Dr. D'Anne Rudden: Let me start by saying that I’m a proud Gen X-er. I actually remember a time before the internet made all collective knowledge accessible for any question that crossed my mind.

Unfortunately, despite having more access to high-quality information to help us make life’s decisions, it hasn’t made some decision-making any easier. We develop a sort of “analysis paralysis,” despite having the power, at any given time, to research the pros and cons of each and every option available to us.

I mean, a simple search can often open a time-sucking black hole of link clicking, article reading, video watching. That search may end hours later... with no new answers. Delaying action while overanalyzing information doesn’t help anyone get things done.

But here is one thing we can all agree on without the need for a lot of tedious web searches: Electroacoustic analysis, aka EAA, is something we should all be doing a LOT more of in every clinical setting.

EAA can verify that the hearing aid hasn’t gotten weak, the frequency range is as big as it should be, there’s no distortion in the sound quality, it’s not noisy, the directional microphones are working, and the batteries aren’t draining faster than normal.

All great information for the clinician and the patient, right?

So, why do we develop “electroacoustic analysis paralysis” when it comes to incorporating these measurements routinely in the clinic?

On the podcast this month, a woman who knows the value of electroacoustic analysis from both sides of the “better hearing experience” equation.

Dr. Laura Pratesi was born with progressive hearing loss and is currently a bilateral hearing aid user. She’s also an accomplished Doctor of Audiology, becoming the youngest person to graduate from Auburn University’s AuD program in 2012. In her relatively short professional career, she has been named an Orlando Magazine Woman of the Year, had publications featured in The Hearing Journal, and been a presenter for Audiology Online on the subject of electroacoustic analysis. If all of that wasn’t enough, Dr. Pratesi founded Citrus Hearing Clinic in 2018 in order to better serve her home community with best practice audiology services for all ages. Welcome to The Hearing Journal Podcast, Dr. Pratesi! Thank you so much for taking the time to help us all move past whatever issues we might have about performing electroacoustic analysis! So excited to have you here.

03:54 Dr. Laura Pratesi: Thank you. I am so excited and honored to be here.

03:57 Dr. D'Anne Rudden: Let's begin by talking briefly about the difference between validation and verification, because sometimes we get those terms mixed up?

04:19 Dr. Laura Pratesi: Absolutely. Verification of a hearing aid fitting is an objective measure. It is often referred to as real-ear measurements or probe microphone measurements that ensure the hearing is operating appropriately by analyzing the device using a hearing aid analyzer or through probe microphone measurements.
Validation is a subject of measure that captures the hearing aid user's perceived benefit, satisfaction, and handicap reduction by the use of hearing aids according to ASHA, 1998.

By definition, both real-ear measurements and electroacoustic analysis are technically verification measures. But I like to think of it as I verify that the hearing aid is working appropriately, and then I validate that the patient is satisfied with how it is programmed.

05:10 Dr. D’Anne Rudden: Perfect. Thank you for the clarification. Let’s talk about EAA. What is the most important test to perform with EAA, and how do I know what those numbers really mean?

05:38 Dr. Laura Pratesi: All of the measurements are important because the hearing aid could malfunction in different ways that could result in different types of problems with the hearing aids. The three measures I look at the most and the easiest way to explain to patients are the THD or distortion, the EIN or equivalent input noise, and the directional microphone test.

For distortion, I remember at Auburn is that you want it to be less than three percent. When I opened up my own practice and started looking into it more, I found anything below 10 percent is considered ideal. You need to look at the manufacturer’s specifications for the particular naked model of the device. For example, Auticon has told me that 11 percent is considered acceptable for their exceed BTE ultra-power device, and I’ve had the device measuring at that level. I would like to see that most dates are under the three percent distortion, but if I have questions about it; I reach out to the manufacturers.

One of my hearing aids was measuring at 60 percent distortion, and it definitely sounded distorted to me during a listening check. I had a patient once who had been given a hearing aid from her sister, and its distortion was measured at 498 percent. I have to admit until that point that distortion could measure more than a hundred percent.

07:14 Dr. D’Anne Rudden: My jaws are like on the floor. I wish everyone could see me. I was like—WHAT? How was that real?

07:21 Dr. Laura Pratesi: I know. What I love about the test boxes is it pushes hearing aids to the limits. Limits that patients may encounter in real-world listening situations. We may not hear the distortion in a listening check of the hearing aid in a quiet office, but the patient can hear at a bar during a super bowl. By running EAA, we can see how the hearing aid will perform when it’s stressed out. It is easy to show to the patient when the measure is less than three percent, but if it’s 20 percent, then we need to get it fixed.

I am a very visual person, and I think a lot of patients responded to it, as well. I had a patient who had a Widex, Evo, 440 hearing aids that sounded great. We did a listening check to it, it sounded fun, I hooked them up—20 percent distortion and a bunch of other measures that were out of specs. It was not working, and his wife said, "He could never hear me when he is driving the car, and I am on the right side." So, I told them that the hearing aid is broken.

The EIN basically measures how noisy the internal components of the hearing aids are, and ideally, it is less than 35. Most RICs are usually less than 30. Superpower and ultra-power BTEs can creep up to that 35. Think about it, if the patient can hear at 25 decibels, they are going to hear those internal components doing their thing.

Directional microphones are so sensitive. Some manufacturers’ directional microphones are a little bit more impressive than the others. Boy is it obvious if they’re out of whack. You don’t want to see those numbers because
it could indicate the mics are reversed. Sometimes, I find a lot of back microphones are not working and are not performing, as what you've got on a directional device.

The OSPL90, the reference test came on port of measures, but a little harder concept to explain to a patient. The one measure I probably skip the most is the battery current because I haven't figured out the way to test it with the rise of rechargeable batteries, which most people seem to be favoring ordering now, but I've found my patients would definitely let me know if they feel their battery life is short.

09:48 Dr. D'Anne Rudden: Right. You have a good point, but I want to circle back because we sometimes think, as seasoned professionals, that we are going to hear the sound. If we listen to the device, then we are going to hear a sound like it is distorted or out of whack by simply putting on our little scopes, and hearing "ch, ch, ch, 1-2, 1-2, 1-2," will tell us everything that we need to know.

10:23 Dr. Laura Pratesi: Yes. It is where being a hard-of-hearing audiologist myself has given me this superpower because I don't trust my own ears, so I measure it. I get the objective data instead of the subject of data. I could say if it is working or not, or if it sounds fine, but as I've said, the box pushes it to the limits.

11:01 Dr. D'Anne Rudden: At that point, if you are testing it on the test box, and all the numbers are lining up and the patient is saying "I still don't like the way this sounds, and it sounds that way to me." What do you do? Do you feel confident that there is nothing wrong with the hearing aid?

11:20 Dr. Laura Pratesi: That is where I start to get more into validating the patient's feelings. I'll probably re-run or look at my real-ear measurement. If I used NAL-NL1, or if they prefer NAL-NL2 as an L1 220, are they a power junky? I should have put them in DSL, then I didn't even think about the fact that they have been wearing hearing aids since childhood. Put them in a booth to do some functional gain testing. What I love is running an easy bio and telling the patient that they are doing great and getting 99% correct.

11:59 Dr. D'Anne Rudden: You are doing better than you think you are.

12:01 Dr. Laura Pratesi: Yes. I can't get more into the counseling aspect. It is important to me that my patients are happy with how things sound. I always start with the measurement first, before getting into feelings or in science.

12:21 Dr. D'Anne Rudden: One of the things I appreciate about you and the teachings you have been putting forth, is going out there for all of us and helping us to be confident. They were accessing and putting the device in the appropriate conditions to make the measurement successful.

Talk a little bit about how you are taking that information, and what are you comparing it from? I have heard you said you are comparing the ANSI standards and the manufacturer's specs? Are you comparing it to previous measurements? Can you wrap that up in a bowl for me? How do I become a better clinician in this way?

13:10 Dr. Laura Pratesi: Yes. The manufacturers' specs are based on international ANSI's standards. You can pull most of the measurements for individual hearing aid models from the manufacturer's website, or call or email a representative to get ahold of them. Some manufacturers will include specs in the box when you order the hearing aid or when it comes back from repair—makes life easy.

I have a notebook where I keep copies. As I order, it will get added that I don't have to track it down every time I have a particular model. It can get challenging when patients walk in with the old hearing aids. If I can't find the spec sheet or if the manufacturer doesn't give it to me quickly enough, then I'll compare the right side to the left
side. It would be weird, though not impossible, for two aids to be broken in the same way at the same time.

If I look at the general curves, I ask, does it look reasonable? When you run a lot of EAA, you have to learn to trust your guts on the curves. I look at the right hearing aid versus the left hearing aid, and if the tolerance is not more or less than three or whatever the tolerance is for that particular measure, then there is a good chance that one of the hearing aids is defective. Sometimes you figure it out by just looking at which one has a discolored speaker wire or through a listening check. Does one sound weaker than the other? That's why I love previous measurements.

Before every new fitting, I will run EAA before giving the device to the patient, which also gives me the baseline to which I can compare for future test results. If they come back in for a clean and check and complain of sound quality issues—I can pop it in the box and look at how the new test compares to the old test. I don't usually have to get my notebook out.

Cliff Olson talks about a trick where he'll program the devices to REMs. He put the aids in the test box and ran the measurements at user settings. It is not going to look great, the curves might look off, or distortion is high, but if you run EAA the proper way, then it will work. You get the measurements at a user setting so that in the future appointment you can just run the device to see if it deviates from the baseline—a quick and dirty shortcut. If you are not sure about it, then you can always take the time to do it the proper way.

These are some of the tricks I use if I can't find the sheet (in Florida) by comparing the right and left (hearing aids). Do a lot of snowbirds, and you never know what's going to walk in the door, and that is one reason why I've tried really hard to get comfortable working with all the different manufacturers, the seven major ones and some little ones, as well. Being able to help anyone who walks in the door no matter what they have.

16:20 Dr. D'Anne Rudden: Right. Being able to give them quality, objective information.

One last thing before we finish the first segment because sometimes clinicians, including myself, say, "We don't have time to do this." How long does it take from start to finish to complete EAA?

16:50 Dr. Laura Pratesi: I have heard the argument about time a lot. What I say is I don't have time to fit patients with hearing aids that don't work. Sometimes, you get one shot at getting that fitting right for a patient. There may be leery of the process, or maybe they don't want hearing aids to begin with.

Do you really want to fit a hearing aid that is broken? What is that going to do for you? I catch problems, and I can get them fixed before the patient comes in to pick them up, and they are none the wiser. I want to fix a problem before it starts.

In my humble opinion, I find Starkey as the easiest way to run EAA, you just set it up in the software—it's all in one place. The testing would only take five minutes from start to finish while some software such as Sonova, Products, and ReSound takes a bit longer, close to 12-18 minutes to complete sometimes. BUT I still maintain doing it on the front-end of the appointment before a new patient hearing aid appointment fitting will save you time in the long run.

I think in this area, we can take a closer look at our clinic procedures, the workflow, and the support staff to use our time wisely. This is a great job for audiology assistants or interns and externs to complete.

18:08 Dr. D'Anne Rudden: Dr. Laura Pratesi, you are amazing. I am so happy that we had the chance to get the conversation started, and hopefully, you encourage one more person to do EAA consistently, then our job is done.
Dr. Laura Pratesi: I feel like I have left a legacy.

Dr. D'Anne Rudden: Yes. You already have. Thank you so much for being on the podcast this month, but don't go away because we are to dive in a little bit deeper in the Aftershow.

AFTERSHOW

We are back on the Hearing Journal Podcast Aftershow with Dr. Laura Pratesi from Citrus Hearing Clinic, Clermont Florida.

If you heard the first part of the conversation, Dr. Pratesi has been named Orlando Woman of the year. She is an accomplished audiologist and an accomplished woman in the world. She is here to talk a bit about electroacoustic analysis.

Why should you do it? What should you do? How you should do it, and why sometimes do we get our own way about it?

But I want to talk about you as a person because of your journey and your unique lens of using EAA. Will you tell us about your own hearing loss, and how it made you the audiologist that you are today?

When I was born in the '80s, they didn't have newborn screening. My own hearing loss went undiagnosed until I was five, and I failed the screening in kindergarten. I finally got referred to an ENT. I had a hearing loss in my left ear, and they could not figure out why they didn't recommend the hearing aid to my parents at the time. They followed me for a couple of years, saw me pretty stable, and thought that I am good to go as long as I am making As and Bs—nothing to worry about, they say. They told my parents that a hearing aid will amplify sound and distract me. As long as my grades were good—it was okay.

It wasn't until I was going to college that I was trying to register with the office of accessibility which back then was called the student with disability department. They told me that they need an audiogram that has been performed in the last 10 years, so I went back and got another test. They were shocked that I have been going the entire time without a hearing aid. They said, "Do you want one?" and I said, "Do I need one?" They said if I had gotten by, then I am probably good. So I just keep going on without one.

I was on a theater scholarship at Auburn, as a theater and opera major. It got in my head that I was going to be a music therapist because I didn't want to be a waitress for the rest of my life. Auburn did not have a music therapy program, but a speech pathology, so I started taking undergrad speech courses which led to an intern audiology course that I fell in love with. Dr. Krishnamurthy talks curses like "Come to the dark side. Come switch to Audiology." So, I switched my major and my classmate fitted me with my very first hearing aid which changed my life. That is how I got interested.

Fast forward, just a few years ago, I had a sudden drop of hearing in my right ear which is my good side. I went to some amazing otologists at a Hearing and Balance Center in Tampa Bay. They finally gave me my diagnosis. I have a Bilateral Mondini Malformation, Incomplete Cochlear Partitioning, and Enlarged Vestibular Aqueduct (EVA). I am now a bilateral hearing aid user. I recognized my loss is progressive, so I will probably need cochlear implants someday, but I know I am in the right field for this.
Dr. D’Anne Rudden: I feel like you know someone that might be able to help. I feel like all the pediatric audiologists must be cringing out there listening to how your hearing loss was handled when you were a child.

Dr. Laura Pratesi: I fell through the cracks so many times in so many ways. It got me into saying that it’s my job to make sure nobody else falls through the cracks. I can do something about this by helping people who are like me. I am a big fan of best practices now because I have worn hearing aids that weren’t programmed ideally. I have assumed the differences I just made, and I have worn aids that were broken. People insisted I was crazy that it wasn’t fine, so I put them in my test box and said nope.

Dr. D’Anne Rudden: It was actually 468 percent distortion [laughs]. I am just kidding.

Dr. Laura Pratesi: It was 498, and I was like, oh my gosh! It was crazy, it could be more than 100 percent distortion. Who knew?

Dr. D’Anne Rudden: I am going to switch gears a little bit because it is interesting. I was in training with Lindsey Jorgensen yesterday before coming in for a talk with you. One of the things I felt I had was this moment that I kind of short-circuited. She said that a lot of times when we send hearing aids and get the device back that says, “Replaced due to service or Replace in full.” We are not getting brand new hearing aids. We are actually getting reconditioned hearing aids, and if we don’t run them on the test box, we are never going to have an idea how these things are functioning.

My mind was blown away. If this is happening routinely and we are not running EAA, what are the risks, and how big is the risk if we are fitting malfunctioned hearing aids on people?

Dr. Laura Pratesi: It is happening all the time. As I said, I am in Florida, I see a lot of snowbirds—I felt bad. People buy their hearing aids, they pay lots of money from summer to autumn, and they bring them to me. I update their hearing test, and I program them. I am unbundled, so I charge with all the things I do. I tell them I need to charge them for programming, for real-ear, and I would say to just skip EAA. After the first two patients I adopted, they would say it sounds terrible after I re-programmed it. I would say, “There’s no way! Let’s pop it in the test box to see what’s going on.” Their aids didn’t WORK. I was led to tell them that it was just a new protocol.

I did not sell the hearing aids to anybody, instead, it goes into the test box. I presented it to the patient like this, “When you take your car to the mechanic, they hook it up to the computer, and they run a systems check. They can tell you that your brake pads are old, they need to be replaced, your oil is low, the tire pressures bad, and these are things we can fix.” So, there is no sense in paying me to run real-ear or reprogram your hearing aids if it is broken, to start with. If it is under warranty, we can get it fixed. If it’s not, then we need to figure out if the cost is worth investing in this hearing aid you have. If it’s out of warranty, then that makes it a few years old, but is it better to put towards better technology?

It has been my equipment that pays for itself very quickly. For that reason, people intend to get brand new when it is broken or not working. I love it. I do not want it to malfunction. My test box and my PMM system are the two most important pieces of equipment I have after my audiometer.

Dr. D’Anne Rudden: One of the things I talked about to my colleagues yesterday is how to present EAA to a patient both as a chargeable option or not. Do you present or run it in front of the patient while he or she watches?
Dr. Laura Pratesi: I do. It was just me when I first started. I did not have a receptionist or a patient care corner. I set up my office to be as easy for me, so I could have my programming computer and my test box right there. I would run it in front of the patient so they could see the curves, the numbers which I describe to them that are not supposed to be high or not supposed to look like that. I am at the point where I am getting busier and thought about moving it back to the lab so that the students can run it while I am with patients.

There is something nice about having it right there and running it in front of the patients so they could see the results. I always print a copy of the test results so I can go over it with the patient and scan it to their chart, as well.

Dr. D'Anne Rudden: It is where the power lies. The information that you provide to the patient in black and white is what validates their concerns. You are addressing whatever it is with objective measurements. It is not about getting the patient a new hearing aid but maximizing what is currently happening.

Dr. Laura Pratesi: It is so powerful. I love it.

Dr. D'Anne Rudden: You have taken an interest in making sure you are educating audiologists on doing EAA, and embracing it in their office. How did you get interested in making that leap? You could have just kept it to yourself?

Dr. Laura Pratesi: I know some people will say that it takes a lot of time, but this saves me time because "An ounce of prevention is worth a pound of cure." I spent less time with patients who are happy because their devices are working and sound good than with patients who are wearing broken hearing aids. I know the cost of equipment can be a barrier to some, but the number of patients who have opted to buy new hearing aids because I was able to show them their current devices is not meeting the manufacturer's specs. It could have probably bought me 10 test boxes by now. It has some upfront cost, but it will pay you back. What I am saying is that you can find used equipment out there.

The biggest issue in our profession is that people don't know how to do it, they don't know how to interpret the results, and they don't know where to find someone to teach them. All the things I dislike about audiology are the things I wasn't comfortable with. If I realized that myself or in my training, then I address it. There are a lot of people advocating to do EAA, but who is going to sit down with you and walk you through it?

It is what I try to do with audiology in my course. I have an oracle that maybe doesn't help as much if you have a Verifit or a MedRx, but the set-up in the manufacturer software is the same regardless of which test box you used. From my class, I rode out the PowerPoint step-by-step instructions on how to navigate through each manufacturer's software to set up flogging, reference testing, etc. I have videos where you can see me walk through the equipment in real-time to see exactly what I am clicking to get it set up for each test.

The last time I checked, it was about 550 people who took the course, which made me excited and humbled. I got passionate about it because I was looking at materials to teach myself on how to do these, but I could not find them. It took a year and a half of having the equipment to feel super comfortable doing it.

There are times I called the manufacturer like Signia, but I got transferred five times. I was on the phone for more than hours, but nobody could find the answer on why I could not get a reference task to look the way I wanted it to. Finally, they hooked me up to the right person and I got it fixed. I took the long course for days and used the information.

Dr. D'Anne Rudden: As I said in the opening, I've been around the audiology block for a few years. When I
learned how to do test box measurements, it was a matter of adjusting a couple of potentiometers and VC wheels. It was basic and simple, but for someone like me, it feels very intimidating.

One of the things I appreciate about learning from you is that you made it accessible for someone like me. I am a little bit embarrassed because I didn't know how to do these things or how to put them in the right mode. I knew what I wanted to do, but I was not sure how to get there.

15:21 Dr. Laura Pratesi: I just found out the other day, even in the course that there's not a way to run a telecoil test on Unitron. I got a new Unitron, and I was told there is a way but I don't know where, so they called me the other day and taught me which section to find. It is a course, and I think that every manufacturer should be able to train clinicians on how to run the test on the hearing aid they make. They claimed they run the tests before it gets to us, but sometimes I get them and it is not working great. I can't trust that it is done unless I do it.

16:29 Dr. D'Anne Rudden: Maybe because you are out there teaching us how to do it routinely and effectively. Maybe, all of us will become advocates of wanting to know. Tell us about these things?

16:49 Dr. Laura Pratesi: I run into that a lot when I was asking questions about trying how to figure it out. Nobody runs and does that but I am doing it, the school is doing it, so there should be no excuse. We need to know.

I contacted audiology online because I want to learn how to get more or deep dive into the stuff, but they didn't have anything, so I asked if they wanted me to teach it. That is how the basics of electroacoustic analysis came about.

17:27 Dr. D'Anne Rudden: You springboarded from that position and now you are a part of the Audiology Practice Standards Organization—thank you for all the hard work with that!

Tease me a little bit about standards. Take us through the protocol for basic standards for how we should be performing EAA and then in a perfect world, what are the best practices we should all be striving for?

18:12 Dr. Laura Pratesi: I am so glad you mentioned APSO. They have done and are doing such great work for our profession which I am so excited to be a board member this year. I have a link to the current standard for hearing aid fitting for adults and pediatric patients which I am going to send to you. We are working on standards for pediatric fittings now.

Number nine on the list is an assessment of initial product quality is completed using standard electroacoustic measures to verify either manufacturer or published specifications.

Number fifteen on the list is the short and long-term follow-up is conducted to ensure post-fitting needs are addressed. These include updated audiological assessment, hearing aid adjustment, and routine maintenance as needed to ensure the devices are functioning properly and appropriately for the patient.

Ideally, I would say the EAA has performed before the hearing aid fitting as a part of routine maintenance. I joined APSO after the standard was written, but I wholeheartedly agree with it. I can tell you what I do in my clinic.

Number one, I run EAA before new hearing aid fittings.

Number two, I run EAA if the patient has a sound quality complaint that I think might be related to hearing aid function rather than programming.
Number three, after the hearing aid, has come back from the manufacturer's repair.

Four, on RICs if I change a speaker wire. New wires can potentially give different sound quality. Note how many defective wires you will find in a brand-new fit kit. If you exchange the wire length or power level, then you need to re-run EAA because different power levels could mean different full-on gains.

Number five, before the hearing aid warranty, expires. I want to make sure that it is functioning, if it's not then I get it repaired before it expires.

Number six, when adopting a new patient into my practice, they have hearing aids I did not fit them with.

Number seven, prior to any aided sound field testing. I do AC Bio for cochlear implants evaluation. Would you want someone to qualify for CI surgery because they were just wearing a perfect hearing aid that affects their speech-in-noise performance?

Eight, if a patient ever has a question if the hearing aid is working. I had patients who would call and tell me that it is not working, so I tell them that we are going to run EAA.

And nine, for the kids at the start of a new school year. I don't want them to suffer because they start the year off on the wrong foot.

What I don't do is run EAA at every single hearing aid cleaning check appointment. My practice is mostly unbundled, so if I have a patient who wanted to pay me to do that, I would not tell them no, but I don't necessarily see the value in that. There are maybe other hands that I can run it to, but those are the main ones that I could think of off the top of my head.

21:18 Dr. D'Anne Rudden: Dr. Laura Pratesi, you are a catalyst for change and goodness in our field, and I am so happy we got a chance to talk a little bit more about EAA. If we get out of our own way, we might find that these are some of those magic bullets that create value for us clinicians. It also gives us leverage to be able to utilize the products in an even more effective way. Thank you so much for your time to come chat about the paralysis we all seem to have about EAA.

22:04 Dr. Laura Pratesi: Absolutely. One thing I would like to say is that every profession has certain tools that are necessary for them to practice their job to the fullest extent of their ability. For anyone fitting hearing aids, in my opinion, test box measures are one of those things. Surgeons are not going to agree to operate that isn't well lit because they need to see what they are doing. We need to see what the hearing aid is doing so that we can make sure our patients are getting the most out of their devices, and that is what sets us apart from OTC, and the like.

We verify the work that we do, and we don't accept sub-standard device performance for our patients.

22:49 Dr. D'Anne Rudden: Yes. I love it. Dr. Laura Pratesi you are amazing! I can't wait to see and hear more from you in the future as we get better and better. Thank you for being on the podcast.

23:03 Dr. Laura Pratesi: Thank you so much.

23:05 END