and explore out into what we call the foraminal region to make sure there's no pressure on it. So this is the problem that led to the patient's surgery and for what Dr. Beutler is treating right now.

Well that's really where we are. That's what we're doing, is the foramen is exactly where I'm putting my instruments right now, and those are small pieces of disc that I'm taking out. I'm obviously going real slow through this area, and the reason is that is there's those large veins that are there, and I prefer not to have to mess with those today or any day.

So can I have the nerve fork. I'm going to check now, make sure that we got the job done. I think we got everything out that we needed to get out. So I'm kind of feeling in the nerve where the nerve exits. I'm passing this instrument right out there. We call it is a nerve hook. And this hook slides right out relatively easily, and that's exactly what I want. I want this to slide very easily so that I know that nothing is pushing on that nerve.

So the differences are now is that, again, what Dr. Beutler said is that normally at this point in time we would grab a bone implant and place that into this in inner space. What he's going to do now is prepare for the artificial disc, and that artificial goes in three separate steps. The first thing he will do is measure and get a trial implant. This implant will be approximately the size of the final implant that we insert and also place it in the exact position we want our final implant to be inserted at.

After he places a trial and he's happy with that, the next thing he is going to do is create what they call a "keel," or a slot for the keel. This is part of the implant that slides in the vertebrae through a notch and allows the vertebrae to lock on or hold the implant tight so it has a good part to heal. And the third and final aspect that he's going to do is actually insert the entire implant.

Now when we look at the implant, the implant itself is made up of three components. The top and bottom part of the implant are made out of a metal called "chromium cobalt," and on the outer surface of it, as we see it gets inserted, it's very rough. It's titanium plasma sprayed, and this allows for the body to actually grow into the implant.

Now between these two end plates, which go above and below the disc, is a small piece of what we call -- it's a medical plastic. It's ultrahigh molecular weight polyethylene, and it's a medical-grade plastic that's really been made to sustain active compression and motion on this area for many, many, many year, decades.

And so you can see when the components are placed in place that the body is able to maintain motion of the neck in both flexion, extension, and rotate. And this is what's been so much different than the fusion.

The ProDisc C total disc replacement from Synthes Spine is an FDA-approved spinal implant intended to reconstruct the diseased intervertebral disc in the cervical spine. The ProDisc C is indicated for patients suffering from intractable symptomatic cervical disc disease, or SCDD, at one level between C3 and C7.

The Pro Disc C is a ball and socket implant that is composed of two cobalt chrome alloy end plates and a polyethylene insert. The polyethylene insert is affixed to the bottom end plate forming the ball, and a polished dome in the top end plate forms the socket.

The implant components work together with the surrounding spinal structures to provide stability and function. The ProDisc C implant is secured to the vertebral bodies above and below the disc space and held in place with two central keels. All bone contacting surfaces of the ProDisc C implant have a plasma-sprayed titanium coding to provide bony coating to promote bony on growth, providing long-term implant stability.

The ProDisc C is a zero-profile implant that does not contact soft tissue structures after it is implanted.

The technical aspect of putting the implant in is far greater than just putting in a piece of bone. So Dr. Beutler now has prepared the end plates. He has gotten rid of all the cartilage, all of this material, and now he's asking for the trial implant to be fitted, hopefully, right in the midline.

There are six sizes of implants, so Dr. Beutler has to find the optimal size for this patient, and not only in the width but also in the height and the depth as well. So this is a little bit -- we don't want to put too big of an implant in there, do we, Bill?

No. If it's too big then you don't get any motion. If you just block the bones apart so that they're pulled away apart, then ligaments will be stretched. It's very hard for a person to move. But we want natural motion, so I put it that distractor in what's called "neutral," right where it wants to be, and that should be a natural position for the bones of the neck. And then as I put an artificial disc in, it should be able to move in a natural position right over that disc. So we're going to get a nice view right in the middle. There it is.

Now we can see it, pretty much in the midline right between your two tractor blades in the upper end of our picture as I see it. A lot of our sizing has to do with our experiences. And with some of the FDA trials that we have done and some of our experiences that we've learned putting these things, we've learned a couple lessons.

Well it's not something you learn in med school. This is on operation kind that takes experience, and once you get that experience, it's a very, very handy operation. I need a handle to hold it up. So what you want to do, in this case, I just want to move this a little bit more toward the center.

So what we had to learn is we were part of an investigational group that was in the United States. There were 20 centers in the United States that were chosen to investigate these discs and decide whether they were appropriate for people. So we did fusions and we did discs, and by doing both, we're able to see whether or not this was an appropriate procedure that would work.

These studies turned out well, and the FDA has approved these. Fluoro. A little bit more. Let me take a look here. Suck here.

That looks perfect, Bill.

Yeah. We're wondering if we shouldn't put in a shorter one. But I'm kind of liking it. I want to make sure it's off midline. As you see the two distractor posts you can see this post here and this here, a so it's not dead-center midline the way I think. I'm just going to take a look at what a shorter one looks like, and so I'm going to pull this out and put in a little smaller one, and this is that sizing business.

So what I'm going to look at now is one that's just a little bit smaller. So it's the same width, it's just not quite as deep. I don't know if you see the fluoro image, Walt. We put in a little smaller implant depth-wise. It has the same height; five-millimeters height, but instead of 14 deep, it's 10 deep. And you can see it looks a little bit better. I'm able to put this a little more back where I want the natural motion of a disc to be.

And it looks great, and the height appears to match the disc level above and below as well.

Good point. It does, and so I'm kind of liking this size right now. So the next step that Dr. Beutler is going to do is actually create a drill hole and a bur hole for this trough for part of the implant to slide into.

That's exactly what we're do going to do, Walt. We just got a AP view, a front view that you might be able to look at that shows the implant is right where I want it, right in the middle of the spine, so I'm very pleased about that. And now we're going to do a side view X-Ray to make sure I have my depth right before I start drilling my keel holes.

It looks like I can go a little bit deeper with my trial, so I'm going to do that right now. I'm going to put my handle back on, and meanwhile, the scrub nurse is preparing the actual disc itself because we're satisfied with the size, we're set to put it in. So she's preparing that and putting the pieces together. It's actually three pieces, as you described. All right. So I tapped it in just a little bit more. Can you do a fluoro image, please.

And that's where I wan it. That looks beautiful, so I'm very pleased about that. I'm going to put a little compression on it, just squeeze down there a little bit better. And now we're going to put on a --

Now what Dr. Beutler is going to do right now is he's putting this device over top of his trial implant, and this is the jig that he's going to use. And through this jig he's going to insert a stay pin, which is going to hold it in place, and then he's going to use a high-speed drill to drill out the bone in the exact area where the keel of the final implant is going to be inserted. And so this is the steps that he's doing now. He's making sure that the trial implant is exactly positioned to in the area that he wants to create the keel, and then he'll insert that jig on top.

It's amazing how strong these keels hold these implants in place, Bill. You know, we've been doing this for two years, and we've there's no screws to hold these implants in place. It's just basically in-growth, and we have never had any of the implants dislodge, slide, subside, or anything else. It's pretty amazing how the body incorporates this implant pretty quickly.

Boy, that's a good point. You know, folks would worry about where does this thing is going once it's in. But there's two reasons why it doesn't go any where; one is that we're putting in a real strong keel here; but the other reason is is that there's little places for the bone to grow right into the disc itself and hold it there. So it just naturally will grow right in to the disc itself and hold it in place.

A trial is used to assess the implant size and position within the disc space. Next, keel channels are prepared in the vertebral bodies above and below the disc space. The keel channels for the ProDisc C implant can be prepared using either a milling technique or a chiseling technique. In the milling technique, a milling bit is used to create the channels for the ProDisc C keel.

The chisel technique utilizes two chisels to create the keel channels. First, the primary chisel is inserted over the trial and advanced into the vertebral bodies. The step is repeated with a secondary chisel to

remove any remaining bits of bone from the keel channels. Both the milling and chiseling instruments are designed to ensure that the final placement of the implant precisely matches the placement of the trial.

This is a jig. It's going to guide my drill that I'm going to put in here. This allows motion of the drill in and out so that I'm able to cut, a "keel cut" we call it, but it's going to where the actual disc keel is going to grab bone and stay right where we put this disc.
So I'm sliding this down on my implant, and then I'm going to tighten it on there.

It's really amazing how minimally invasive this procedure is. It's such a small incision and such carpentry that can be done through a one, one-and-a-half-inch incision.

Well, it is. You know I guess looking at my thumbs, you can see that the space where we're working down here is fairly limited. You know, there isn't a whole lot of room to work, but by doing it this way patients have less pain, less scarring, and seem to do better. Let's have a pin, please. A sharp one.

So what Dr. Beutler is doing now, this is a holding pin. This locks this jig into the vertebral body and allows it not to move once he starts to cut the one side. And so he's just tapping this in. This is a very light-weight hammer by the way. He's not pounding on the neck.

Yeah, that seems to hold things. There you can see on the top part the small little bony plate coming through, and that's the holding pin now.

So I'm going to take this drill and go right down to the spine. Okay, fluoro. And you can see the now on the fluoro. Now I'm going to go live on the fluoro. Go live. And I'm going to wiggle that drill. You can see I'm wiggling it until I create a nice space for my keel.

Now, Bill, that device that you put on there, that's a stop for that drill; right, to make sure you don't go too far?

Yeah, it is. You can't go too far. That would be a problem.

That would be scary.

That would be very scary, so we don't want that. Do you have a cut. And the drill again. Suck in there too when you get a chance. Now we're doing to put the drill in again. Okay, fluoro. And you can see the drill right there. Now, again, we're going to go live now, and I'm going to --

And what this is doing is cutting the trough of the stem of the implant.

We have it cut right now, so I'm going to remove all this now. So our keel cuts are cut. And now the chisel.

Now he's using the chisel to kind of clean it out to make sure there's no bone any fragments in there.

That's what this is. This is a chisel that as this slides in front and back of that implant, it's going to cut the channels for the keel. So we're going to do that right now. We're going to slide right over. Everything is -- the trial implants in place, so now I'm going up and down the same trial implant --fluoro -- and making chisel cuts. Slide it up and down a little bit. A little bit better there. Fluoro. All right. That's it.

That looks beautiful.

Now we're going to take all this down. Now while Dr. Beutler was doing that on the back table, the scrub nurse and the circulating nurse were putting together the actual implant. As we said before, the implant comes in three pieces, but it is inserted all in unison in one piece. So the scrub nurse has assembled the size of the implant and the components that were selected by Dr. Beutler. She's putting them together on

an inserter to allow Dr. Beutler to insert the final implant utilizing one insertion device, and that's already been put together on the back table.

This is our trial that we were using earlier on all the fluoro image, so we're just setting it aside. We're done with that. This is a way that I can clean out the channels that you saw me drill out and chisel out. I'm going to put this down low, do a shot to see where it is, and then just clean out any little bone fragments that might be in there.

You can see the keel cut right here. You can see bone, you know, has been removed here and here, so now I'm going to go -- and this image here shows me where that is. It's right on the very back of the bone. And now I'm going to clean that out. Nothing in there. Now we're going to do it on the other side, and we're going to clean that out, and then we're going to put in the implant.

After the keel channels have been prepared, the vertebral bodies are ready to be implanted with the ProDisc C implant. The implant is attached to the inserter, the keels are aligned with the keel channels, and the implant is inserted all block into the vertebral bodies. The instruments are removed, and the final implant placement is confirmed.

The implant has a top and a bottom to it. This is the instrument that allows us to put it in. You can see the up and the down, showing us where the top and the bottom, and the surgeon also check on it. You can see the top on the actual implant itself.

This area right here you can see is kind of roughened up, and that's what we meant by bone from the vertebral body, then, can grow into that and grab. This is the keel that will help hold it in place. And as bone grows into this roughened up area, then it will also help hold it in place. It's in three parts. It has a top, a bottom, and then the center core that the disc can then slide up and back, and back and forth on, which allows bending and natural motion.

So you can see where it belongs. Here's the cut I made above and below. There's the bottom. There's the dura and the spinal cord. We're going to put in its place, so I'm going to put it right on top here. Now I match up where I had everything, and we're just going to put it right in. Fluoro. All this is done under fluoro, so I'm watching where it is. I don't want to go too deep. I don't want it too far. I don't want it too little. I got to put it right where it's supposed to be, so we're going to go back a little bit more. Fluoro. And there it is. It's in.

It's perfect.

So now we're going to take all of this off.

Now normally you have a fine-tuning device, but you don't even need that. You put that in there so good the first time, I don't even think you can find tune it any better, Bill.

Well, this is the second one today, so I guess we're getting better at it, huh?. No, it's an operation that, again, there is a degree of experience -- no question -- that you want to have. But normally the operation should go smoothly.

Here is the disc itself right now. And we're going to put in some bone wax to keep bone from growing. These rough edges right here, I don't want bone to grow from this edge down to that edge. I want it to stay just like this and allow motion over the top of that disc.

This stuff that I'm putting in here is called "bone wax, which is wax that is very natural. The body can dissolve it, but it also will inhibit bone being able to grow so easily back in.
The only place I want bone to grow is into the actual disc itself, so I'm filling up any rough edges that I created with all the work that we were doing today.

Our early European studies did show that many years ago when they started doing this that the body can actually bone grow bone on top of the implant and create a fusion. And, again, that's not what we want to happen. So, again, through knowledge of our European counterparts and experience, that's why we use the bone wax.

And Bill's and my experience of dozens of theses implants lasting a year, two years out, have not shown any growth of bone over the implant, and we were able to maintain motion with this technique of putting bone wax along any bone.

It's beautifully recessed. If anything, I could go more anterior, but it seems to be recessed. Do you think more anterior?

No. Ideally that should work.

Well that's right on the border now.

Yeah.

Well it looks ideal, everybody. So what we're going to take out the distractor device. Do you have the screwdrivers to remove that? So I'm taking out the little nuts that held my retractor in place.

Now Bill, this patient did fantastic. He's going to go to the recovery room, spend maybe an hour, hour and 15 minutes in recovery room and then go to the floor. How do you handle this patient postoperatively?

Well I'm going to give him a little neck brace, Walt. I'm going to give him a brace that -- you have a small handheld Cloward. Just hold that up. It's a soft brace, you know, just a little foam. And he's only instructed to wear that when he wishes. It's not required. It's just for comfort if he feels he needs it.

But because I'm not doing a fusion, I really don't have a good reason to immobilize this patient, and so, natural motion is okay. I'm going to ask him not to go to work for about ten days. I must say this patient here, he is a very kind of a go-getter guy, and he wants to go back to work, you know, within a week or so. And so we're -- his wife and I had a little talk before this operation. We're trying to figure out ways to hold him down.

But the problem is -- and I guess it's kind of a crazy thing to say it's a problem -- the patients do so well right off the bat, you know, a little trouble swallowing maybe. I mean not even trouble, just a little minor discomfort there. Tonight this fellow will have dinner. He'll be able to walk around. I'll probably keep him overnight and let him go tomorrow. But there are some centers that allow patients to go home the same day after these operations because they feel well right off the bat.

So I'm taking out these pins. I put some bone wax in the holes because bone is pretty vascular. It tends to bleed.

Activities, the patient wants to know, "When I can play golf? When can I play tennis? When I can do things recreationally?" What are your thoughts on that? Well, the more athletic they are, the more I'm going to wait a little bit. But people are up and at work and doing activities by around two, three weeks, and people are back to doing sports like. Now golf is not a very high-impact game, but there's a lot of bending, and I'd let this man start golfing somewhere around six weeks or so after surgery.

How about something active, really active like skiing.

Well, for that, I'm going to bone grows in. I want bone to grow from this bone into the implant right here and that's going to take a few months, so I'm certainly going to, you know, give it a matter of months, three to six months before we have some real heavy activity like that. But patients, they are encouraged

to get back into a normal lifestyle in every respect, and that's what happens. So it's a great little operation.

You can see there's no bleeding here. The disc is in good position. The bones are here and here. It's holding it apart. It will allow motion there. I'm going to take out my retractors now, get my final X-Rays, and then we're going to close up.

The artificial disc is an FDA-approved device that we have been using now for the last couple of years, some of it investigation. This device has been approved now for about a year. It's my opinion, and I think the opinion of many surgeons out there who are utilizing this, this may actually be the way to do this in the near future of the state of the art. What are your thoughts on that, Bill?
I really think this is going to grow and grow. Artificial disc in the lower back still has some improvements to have happen. In the neck, this operation is quite the opposite. It's a very, very high success-rate operation. The clinical results and the FDA studies, in our study, in all the literature that I've read has been extremely positive that this is an operation that I think will become standard, and state of the art.

Right now we're following these patients out long-term because what we want to know is whether these discs will keep the next level up, this level up here, from going bad versus a fusion, where we definitely see them go bad in a percentage of patients and then have to fuse that level.

Patients come in my office, and they're concerned about, "Well what about the next level? What if that goes bad? You know I've heard of that happening to my family member of friend or something that I ran into." And that's a valid concern. And I think with this, it's not going to be considered -- I'm hoping it won't be a valid concern, and that's what the long-term studies are going to show.

Already the data that you and I hear when we going to meetings regularly is that the data is showing that; that these patients are having very few in the way of problems, and long-term success seems to be holding, so I'm very, very encouraged.

So there's the disc, and I just check for bleeding. I check to make sure that esophagus and the trachea are okay. I check -- why don't you get some irrigation there. We're going to irrigate a little bit. That's just fluid to wash out any blood or bone wax or whatever, pieces of bone. And so that sort of just washes everything out. And it looks god. I check for bleeding again. I don't see any at all. And that's it. We're going to close up.

Excellent job.

So I appreciate everything. It's really been a pleasure having everybody in the operating room today. And our staff here has really worked hard to make this production today, so I appreciate everybody's time and effort. And I thank our viewers. And any questions, I'm sure there's ways to get the answers. I appreciate your time. Thank you.

And I want to thank Dr. Beutler and his staff for helping out with a successful procedure. I'm sure the patient is going to do extremely well. And, again, this is, I think, technology on the forefront that will become the state-of-the-art of treating disc herniations in the future. Thank you.

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