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Programming the Cochlear™ Nucleus® 7 Sound
Processor for Nucleus® 22 Implant Recipients
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- [Mary] Hello and thank you for your interest in Programming our Nucleus 22 Patients. We're so excited to be able to offer our first-generation of implant recipients the technology in the Nucleus 7 Sound Processor. My name is Mary Beth O'Sullivan. I'm a Professional Education Manager at Cochlear and with me today is Dr. Dave Catlett, Senior Manager of Clinical Training Services. This course is literally packed with information that will directly impact your patient care. You'll be able to counsel about the sound processor, identify the unique characteristics of the Nucleus 22 implant and comfortably navigate on our new custom sound pro platform. In order to accomplish all of this, Dr. Catlett will be going through some case studies and walking you through custom sound pro in a live demonstration. We have included some helpful screenshots in the attached PDF of the slides, so you may wanna take a moment now to download them and maybe print them out so that you can treat this course as a workshop and have a nice take-home packet. You will also find attached the technical specifications for the Nucleus 7 Sound Processor, a quick guide for upgrading and a guide with suggestions for ongoing clinical care. It is possible that our Nucleus 22 implant recipients are the best example of our mission at Cochlear. We have continuously offered meaningful innovation to all of our implant recipients to empower them and transform the way people understand and treat hearing loss.

- [Dave] Hi, this is Dave Catlett. So who are these Nucleus 22 recipients? Well, they have been implanted for over 20 years. Many will not have been seen at their clinic for several years, usually coming in only when they perceive a change in sound quality now and then, or for upgrades to newer technology when it's available. It's probably likely that upgrade appointments such as to the Nucleus 7 are not the time to do profound mapping changes because they can be a little resistant to anything that alters their perception of the sound and going to a new processor with new features will do that innately. So sometimes it's better to have them return at a later appointment if follow-up mapping is needed, we want this to go as smoothly as possible. Some of the earliest Nucleus 22 recipients who are now young adults have grown up with this

implant. They may have never adjusted their processor settings or used smart sound input processing. So may find it disconcerting to not hear background noise that they've always heard in the past. On the other hand, they might be quite adept and confident with controlling their processor manually and feel uneasy about the adoption of pre-processing algorithms like scan, automatic mic directionality. In addition, they may never have been asked what their hearing goals are, it's just been a part of them. With this upgrade and given the multitude of programming options, connectivity, wireless accessories, et cetera, we would suggest that you ask the recipient what they're hoping and expecting the Nucleus 7 Processor to give them and in turn express what you expect for the upgrade. For example, is it a younger adult who could potentially benefit from better hearing and noise or connectivity with their smartphone? Or is it an older recipient who would prefer things kept as simple as possible? When the Nucleus 22 was launched, there were far fewer implant centers in North America. With this upgrade, we expect some recipients to return to those centers with their many years of experience but others may seek out a newer clinic closer to home. If you are a professional in one of these newer clinics, you may not have a lot of experience with Nucleus 22 implant technology, the coding strategy utilized or the programming methodologies in place with this population.

So today, we're gonna provide some background on the Nucleus 22 device. Cochlear has delivered almost 40 years of innovation with the first implant placed in the early 1980s and FDA approval for adults with profound sensory neural hearing loss granted in 1985. Early on, the focus was simply improving hearing for all. Since then, we've continued to innovate from the early days of body-worn processors through to our smallest and most advanced sound processor with the Nucleus 7 CP 1000. Seeing here all of the processors that had been available for and utilized by our N22 implant recipients over the past few decades. Delivering backwards compatibility requires significant engineering effort and expertise but it's something that we, at Cochlear feel passionate about doing, it's part of our mission. How awesome is it that our earliest

recipients, some with over 30 years of device use can continue to benefit and gain additional functionality from an external upgrade without the need for revision surgery. The Nucleus 22 was Cochlear's first commercially available Cochlear implant. Globally, there are approximately 13,000 recipients with an N22 implant. As you can imagine, the receiver stimulator chip and coil design is not quite the same as compared to current commercial devices. Because of these differences, there are some considerations to remember when supporting these recipients. The Nucleus 22 implant supports only the SPEAK coding strategy, allowing a maximum of 20 channels and more detailed and intricate programming than our newer implants and coding strategies, which offer a more streamlined approach. In addition, Nucleus 22 implant devices typically have higher power consumption needs than more modern implants and this can significantly impact the battery life. The Nucleus 22 implant was released over 30 years ago when telemetry functionality was not yet available in the electronic chip set.

This means that some of the new features available on the N7 Sound Processor that rely on telemetry, such as coil offs with hearing tracker or data logging are not available for the Nucleus 22 implant recipient. Some software options for audiologists will also remain unavailable in the fitting software. Things like implant ID, the ability to measure electrode impedances and MAP compliance levels and NRT, Neural Response Telemetry. The RF or radio frequency transmission of data and power to the implant occurs in a different way and on a different transmission frequency for the Nucleus 22. The transmitting coil is there for unique for this generation of implant. Because the Nucleus 22 implant chip cannot send information back to the sound processor, that is there's no telemetry, the interaction is slightly different compared to all of our later Cochlear implant generations. The radio frequency transmission of data and power to the implant also occurs in a different way on a different transmission frequency, 2.5 megahertz for the Nucleus 22 implant. That's why the transmitting coil is unique to this population. The lack of telemetry functionality essentially means there's no implant ID for Nucleus 22. As I mentioned, you can't measure impedances or compliance. You

can't get neural response telemetry because the information from the implant can not be sent back out. Auto Processor Off, the option that can be set where they take the processor off their head and it will power down after two minutes is not available because the processor isn't receiving the information back from the internal device to know if it's on or off. Likewise, it can't detect the coil off and data logging cannot track coil off time. Finally, more modern advancements like Master Volume Bass and Treble are also not available for this population. Stimulation mode describes the location of the active stimulating electrode relative to the ground or indifferent electrode. The electrode contacts are numbered one to 22 with electrode one located at the basal end of the array and electrode 22 closer to the apex. This pairing creates an electrical circuit. Each electrode pair is assigned to a channel. Both the active and indifferent electrodes are located in the cochlea within N22 device. Selecting a wider stimulation mode typically lowers the amount of stimulus needed to elicit a hearing percept. A variety of different stimulation modes are available in our Cochlear implant electrodes. With the Nucleus 22 system, having stimulation modes often utilized only in this device, upgrade patients will likely need changes to the stimulation mode very rarely if ever. So going ahead, we are gonna review common ground mode, bipolar mode and pseudomonopolar mode.

Common ground mode is rarely used for patient MAPs and with this population mainly used for evaluation purposes. A common ground evaluation is typically used when a channel or several channels have unusually low T and C levels in comparison to other channels, don't generate an auditory percept response or elicit a threshold sensation but don't have a perception of loudness growth as the stimulation levels increased. We said, we need to identify an active electrode or an indifferent electrode. In common ground mode, we assign one electrode as active and all the remaining electrodes are tied together, electrically to form the indifferent or ground. Singling out that electrode gives us insight into the integrity of each electrode via recipient reported perception, which can be useful given the lack of impedance telemetry or other diagnostic

measures with later implants. Common ground should not be used with patients with partial insertions because current is flowing to all the electrodes, even those not in the cochlea in this case. This could produce non-auditory sensations in patients with a partial insertion. Bipolar stimulation refers to current flow between two intra-cochlear electrodes. So in the bipolar configuration, both poles of the channel are in the cochlea, hence the name bipolar. The physical separation of the electrodes determines the spread of current and therefore the area over which the spiral ganglion cells are stimulated. By using wider bipolar modes, you stimulate more neural elements, so less charge is needed in order to reach the appropriate T and C levels. Wider modes can be useful in patients with facial nerve stimulation or in a patient with electrodes that are out of compliance as deemed by a lack of loudness growth when trying to measure that C level. Creating a new Nucleus 22 processor MAP, the software will default to a Bipolar +3 Map and that's a real reason that ideally you want to build off of a recipient's current processor MAP. You either want to convert it if it's in your software, request the CDX file from a previous clinic, if it's not in your database. So you would have that to build off of or even request the clinics send you a printout of the map so that you can enter it in manually.

Again, recreating these from scratch is more difficult and these MAPs are programmed very differently. So it's not as straightforward as our current implants. Variable mode stimulation involves different bipolar modes in the same program or MAP. For example, in variable modes, some channels may be programmed in BP+1 while others in BP+2, BP+3, et cetera. Variable mode can also be used to increase the number of active channels in certain situations where there are a reduced number of electrodes available. Variable mode can also be used to create wider stimulation modes for channels that have two high C levels in the nominal mode. If you're using variable modes, be sure to check the pitch perceptions of the patient. In this situation, you may wish to consult your clinical territory manager when completing this type of programming for further guidance. Pseudomonopolar is a specific application of

variable mode. Typically, it is used in cases of partial insertion of the electrode array. In a pseudomonopolar, each of the intra-cochlear electrodes is typically grounded to one electrode that is at the basal end or just outside the cochlea. In this case, it's the ultimate variable mode MAP. I'll cover the software when we walk through a few case studies but a few key things to keep in mind when providing Nucleus 22 programming. When mapping, each T and C must be measured individually, as interpolation is not allowed for this coding strategy. If the patient was recently programmed, we recommend simply converting that MAP, it's a much easier step. In this bipolar +3 SPEAK MAP, the patient has a 5.1 millimeter skin flap thickness and the power level is 61%. The recipient is able to successfully use all three battery types. No warning messages are appearing. So all accessories can be used without experiencing sound quality issues or intermittencies due to lack of appropriate power. A key thing to note about Nucleus 22 MAPs is that no two look alike. You cannot interpolate between channels. Each channel must be mapped individually.

The ranges, as you can see here are not as you would expect, given recent Cochlear implant technology and the MAPs you see there. And again, battery life can be different. Since we are not using monopolar stimulation, individual T and C levels should be measured. You will find that you can neither make only selected channels measurable or use the interpolation button in the set T's and C's area, those icons will be grayed out. You will however, be able to hug the seize onto the T profile and utilize live C's. But we would recommend caution with this because the C-level profile typically does not match the T-level profile. Ideally, you will work from the patient's current processor MAP and convert that to the Nucleus 7. Then simply utilize sweeping to determine if any channels need to be remeasured. On the set level screen, if you'd like to verify stimulation mode, you can see the MAP summary box on the left indicates this is a BP+1 MAP. A more specific way to see this grounding is to right click in the data grid and choose to show active electrode and stimulation mode or indifferent electrode in the bottom to see the stim mode grounding pairs. You can also make

these parameters shown by default via your clinician preferences under the Display tab. In this case again, BP+1 is being seen. You can see on electrode seven, that it is grounding to channel nine. Thus it is skipping one electrode, BP+1. You may see channels in red along the top in any MAP. To determine the electrode pairing in the channel, again, simply ensure the data grid shows the active and indifferent electrodes. In this case, you also see these wider bars. This is indicative of double channel mapping. Double channel mapping is a technique that uses the same electrode pair across more than one channel. It was historically used in non-digital processors to ensure that frequency range was not compromised for patients who had a reduced number of electrodes available for programming. Double channel mapping is a real reason you would be better off to upgrade from the patient's current MAP because recreating this on your own might be difficult.

Again, consult your clinical territory manager for additional information as these come up. Why does the pulse width equal zero? You can see in the data grid below and in the MAP summary, it indicates the pulse width of zero. It's not truly zero. The difference is older devices used a stimulus or ESPrit stimulus levels of scale, which is different from our modern current level scale. This is quite typical for Nucleus 22 recipients. Using that scale as you increase a T or a C level, current is increased like we're used to today. And at a certain point, the current is held constant and the length of each stimulation or the pulse width is increased. This results in increased charge and thus increased loudness perception. This happens automatically behind the scenes. So as you're moving up with your T levels or your C levels, note that sometimes current is being increased and sometimes it's the length of each stimulation that's being increased. Given this, the recipient may be at risk for being out of compliance or have poor battery life. You won't see the compliance markers, the little red hash marks like we're used to with modern implants. So it's important to utilize the patient's perception of loudness growth as you increase this. At the end of the day, you cannot change pulse width because it is being changed for you automatically.

- [Mary] We've seen how the Nucleus 22 implant is unique to our implant portfolio. So preparing your patient for the upgrade might feel a little different. Let's take a look at how the Nucleus 7 Sound Processor will work for the Nucleus 22 recipient and what you can do to help them prepare for an upgrade. For the first time, Cochlear is excited to be able to offer the ready to wear option on upgrade orders for the Nucleus 22 patients. Ready to wear means that patients receive their new processor with their MAPs preloaded, so that it's wearable while they wait for their appointment with their audiologist. This option is only available to Nucleus 22 patients currently fit with an N6 processor and with the most recent MAPs available to send to Cochlear. As with previous coil cables for Nucleus 22 implants, you will be able to identify the new Nucleus 7 Slimline coil cable by a green colored plug and the serial number on the coil will end with N22.

These patients will always use the axial magnet for the coil and from one half to six. The use of an automatic scene classifier scan, dual microphones and ForwardFocus offers significant performance benefits in noise. Experiencing comfort in noise allows patients to feel more at ease and ForwardFocus is designed to attenuate distracting noise from behind the listener so they can more easily enjoy a face-to-face conversation. Recipients can choose when to activate ForwardFocus only if it was enabled in the software and activated by them in the Nucleus Smart App or on their Apple watch. If they have received the processor through Cochlear's ready to wear option, it will be enabled in the software. As Dave has previously stated, this population tends to struggle with major changes. So it is recommended that you consult with the patient to determine if this could be of benefit to them. Since the Nucleus 22 coil doesn't support telemetry, the sound processor will not know if it is on the implant. Thus, it is important that recipients always turn off their sound processor when it is off the implant to save battery power. This is particularly important for recipients not upgrading from an N6 which was the first processor to power on automatically when

attaching a battery. Since this is a new feature, it will require a little bit of counseling in advance. Three battery options are offered with the Nucleus 7 Sound Processor today. Standard rechargeable, compact rechargeable and standard battery. For Nucleus 22 implant recipients, the standard rechargeable is most selected given the higher power requirements of the Nucleus 22 implant. We will be providing three standard rechargeable batteries as a standard part of our Nucleus 7 for Nucleus 22 upgrade kits. If your patient was using zinc-air batteries previously, they may be able to use the zinc-air batteries with the Nucleus 7 Sound Processor. Eligibility to use the zinc-air batteries should be confirmed at the time of the mapping by reviewing their estimated battery life within custom sound pro fitting software and taking into account that individual's interest in streaming. If a Nucleus 22 implant recipient is using zinc-air batteries and their coil is off the head, the sound processor may automatically turn off. This occurs because the battery is unable to supply the extra power it uses when reaching for the internal device.

To resume use, the patient can simply reconnect their battery or press the button to turn their sound processor on. Even if the custom sound pro indicates that the patient can use zinc-air batteries, they may still experience the processor turning off automatically when the coil is off the head. Nucleus 22 users have been accustomed to turning their sound processor on only when the coil is on the implant to avoid that battery drain. So it's particularly important to instruct Nucleus 22 users that the N7 Sound Processor will turn itself on automatically when the battery is attached. They will need to learn new habits for putting the processor on. You should instruct them to get the coil in place promptly. In fact, patients may forget that the sound processor is already turned on and press the off button after placing the sound processor on the ear and then wonder why the sound processor is not working. Similarly, instruct the patient to turn it off promptly. Usage data will not display coil off time due to the telemetry restrictions previously mentioned. Usage data will display flat battery to demonstrate the processor was turned on but no stimulation to the implant occurred as not enough

power was available. How does the Smart App work for Nucleus 22 patients? Well, during the onboarding process, Nucleus 7 Sound Processor users are asked to verify their sound processor by removing the coil. However, Nucleus 22 implant recipients, this screen will not appear because the system detects a Nucleus 22 coil is connected and this step is not needed in the verification process. For people who do not have access to a smartphone or choose not to use it. The CR 310 remote control is available. When pairing to the CR 310, there is a pairing window of 25 seconds. Due to the telemetry limitations, the ability to capture the number of coil off occurrences will not be displayed in the hearing tracker for Nucleus 22 implant recipients. However, the remaining portions of the Smart App are available to this population and many do find it helpful and useful. Dave, I think everyone's excited to hear about the case studies and see the software.

- [Dave] Excellent, so let's talk through a few cases here with some simulated patients, I will be in custom sound pro training mode. So I can simulate making some changes and showing you the best way to work with these patients. So first up, we have Kathy, a bilateral recipient with a left Nucleus 22 and a right CI24R. Kathy is here for her fifth upgrade so far. She went from a Spectra through several body worns. Currently wears a Nucleus 6 processor and is here today for the Nucleus 7. She was implanted with her Nucleus 22 in 1995 in her left ear and she's really enjoyed using the phone clip with her phone and excited for the functionalities that the Nucleus 7 can bring. So I will go into custom sound pro, as you can see, it's in training mode at the top and here's Kathy bilateral. So again, here's her left CI22. She's had it for 26 years, this is very exciting. You can see her last programming session, which was fairly recently was with her Nucleus 6 and we can see that at that session, MAP 104 was loaded into both slots, one without scan, the automatic directional microphones and in program two, the same MAP but with that feature added. So I would certainly want to ask Kathy, which program do you use most often? Do you find the automatic features useful? Do you go to that program a lot or do you kind of prefer it the way it was before the Nucleus 6?

So you can tailor what you do in the session based on Kathy's needs. Several things to point out on this screen as well, that are a little different, patient goals may be a big thing. Now we might wonder why a recipient has had this device for 20 plus years, what goals they have? Well, obviously Kathy is a user of the phone clip. Maybe her goal is to use the Smart App. That's a new feature with Nucleus 7. Maybe her goal is to stream audio directly from her compatible smartphone. Both of these are new things. So if you'd like to enter a goal for her, you have a variety of options, I'll choose other. She uses the phone clip most of the time. Let's see, Kathy would like to control her... What about our goal? Let's start at about half the time for now and we'll save that goal and come back to it. So, we know that she, again, wears MAP 104 and that's the MAP we're gonna build off of. We're not gonna recreate the wheel. We're gonna build off of that MAP. So I will connect a Nucleus 7 processor.

I'd like to point out at the bottom here on the lower status bar, you can see for this left ear, the blue icon of the processor, there's no MAPs yet. We're gonna get to that in just a second. You can see the small 22 here. This is indicative that I have connected a Nucleus 7 processor with the appropriate Nucleus 22 coil. If you don't see that 22 or you see over here to the right, an icon where it's searching for the implant, you know that the proper coil is not attached for this population. When a Nucleus 22 coil is attached, the implant icon goes away because N22 does not have telemetry. So let's see what we can do next, let's go to adjust. We're gonna work on the left ear today, it's a big day. I will point out when you're working with the Nucleus 22 ear measure is unavailable up here along the top because impedances and NRT are not available for Nucleus 22. So that won't be an option, it takes us right to adjust. Here is Kathy's most recent MAP. It's her Nucleus 6 MAP that's loaded into her processor now. We have a couple of ways to convert this to a Nucleus 7. One is to select the MAP in this list, right click and choose Convert Map, N7 CP 1000. The other option is to come to the MAP pull down up here, choose Convert Map, again, Nucleus 6 to Nucleus 7. We'll do it from there. Do you want to copy settings from your patient's previous processor or use

the default settings? These are things like the pre-processing. So whatever was programmed before will carry over. To make it easier and consistent for Kathy, let's copy the previous, it converts the map and here we are. When you convert the MAP or you upgrade the MAP, the T levels and the C levels do not change. You're basically just making a similar map compatible with the Nucleus 7. So here's her MAPs, so I might choose to go live. When I do, you will get this pop-up, it's the patient's coil on the implant. Although there is no telemetry, there is a rudimentary skin flat measurement that can be used to help try to optimize the power. It's not as specific or tailored to the recipient as later power level advances to maximized battery but it's highly recommended you utilize that to try to help provide a consistent link for all that they want to do. So once the patient has the N7 on their head and connected to the coil, you click Yes, it will measure the skin flap thickness and it will go live when it's done. You can see down here, it's a skin flap thickness, equals 6.3 millimeters and you could see what the yellow bar is here, it's live.

You'll also notice that thresholds comfort global and the acoustic perimeters are not available. Global comfort and thresholds are not available because you can't utilize those with Nucleus 22. Acoustic because Kathy likely does not have low-frequency residual hearing preserved from a few decades ago. If she did, you could certainly enter the audiogram into custom sound pro and make a hybrid MAP. It's not as likely with this population. Again, because Kathy is going from a Nucleus 6 to a Nucleus 7, she's already had the benefits of dual microphone technology and the better microphone technology. She also understands some of the functionality that Mary Beth referred to such as putting the battery on to power up the device. This is probably an easy transition for her. The sound quality should remain roughly the same. It's the additional functionality that will really be of benefit to her. If all is good at this point and you don't wanna make any mapping changes, which again, for this population is not as likely, then you're ready to go on to finalize. So you can follow the guided path at the bottom. What you can see here is that her settings from her Nucleus 6 carried over.

Again, program one does not have scan automatic directionality enabled. Program two does, if you wanna verify, you can click on either of those, make sure this matches the needs for the patient, check. So Kathy has had ADRO and auto sensitivity enabled. She has background noise enabled, does not have wind noise enabled. In program two, she actually has wind noise enabled, no ADRO and she does have the scan directionality. So you can customize this as much as you want. You can even give her two additional MAPs with different combinations of pre-processing to set her up for success. So we'll keep it as is, the coils on her head. We're going to write it. Again, it's gonna ask if the coil is on the implant and we're gonna say, yes. It does this as it writes to help calculate the battery life estimation for Kathy based on her MAP, based on her flap thickness and the MAP parameters. You can see at the bottom, it's writing to the processor and here we go, she's back on the air. You see the on-air button in the upper right. You can see the yellow down here in the status bar indicating that MAP is live.

So if you have any counseling or anything to give her, you can see that the skin flap thickness carried over into the notifications as well. I'm gonna click on the battery estimation and what you will see is for the two programs, both rechargeable batteries are a viable option but you can see the standard that is the two, power 675 batteries is in red and the message here, the battery cannot deliver enough power for this MAP. Using it may in unreliable operation and possible intermittencies, use of this battery type is not recommended. So we're gonna counsel Kathy and again, as a Nucleus 6 user, she's probably very familiar with rechargeable batteries. We're gonna counsel her that that is the best and ideal option for her to wear. And then we end the session and we can focus on pairing to her Smart App, which we know is one of her goals, showing her some of the functionalities, going from an N6 with two buttons to an N7 with one. There are some key differences and we'd like to highlight with those as part of the counsel. So now let's look at a different user, this is Francis. She has a right Nucleus 22 that was implanted in 1994. She is currently a Freedom processor user and has

been since 2007. Obviously, she takes really excellent care of her equipment and is really only upgrading due to the fact that this processor has been obsoleted and there's a real inability to repair or replace parts. She doesn't wanna be in a bind if her well-maintained Freedom does eventually break down. Previously, she had a Spectra body worn and then a ESPrit 3G. She's a little adverse to change and happy with what she gets, again, she loves that Freedom. So we're gonna build off of that. We'll go into custom sound pro and we'll open up Francis. Now, what's going on at the bottom here? Again in training mode, I was just programmed. Now I have Kathy's processor attached for Francis. That's not good, so let's reset that. Again, 27 years with a Nucleus 22. Most Nucleus 22 recipients are unilateral but again, some got the second side at some point as they went. Okay, so you can see at the bottom again, I have the correct virtual Nucleus 7 with the correct coil. You see the 22 there. So I'm going to make that selection for the right ear and you can see continued to MAP selection is the next available option. So what was Francis wearing?

Let's go to the session history. Well, on her Freedom that was last programmed in 2007, she has MAP 57 and MAP 58. So those are the two I want to build off of. So again, when I go to MAPs selection, we know 57 and 58. Here's ADRO, the preferred MAP. This time I will choose to convert it from the right click menu and we will go from the Freedom to the Nucleus 7. When I select that, it says converting and here we are. So again, the T's and C's and the frequency boundaries all carried over from the Freedom as we would want. You can see her MAP is pretty power intensive. So let's find out what that means but first, let's go live. I also wanna point out that she is in a common ground MAP. So she is one of the rarities that you will see out there. Again, the recommendation with those is not to convert them to a bipolar or other mode MAP but keep them where they are. They will thank you and you will thank yourself. Let's go live, is it on her head? Yes it is, so we're gonna measure the skin flap thickness. Obviously with the MAP this power intensive from the looks of it, we're gonna want to make sure. Her skin flap measurement was also 6.3 millimeters. We are alive, now

does that sound? My guess coming from a Freedom to a Nucleus 7, it may sound sharper, it may sound crisper. The microphone quality may be much better, no matter how well-maintained her Freedom was, chances are that mic has degraded a bit over time and the ability to have Freedom mic protectors is probably been harder to come by. So you may get the report of, oh, this sounds louder. This sounds sharper, those are features, not bugs. You have better mics and so again, the ability to keep the MAP parameters consistent doesn't mean that it's not going to sound different and what we might consider better sound, more accurate sound is different and so we would have to see how Francis reacts to that but we're gonna give her some time with it. Can you get used to wearing this? This is the exact same MAP, we always like to reiterate. This is exactly the MAP that you've been listening with in those levels, you're just listening to it through an improved and upgraded processor, that's the beauty of this continuity. So let's say this was pretty good, different but she's gonna learn to live with it, that would be great. Let's go to finalize.

Okay, so in her, you can see it's defaulting to the Nucleus 7 parameters that would be set for most new patients, right? A scan in program one, the same MAP, number 60 in this case. In program two, without the automatic directionality. My guess is Francis may not be quite as excited to have all of these features. We know that her previous MAP contained ADRO. For the moment, I'm gonna take her off the air so we can make some manipulations here. We're gonna turn scan off. So she just has standard directionality. On the Freedom processor, you could have an adaptive directional or beam program but it had to be in a separate programming slot. I might counsel her if she ever had that or ever wanted to try it, again, you don't have to absolutely leave it the same. You do have four MAP slots you can give her various combinations in. So let's base it on the recipient preferences but maybe give them a few options to try. It's all new right now, so why not throw in a few other things that we know may be a benefit if they can adapt to it? So keep it in standard directionality on this one, she did have ADRO, that was her preferred. She did not have auto sensitivity in that first MAP.

That was in P two, so let's take it off in the first one. Background noise reduction and wind noise reduction, those are brand new. So in P one, her home MAP will leave those off. In P two, let's give her the auto sensitivity plus ADRO. Let's keep the microphone directionality standard and let's also get rid of background noise and wind reduction. I'm gonna add a third program. Again, the same MAP, MAP number 60, in this one, you know what? We're gonna go out on a limb and give her some adaptive directionality based on the scene. She can certainly stay in program one or even program two but it's a nice counseling point to get her to understand that these new features are really meant to reduce background noise and make it easier for you to understand. Again, it will sound different, it may sound reduced. It may not be as loud and they may not be able to hear background noise that they've always heard. That is a pro or a con, depending upon the recipient. So we're gonna broaden their horizons a bit but we won't go super crazy. It'll take background and wind noise off for that and then I can put another one in P four. Maybe we'll go all in, we'll do scan. We'll give ADRO and auto sensitivity and we'll give the background noise. So in this case, we have four different programs. She may leave the clinic and remain in program one the entire time but you've given them options which is great. Processor settings, again, has many more settings than the Freedom did, so you can take a quick look at this. Is the button enabled on the processor for an adult? That's the default, yes. My guess is even if she doesn't change it much, give her access to the button.

We could consider allowing ForwardFocus. Again, that's a feature that is enabled by the clinician and then if the recipient uses the Smart App, they can activate that for a very, very fixed directional that really emphasizes sounds from the front and tries to greatly reduce sounds from the sides and the back. You can decide to put that on there, maybe not. So I think I feel okay about those settings. I haven't made really any changes. Let's save it to her processor, we'll click Save. Is it on the head? Yes, I definitely wanna see her battery life estimation given what her MAPs looked like, so we can counsel about appropriate battery use. My guess is this far out that she's using

three disposable batteries with her Freedom because the rechargeable batteries after 13 years, I'm gonna guess are not quite as resilient as they used to be. So it's writing the process or doing that skin flap calculation. Oh, good, excellent. I'm gonna click on the battery life estimation. And again, maybe this is a function of training mode but you can see it's recommending rechargeable batteries and not recommending standards. So again, if she is using disposables, it certainly seems like it would be easier for her to recharge her batteries overnight. Put one on in the morning, counsel toward the fact that the standard rechargeable, which again, they would get three of with their upgrade kit is probably what they're gonna do. And she should get a minimum of eight hours of battery life, excluding streaming and some of the wireless accessory use. If she doesn't use that, she may very well get more. It also depends on the environment but this allows you to counsel her. If you use these programs, you can expect the stain battery life. Again, it's the same T level and C levels from her Freedom MAP.

So she can just explore them without worrying it's going to reduce her overall battery life or change, things like that. You can spend the rest of your appointment focusing on that. Maybe she's never gonna use the Smart App. Maybe she's gonna use the CR 310, the small remote control or maybe she's just gonna put the battery on in the morning, put it on her head and forget about it. We have a lot of options, that's the great thing about the modern processors. So let's end her session. Finally, let's look at Spencer. Spencer is a long time user who hasn't worn it in a while but is looking to try again. These do pop up and these can be very exciting and mildly terrifying. So let's sort of set the scene for this. He was implanted at 13 with the left Nucleus 22. His original processor was a body worn Spectra. He then upgraded to an ESPrit 22 and then an ESPrit 3G processor in the early odds. He's upgrading to Nucleus 7 after several years of non-use when his ESPrit 3G finally stopped working and could no longer be repaired, it was obsoleted. He works in IT, he's very successful and insurance through his new employer covers Cochlear implant processor upgrade, which is a big boon to him getting this upgrade. The other boon is he's engaged to a

bilateral hearing aid user who has motivated him to try to use the CI again. I have seen several patients like this, as I said, it can be very heartwarming and touching and you feel like the recipient has a great deal of support but they haven't heard in a very long time. This is a situation where having the MAPs from way back then may be critical just to see what it was. But realistically, if he hasn't worn it in years, you're gonna be starting from the ground up again anyway but I will always recommend you have access to the earlier MAPs. You can see if certain electrodes were disabled. Maybe you can find out why that was but it's better to have a broad outline of what Spencer was using. So let's go into his file. All right, let me virtually reset Francis' Nucleus 7. I'm sure Spencer would not like that. All right, you say unilateral. He's had his implant for 24 years but has not had 24 years of use apparently.

So let's look in his session history. His last session was also in 2007 with a Freedom. Maybe they tried that in the clinic and maybe he couldn't get it, but they had a very variety of MAPs. Let's just go to the first MAP. Let's just get a sense of what Spencer was doing. Okay, my guess is, if you convert or upgrade this MAP and then go live, it will not go well. He hasn't worn it in a long time. So this does give you a sense that he was programmed in a common ground, another common ground. Again, that's why it's good to have the program. You could consider starting a MAP anew, you could consider selecting a MAP. The Nucleus 7 against SPEAK is the only coding option. We're gonna use the stimulus level. That's the level where it varies both current level and pulse width, that would be familiar. You can see the default mode is BP+3. You could choose otherwise. You could choose everything from a common ground mode, all the way to a BP+7 or that pseudomonopolar mode I mentioned but if you wanted to start anew, we could go with a BP+3. The rate, the maxima, that defaults again, pulse width. It's not really zero, it's just not within our control. Let's look at both, so first I will convert the MAP. Actually, let's convert from his Spectra. So if I convert from Spectra, you see that I do not have the option to upgrade or convert from the Spectra to the Nucleus 7. What you have to do in this case is first convert it to a Freedom MAP. You

will see this pop-up, that shows changes that were made to this MAP in that conversion from the spectrum to the Freedom. In this case, the maxima went from six on the Spectra to eight on the Freedom, that's the Freedom default. The frequency table has been reset to the Freedom default as the original is unsupported. And the Gains, that is which electrodes are more or less likely to be selected as maxima has also been reset to the default. I find it really helpful if you get this pop-up, that tells you what's changed, you can choose right here to add summary to the MAP notes of the new MAP. And that way you can see what the difference in this MAP is. You'll get a pop-up that says the summary has been added. Click Okay, move on and now this MAP is a Freedom MAP. Well, that doesn't really help with the Nucleus 7. So we have to convert it again. Let's go up to the MAP pull down, convert this MAP. Now you have the option to take this MAP, which again, preserved the T's and the C's but did make some other changes to maxima, to gains, to the frequency allocation table. Now we're converting the Freedom MAP to the Nucleus 7. So choose that.

Again, many of the Freedom default parameters are the same as the Nucleus 7 default parameters. So we have this. Now, again, in Spencer's case, after years of non-use, I'm not sure that I would go live with this MAP but again, you do have the options if you want to play around with it, you could choose to shift all of the C's down, essentially turning it down a bit. Given that he has a variety of dynamic ranges across different electrodes, really wide dynamic ranges here, you can see this one's 120, that's a Nucleus 22, all right all the way down to 67. So if you're going to do these global shifts, if you do wanna start with this, again, maybe not the ideal, I might recommend you change from shifting the current levels to shifting to percentage of dynamic range which will reduce the dynamic range differently across the array, taking bigger leaps with the wider dynamic range drops and smaller ones with the narrow one. But let's say, you know what? It's been awhile, we're gonna start you over. I would be interested why they stuck with common ground but we're gonna go with the defaults. It started new, love is in the air. Let's do this for Spencer. We're gonna base it on

thresholds, so here we go. This is again, a key difference with Nucleus 7 for N22 versus Nucleus 7 for any of our subsequent implants. There is no interpolation. You would need to measure ideally the T and the C on each electrode individually because again, in these bipolar modes, these are stimulating very specific neural populations that may have different characteristics. So you might see responses like this, that for more recent implants might make you double-take. That may be absolutely appropriate for the Nucleus 22 patients sitting in front of you. You can also see that this would take a lot of work because we would want you to assess each of these. Again, there's no interpolation and going live may be fine but different dynamic ranges may be appropriate given the recipient's percept. So if you don't have MAPs to build off of or the recipient hasn't been wearing them in awhile, you might try a reduced version of their most recent map even if they haven't worn it in a while just to see or you might start from the ground up, but it would take a lot. I'm, for the sake of time, just going to quickly create this MAP and then we will see what Spencer thinks. Oh, he didn't like that one. So I will right click and just disable that one in this MAP and we'll add a few more.

Okay, let's say, this is what he came out with. All right, now's the big moment, let's get this done. So I'm gonna pick the N7 processor. I'm going to go live. I'm gonna counsel him, you haven't heard in a while. I might even again, reduce the C's that I just measured with him individually by a percentage, a little bit, maybe take the edge off. I might even consider reducing the volume, which also has an effect on the upper end of his dynamic range down a bit before I go live and then here we go. It's gonna need to be on his head to optimize the power by measuring that skin flap and when it is, this is the magic moment, we are alive. Mileage may vary on what Spencer thinks at the moment but what you can do is having an encouraging family member there may help, we can slowly raise this volume back up, which can help a bit. Again, if he hasn't worn it in a while, he may be more amenable to actually having features like background noise reduction, wind noise reduction, auto sensitivity and ADRO on, even if he didn't

before. He probably doesn't remember what it sounds like very well and so why don't we give him the cleanest and most preprocessed signal to really set him up for success in this new endeavor that he's returned to. So again, I also reduced the percentage of dynamic range C. So if he's okay with that, I might increase it a bit. I might keep the volume at six so that when he's out in the real world wearing this and wants to make adjustments, he can turn it up a little bit and solve situations or down a little bit in others. Again, you have lots of routes you can travel with this but let's say this was pretty good, his fiance was excited. He was nervous and excited and we're gonna counsel that this would be great. These appointments where it's been a while and you're kind of giving them a preliminary MAP, may be a great reason to have them seen back sooner for reprogramming than later. Again, you're programming them in your clinic and then they're living in the real world in a variety of environments. And so for this type of appointment, it might be incumbent on them for their success to be able to schedule a follow-up appointment once they've had some experience wearing it. But let's continue to finalize, we're gonna be optimistic.

So if he hasn't worn in a while, I might go with the default configuration, let's have scan and all of those pre-processing features enabled in one. And in slot two, again, this is the Nucleus 7 default would be all of those features enabled, but the automatic directional mics or scan not enabled. Processor settings, let's just give him what's there, right? ForwardFocus, maybe he would be more amenable to it. Maybe he's a younger person who is excited actually about the app and can activate it, that would be great. Allow volume control, sometimes Nucleus 22 recipients, particularly if he came from a Spectra, their only way to control loudness in the world was to control sensitivity. So if that's something that's useful for him, you might enable that but you might also say, no, volume is a better way. Sensitivity can get you into trouble. And we're going to allow auto sensitivity to really be making those decisions for him. He has already other things we want him to focus on. Okay, so let's say he's game, let's do this. We're gonna save it to the processor. Again, we want it on the head. And now

we can counsel Spencer once this runs about what sort of battery life he can expect. No doubt, there will also be a good deal of counseling about how to charge the batteries, how to connect it, even how to orient the processor on his head. He's been out of practice for a while and look at this, as can be somewhat standard with Nucleus 22 recipients, the disposable batteries don't quite have enough juice. There are recipients out there who can utilize them and I guess recipients could use it in a pinch but it's certainly not ideal but again, standard recharge. Well, he's actually getting a little better battery life than our previous two patients. So counsel him to use the rechargeable, counsel him how to use it and you're good to go. You can end the session. Maybe we were exploring some different MAPs. I do think it's a good idea, if you've explored a MAP and then said, no, that's not the one for me, go ahead and save it. You can sort of show your work and later on, you could see what other avenues you explored. So that's a walk through of three different types of Nucleus 22 recipients that you might encounter. Sort of an order of ease, I would say, counseling is a big part, setting expectations appropriately is a big part. The good and the bad is that they often don't want you to change a lot. That can be really grayed in terms of the intricacy of their MAPs as I've shown. It can be a little difficult if you'd like to introduce some new functionality that you know would benefit them if they could adapt to it but they may be resistant but don't be afraid to use those extra programming slots. If they never go to them, then so be it but they do have those options. And when they get out in the world with the crispness of the new mics and the new processing, they say, ah, the restaurants I used to be able to handle are a little loud now. Then they will have those functions enabled that would allow them perhaps some relief in those and they would learn to use those, incorporate them into their daily life. So we have a lot of really great options for them.

- [Mary] With the Nucleus 7 Sound Processor, our first recipients can now enjoy our smallest and lightest behind-the-ear hearing solution, combining comfort and wearability with proven hearing performance, to hear their best anywhere, anytime. As

you've learned, Cochlear maintains a long history of sound processors that support superior hearing performance while delivering industry leading smartphone connectivity. Nucleus 22 implant recipients are about to take a big leap when moving from a Nucleus 6 Sound Processor to the Nucleus 7 Sound Processor and more so, if they're upgrading from an even older generation sound processor. All of these new features are available for our Nucleus 22 implant recipients, direct streaming from a compatible smartphone, the Nucleus Smart App, which offers control and monitoring of their Nucleus 7 Sound Processor, and Cochlear's latest noise reduction technology, ForwardFocus. All of our newest features packaged in the smallest and lightest sound processor. I hope you enjoyed the walkthrough that Dave provided and that the handouts are useful to you when seeing your patients as they come in for this new processor, upgrade for them. And we'd really like to thank you for taking the time to attend this course. In closing, I'd like to share with you this video from our first Nucleus 22 implant recipient in Australia, Sue Walters. At a time when we did not as a rule, expect Cochlear implant recipients, to be able to talk on the phone, it is incredible to see her experience so many years ago and again, with all the current technology available to her. Be well and thank you for joining us today.

- I'm gonna make a telephone call to Susan Walters who has a cochlear implant. The idea is to show you how much she can understand using a telephone, all right.

- Hello.

- Is that Susan?

- Ah, yes, this is Susan.

- I thought I'd ring you and ask you about your holiday

- About my holiday? Oh yeah, I went to Taree for the weekend.

- Why did you go to Taree?

- We went to start a little support group up there for the local cochlear implant recipients.

- And who else was there?

- I'm flying to London on Friday.

- Will you see Buckingham palace?

- Oh, definitely have to go and see Buckingham Palace.

- And meet the Queen?

- I'd like to meet the queen, I don't know if she's free.

- Might be a bit tricky. So I'll see you then?

- Okay, Bill, alright.

- Thank you.

- Bye bye then.

- Bye.

- Bye.

- Bye.

- That was perfection, that was very, very good and she didn't know I was gonna say any of that. That was really good.

- That was really good . It's really clear. Yeah and it's nice just having streaming, straight from the phone, yeah .