

This unedited transcript of a Continued webinar is provided in order to facilitate communication accessibility for the viewer and may not be a totally verbatim record of the proceedings. This transcript may contain errors. Copying or distributing this transcript without the express written consent of Continued is strictly prohibited. For any questions, please contact customerservice@continued.com

Tinnitus Treatment Trends

Presenter: Lori Zitelli, AuD; Tricia Scaglione, AuD; David Jedlicka, AuD

It's my pleasure to welcome a wonderful group of clinicians we have today, Doctor Lori Zitelli, Doctor Tricia Scaglione, and also doctor Dave Jedlicka. I'll hand the mic over to you first, doctor Zitelli to get started. Thank you so much. Good afternoon, everyone. Dave and Tricia and I are really happy to be reunited.

First of all, we present together often, and today we're very happy to be talking to you about tinnitus treatment trends in 2023. So I'm going to be the one that gets us started, and then I'll hand the baton to one of my colleagues. Here are our disclosures. Take a minute and look through that and our learning outcomes. So after this course, we want people to be able to discuss how to classify tinnitus treatment articles into collections that describe the category of treatment employed, describe three different treatment approaches for tinnitus, and explain the method and results of at least one tinnitus treatment related article that was published in 2023.

I'll start with a little background information about what we typically do. So each year we like to find all of the tinnitus articles that we can find and then make a summary based on the topic of their content, information and categories. So this year we found 173 articles related to treatment of tinnitus. And if you want to hear more about any of the other categories that you see on the screen here, make sure you come to our upcoming talk at the American Academy of Audiology conference. Today we're going to be focusing specifically on treatment, so we'll give you a little snip of some of the recent treatment trends that we've seen in the literature.

At the end of the talk, you'll be provided with a QR code that takes you to a spreadsheet that lists all of the articles that we found. In addition, we typically don't take a lot of questions about the articles because we didn't write them. If you have clarifying questions, please feel free to ask them. But if you have questions about specific articles or procedures or outcomes, you probably will be best served to contact the author and ask, which you will be able to do if you look at the spreadsheet

and find their information. So now I'm going to start us with a few articles that are related to one of my personal favorite topics, telemedicine, and then a few articles about some behavioral strategies, which is, of course, one of the staples of tinnitus treatment.

So our first article focuses on an Internet based treatment program, mindfulness. Specifically, this article was published by doctor Jennifer Ganz, a psychologist who's living in California, and she describes her implementation of an online mindfulness program during the COVID-19 pandemic lockdowns. The goals of this study were to investigate changes in tinnitus intrusiveness and determine whether they were maintained at a follow up period. So doctor Ganz developed a mindfulness program that has a tinnitus focused treatment component. So in addition to the typical mindfulness strategies, things like promoting nonjudgmental awareness and acceptance of chronic conditions, the program also aims to help people feel less anxious about their tinnitus.

It aims to provide accurate education and information about tinnitus and then also to teach people how to establish mindfulness meditation skills. So just a quick note hint in the top right corner there. This is a slide you may want to come back to at some point. The program that she developed consists of eight lessons that are designed to be consumed over an eight week period with 30 minutes of daily meditation on days between the lessons. There also is a component where there's a day long treatment session designed to be between the 6th and 7th week, so kind of later in the program after the person already feels established in their habits.

This program had been successfully implemented before the COVID-19 pandemic in person and this study was aiming to see if it could be effective over a tele platform as well. Note that it was offered for free during this period of time. But now if you want to do this program or have your patients do it, there is a charge associated I want to draw

your attention here to the participant characteristics which are outlined in table one on the slide here. There were 577 individuals who were enrolled in this free online program, but 43 completed it. This is a completion rate of 7%.

That may sound very low, but it was noted that in the in the article that free online courses typically have a fairly low completion rate, so it's really not out of the ordinary or unexpected for this type of treatment program or plan. Outcome measures included an initial tinnitus intake questionnaire generally to obtain the demographic information of the study participants. The tinnitus functional index and the perceived stress scale were completed at initial midpoint completion and then six month follow up timeframes as well. Doctor Gans divided her participants into two groups. So first was completers.

These are people who completed the entire program, and if you look at the graph on the screen, these are the results shown on the right side of the graph and then the follow up group. These are people who completed the program and did the questionnaires again at a follow up period six months later. These results are shown on the left hand side of the screen. So you'll see here that both groups experienced tinnitus handicap scores that trended downward over most domains that were measured of the tinnitus functional index over the eight week study period. These domains are things like intrusiveness, sense of control, cognition, sleep, et cetera, et cetera.

You can also see that for both the completer and the follow up groups, the perceived stress scale scores reduced over time, and this is considered to be a positive outcome as well. 44% of the people who completed half of the program, this was 94 participants, experienced a clinically meaningful improvement, and this is defined as a 13 point improvement on the tinnitus functional index. Of the the 43 people who completed the entire program, 72% experienced a clinically meaningful improvement. Ultimately, the findings of this study indicated that the eight week program does

alleviate symptoms of bothersome tinnitus for most people who complete the program. However, it was also thought that an abbreviated program, maybe about three weeks, could be beneficial because a lot of.

A lot of the improvements that were the biggest that were seen throughout the duration of this program tended to happen earlier in the program, with an exception of sleep and cognition, because those two things were things that tended to improve most from the midpoint to the end. So, limitations for this study included the low completion rate that we discussed and the lack of a control group. And I think, given the findings, an abbreviation of this program may be focused on people who don't have sleep, or cognitive disturbances may be a good way to roll something like this out, and you also may find that this improves the completion rate as well. So I hope this is something that is looked at in future studies. Plugging along with our theme, our next study is looking at providing telepsychology through an Internet based CBT cognitive behavioral therapy program that's delivered through a chatbot.

So we know that cognitive behavioral therapy is highly supported for tinnitus management, although this specific strategy is limited by certain things like labor cost and accessibility. So the authors of this study were wondering whether the use of a chatbot may improve access. I think probably most of us have interacted with a chatbot at some point in our lives. It's a computer program that you can essentially have a conversation with. It's meant to simulate interactions between humans and is a good strategy for solving simple problems or answering basic questions.

So the example that was provided in this study, before we even start talking about this study in particular, was a study that had previously used an example called the woebot. So, woebot is a chatbot that had been programmed to provide cognitive behavioral therapy services to young adults who are suffering from depression and anxiety. So they developed Woebot to interact with these participants and help them to

develop CBT related skills. So one example of this would be pointing out when they are experienced a cognitive distortion like mind reading. So if the participant says something in the conversation with Woebot, like, nobody likes me, Woebot would point that out and say, this is the cognitive distortion that you're experiencing.

Woebot would also check in with participants at specified periods of time to provide suggestions based on their responses. So this could be an example of a conversation that might, they might have. So, Woebot might reach out and say, how do you feel right now? And the participant might say, I'm panicking. And the robot might say something like, oh, I'm sorry.

Breathe along with me for a minute, and then we can talk a little bit more about it. So, providing suggestions in real time. The YouTube link that I've posted down in the bottom corner of the slide leads to a video that shows you some more examples, just if you're interested in learning more about Woebot and seeing how that worked. So some more quick information about Woebot that I think is helpful background information. In this particular study, which was published in 2017, the participants got a self help ebook that was designed to help them manage depression, and in one group, also got Woebot interactions.

So after two weeks, the people who were in the Woebot group experienced a significant reduction in their depression symptoms. Woebot was associated with a high level of engagement. A lot of people used the the bot every day, and generally, they viewed that, that group viewed the study more favorably than the group that did not have the Wilbot interactions. So you'll see some examples on the screen here of some of the feedback that were, that was related to Woebot. So people like the videos and the games that were shared by Woebot, they would say things like, Woebot felt like a real person who showed concern, and they felt that Woebot provided helpful coping strategies.

Okay, so now that you know how a chatbot can work in this type of study, let's get back to the study at hand. So Bardi et al. Was looking at if incorporation of a telepsychology component into an Internet based CBT program could also use a chatbot. So this time, we met Woebot. Now we're going to meet Tinabot.

So the authors of this study divided their participants into two equal groups, one getting the intervention from Tinabot only and the other getting video calls with a clinical psychologist. In addition to the tinnabot interactions, participants were instructed to engage with tinabot for a ten minute period of time every day over a period of eight weeks. And the hybrid group was also additionally receiving four video calls, 30 minutes each, over an eight week period. So you'll see on the screen here some of the strategies that were championed by Tinnabot. So these are things that are kind of central to CBT strategies like identifying and challenging negative thought patterns, relaxation exercises, things like that, plus also some mindfulness strategies, things like acceptance and gratitude exercises, et cetera, et cetera.

So the outcome measurements that were included were a variety of questionnaires. The ones that you see on your screen that are in red were not analyzed in this current manuscript, but there are data that were reported for the TFI, the hyperacusis questionnaire, PHQ nine, and GAD seven at pre post, and a follow up time point. This study showed that in both groups, meaning tinnabot only or the hybrid intervention with the telepsychology, over 60% of the participants showed a clinically significant decrease in their tinnitus related distress at a certain point after the program. And it also, the study suggests that incorporating computer programs that are meant to simulate CBT interactions may be really useful and something that we could add to our tinnitus treatment tool belts. Moving on now to mHealth, which stands for mobile health apps.

A lot of researchers are looking more into how we can incorporate these things like the Tinnabot app and sound therapy, apps like resound relief and others that are like it into some healthcare management strategies. So the advantages of these solutions are they're immediately available, people can download them whenever they want, they're considered to be fairly accurate overall, and generally they're fairly low cost. Also, there are a ton of apps that are available on both the Apple iOS and Android platforms. So this study was aiming to understand the research trends in tinnitus applications. And the article assessed 75 articles that were linked to apps and found that there was an increasing trend over year to year in the number of publications.

So this would indicate that there's a lot of interest in this topic and there's a need for new research in this area. Most of the publications in this area were published in either the American Journal of Audiology or the Journal of American Academy of Audiology. So two heavy hitters for us and you'll see on the screen here that the 16 most productive authors in this area, likely some names that you'll recognize here, have been really, really active in this area. Starting around the era of 2015 and after Germany had published the largest number of articles in this field, ended up being about 25% of the total, and also had the largest number of international collaborations, followed second by the United Kingdom and then the United States. The themes of the publications were also analyzed.

They found things related to depression, insomnia, cognitive behavioral therapy, of course computer assisted therapy, and then other applications and smartphone programs that were related to tinnitus as well. When analyzing the 28 tinnitus treatment related apps, the study divided them into three main categories, so the first being screening and evaluation, second being intervention and rehabilitation, and the third being education and information. So of the 28 programs, all had a treatment component. Eleven were related to screening and evaluation also, and then five were related to education and information. The treatment components in the apps included

things like masking, habituation concepts, cognitive behavioral therapy, sound therapy, music therapy, and other variety strategies.

So, to summarize the trends in the literature in this area, the number of field of app of articles, I'm sorry, related to tinnitus apps has increased yearly and has been growing rapidly since 2015. So this would indicate that the area is steadily growing and there's a lot of interest. Despite publications being accepted to AAO and JAAA, the acceptance rates of articles for this field were poor in the top medical journals. So nothing in the New England Journal of Medicine, nothing in the Lancet, the journal of the American Medical association, articles like that. So, just to point out a few issues, the ratings of the app, on average were around 3.8 out of five.

There were some individual scores as low as one and some individual scores as high as five out five. So there's room for a little bit of improvement here, and we hope to see more consistently good ratings in the future. In addition, as always, as we try, the issue that we run into, as we always try to compare studies to each other, there are no uniform treatment protocol or outcome measurement requirements. So that really makes it very difficult to compare studies to each other. So although there was an increase in interest noted in publications in this area, the number of overall studies is fairly low.

And the apps, a lot of the apps that are developed don't always make it to a point where they can be used in the real world. So it was suggested that future research should focus on app properties that can promote use in real world settings. And to wrap up my activities here, I'm going to end with a quick lightning round that's focusing on smartphone based therapies. So two articles that I'm going to discuss here are focusing on smartphone based CBT and smartphone based TRT or tinnitus retraining therapy, two of our long time staples of tinnitus management. So kind of a newer twist on an old standard for us.

In each study, there was an app studied that was intended to provide a specific type of therapy, and both studies used apps to deliver whatever necessary background information was needed for the skills that are necessary for success. So for TRT, this would be information related to the anatomy, the neurophysiological model of tinnitus, things like habituation, the role of sound therapy, and then for cognitive behavioral therapy, things like attention, relaxation, mindfulness, acceptance, those kinds of things. Both studies had a control group. So in the TRT study, the control group received a conventional version, just meaning a face to face component. And then in the CBT group, the control group was untreated for three months.

There was a study period of three months, after which some outcome measurements were taken. In the TRT study, it was the tinnitus handicap inventory and a visual analog scale in the CBT study. Tinnitus questionnaire, again, just pointing out lack of consistency among the measurements used in terms of timing and also the specific instruments that are used. Regarding the TRT trial, both groups showed significant improvements in tinnitus handicap inventory scores over time, with no difference noted between the groups. But notably, the treatment effect at three months was marginal in the conventional group.

So, given these results, it was concluded that TRT that's delivered over a smart device can be an alternative that's effective for in person treatments with similar effects. And now for the CBT group, after three months of treatment, we saw a significant reduction in tinnitus questionnaire scores in people who had bothersome tinnitus compared to no reduction in severity in the control group, which did not have an intervention. So the interpretation of that is that three months of smart CBT, the way they like to call it, depression and stress scores, were significantly improved. And this could also be considered a viable option for people. So I'll leave you before I pass the baton to doctor Scaglione with a few takeaways.

One being we know that telemedicine strategies, in particular mindfulness, cognitive behavioral therapy, tinnitus retraining therapy, are becoming more widespread and are considered to be effective treatment options. In addition, people are becoming very interested in app related strategies that seem to need a little bit more refinement and focus on day to day use. But overall, the area appears to be of a lot of interest, and I expect we'll continue to see more studies as time goes on. So now, thank you very much for your time, and I will pass the slides over to Doctor Scaglione. Thank you.

Thank you so much, Doctor Zitelli. Hi, everyone. Thank you. For everyone who has jumped on to join us today, switching gears a little bit, we're going to talk about transcranial magnetic stimulation. TMS, or RTMs, is not a new concept for tinnitus management.

In fact, it's been researched since approximately 2003 for the treatment of chronic tinnitus. It's not clinically used at this time, but it is used clinically for other chronic health issues, such as seizures and even depression.

With these studies that have been published, there's been a lot of variability that has come out. Rob Fulmer wanted to take a look at why aren't we able to use this treatment clinically if we've had these different research studies? He completed a review of articles that were published over a course of 20 years, and I'm going to go through some of the findings he identified.

So TMS, if you're not familiar with it, it's a non invasive treatment that can be utilized to help various conditions. And like I said, it's been studied for tinnitus. And essentially what it is is it's a wand that produces a type of magnetic field that is held or waved, essentially, over an individual's scalp. And the coils within this essential wand is what

generates that field. And it can cause currents to disrupt or change the effect of neural activity happening in the brain.

And since we already know, through imaging studies and other research, we know that tinnitus is occurring in the brain, affects the auditory cortex and other areas there, that it is possible that this could be a potential treatment for our patients. So why not investigate it in terms of material and methods? He reviewed a couple of different databases. Number of different search terms and variables were assessed, and essentially over 20 years of publications that he found. He found that there was a number of articles that said, hey, rtms or tms can be an effective form of treatment for our tinnitus patients.

And then there were a number of articles that were published that say, not so fast. Actually, it did not prove to be effective. So there's a lot of conflicting information in those findings.

I want to draw your attention that this is one of the questions on your quiz, so you might want to come back to this one. So through this review, doctor Fulmer was able to identify, you know, what are these unresolved issues? Why do we have these discrepancies between the different publications? And why can't we just move forward with being able to use this as a treatment? And it's because there is no consistency among these studies that are being conducted.

This can range from the different types of RTMS equipment that are being used. It can be because of where they're, where the researchers and scientists are placing the coil, where they're targeting the scalp, what type of stimulus parameters that they're using, and as well as what are the characteristics of the study population that they're trying to investigate. There's no cohesiveness in this data. The studies that are trying to replicate findings aren't replicating it apples to apples. So it's really causing a hindrance to us

being able to move forward to determine is this conclusively an effective or ineffective treatment for our patients?

Also, what type of outcome measurements and follow ups are being done for these patients? There's just, again, not no consistency. As you can see, this can lead to a lot of unanswered questions. So I encourage, if anybody does have a particular interest in studying rtms, go back and look at these other studies before you engage in yours and let's see if there's effective studies out there that we can replicate and specifically looking at these different considerations that are shown on this screen here so we can make some forward movement.

The discussion also brought up, well, a lot of these papers, if they had effective or ineffective findings, they came back and said at the end of the day, we need more large, randomized, double blind, multicenter trials. Well, I mean, I think we need that in most of our tinnitus research, so it's kind of a no brainer. But now we need to really dig into why are these large, multi site clinical trials not being conducted for rtms. So hopefully I'm giving you a research question that you want to look into or you want to send your, your audiology students to investigate a little bit further. Jumping into naturopathy.

There was a recent study that was looking at a type of supplement to see if the supplement would help with reducing the emotional effect for tinnitus patients. And specifically looking at does this supplement also reduce tinnitus loudness? Well, why did I pick this article specifically because this titanium duo supplement is looking at ginkgo biloba. So. Or ginkgo biloba is a big component of this supplement.

If you work frequently with tinnitus patients, you may already be aware of the american, the AAO, head and necks, head and neck surgeons, the guidelines for tinnitus that were published in 2014. And their guidelines said if they either their committee

recommends for or against or for different types of types of tinnitus treatment for patients, and this is based on randomized controlled trials, systematic review and so on and so forth. And they found that they don't recommend dietary supplements in the treatment of tinnitus. So let's see, despite these rigorous guidelines that took place, what is this new study finding? The study was a prospective study that was not controlled.

I highlighted that because that's a big red flag to me that took place in one single center. Individuals were given an oral supplement to take in the morning and at nighttime, and they took it for about three months and then they had three visits. They had their baseline visit, follow up visit, and then the end of study visit. And these patients were assessed using a tinnitus handicap inventory, specifically looking at the emotional subscale. They also looked at tinnitus distress rating on a scale of zero of no tinnitus to ten of the patient, ranking the worst possible tinnitus they could experience.

Patients were also assessed by having an audiogram performed looking at thresholds at 501,000 2004 thousand. And you can see here, this is their study protocol.

They specifically wanted tinnitus. Patients that had tinnitus over has been present for over six months and the THI scored at least 24 out of seven on the emotional subscale of the THI. So if you work with a THI, you may be familiar that there's various subscales that the questionnaire is broken into.

Adherence was determined by the number of pills that the individuals returned at the end of the study and to be considered compliant or adherent to the study. At least 80% of the pills must have been consumed. The results indicated that 29 patients completed the study and that the THI and the subjective ranking of the tinnitus loudness decreased in their study groups. There was no change in hearing, which ultimately probably wouldn't expect there to be a change because of the supplement.

So what they're saying is that, you know, this supplement, supplement may be a good option for tinnitus patients, but of course, further studies need to take place in randomized controlled studies to be able to confirm these pilot preliminary results. You know, I do urge the readers to consider it is a low sample and there's also no long term evidence to show how this supplement, if it did have benefit for patients after long term use or after they stopped taking the supplement. I'll also mention when I wanted to highlight when I was going through these slides that in their results, they talked about the PP scoring, which is actually no, is all patients that did not have any major deviations to the protocol in these while doing the study, and then the ITT group, which was all patients, regardless of deviation for the study. So when you're reading back through there when it could be a little confusing, if you're looking at that results slide, that is what that meant.

All right, let's talk about laser therapy in terms of laser therapy. Laser therapy has been used for years for alternative and complementary different types of treatments for different health conditions. So why not tinnitus? Our researchers here we see, we have a big group. They wanted to look at the effects of this red and infrared laser therapy with patients who have tinnitus.

They conducted a double blind, clinical, randomized, controlled study and they combined it with different types of treatment modalities, including ultrasound, different kinds of pharmacological drugs, and vacuum therapy.

And they ultimately wanted to see is this type of therapy helpful for our idiopathic or refractory tinnitus patients. First they had their selection of patients. They started with 107 and ultimately ended up randomizing about 100 volunteers. These hundred participants were allocated into ten different groups. So there's about ten patients you can see give or take per group.

And then in each group there were the patients received different interventions.

The different types of treatments included the light therapy alone, vacuum therapy, which you may better know as cupping ultrasound therapy. Ginkgo biloba threw this one in there because the other ginkgo, I wanted to tie the two together here, as well as fluid meclizine hydrochloride, which is a prophylactic medication that's usually seen for migraine treatment, and it is a calcium and histamine blocker. Then they wanted to compare the outcomes with laser puncture, which you may better know as laser acupuncture, the migraine prophylactic alone, as well as ginkgo biloba alone. So you can see here in this treatment group, patients were randomized into the different interventions. And then you can see here, this is a picture of what some of that light therapy looks like looking at this novel transmiatal, low level light therapy that's being given to the patient right there in the concha and the ear canal there.

Then the data was collected and analyzed. And our findings were that. I'm sorry. At the clinical evaluation, the thi was recorded before they started treatment as well as the 8th session once it was completed, and then after treatment was completely finished. They completed the thi 15 days after that for each of the groups, regardless of intervention.

Now jumping into results, sorry, I was getting a little ahead of myself there. The results did show that there was a positive treatment outcome overall when compared to the placebo effect results. And this was specifically higher when individuals received the laser alone or when they received the laser puncture or laser acupuncture alone. The short term benefit was also noted when they had laser combined with the cupping or vacuum therapy, ultrasound, ginkgo biloba, the migraine prophylactic. So some effect, but not long lasting.

Again, some here, some more of those results here. Those are all. What you're looking at here is the breakdown of each treatment group.

What they're saying, what these research teams are saying is that this light therapy with either the laser acupuncture and this transnational light therapy, it might be promising alternative treatment for our patients and that we do need to do some further investigations to look at the long term effects of this therapy. And when doing this, we also have to look at contributing factors to how we administer the treatment, the dosimetry, the wavelength, as well as the number of sessions that each patient will undergo in terms of physical therapy. So I'm going to do two quick lightning round type articles like Lori did. So these are some short and sweet articles that came out also looking at some treatment options for our patients, our friends of physical therapists, we love them. They also help treat, excuse me, and manage tinnitus.

There was a study that was taking place that looked at patients with somatosensory stimulation in patients specifically looking to see if different exercises aimed to increase muscle strength, motions in the joint and stretching can help patients with somatosensory tinnitus symptoms. Somatosensory symptoms can stem because of the jaw, because of the neck and similar issues. They found that patients who did undergo this treatment were seen for therapy for three weeks and then they were followed up after three weeks, and they assessed the THI as well as the VAs after three weeks of treatment, after the three different weeks of treatment. So they were collected at the baseline, they were collected at week three and then at week six, nine and twelve, depending on which group the patient was in. And ultimately what they found was this.

Preliminary data is showing that somatosensory stimulation with, through physical therapy can help improve tinnitus results, tinnitus outcomes. And this is something that should be further explored. And this is something for you to keep in your back pocket

when you are having patients that are experiencing somatosensory tinnitus, that we should be taking a collaborative approach with our physical therapy colleagues. The last one is weight loss. So in terms of weight loss in tinnitus management, this study wanted to look at if we made dietary and physical activity changes, will they affect our tinnitus symptoms?

So there was 63 obese subjects that reported chronic tinnitus that were involved in this study. And they were divided into a couple of different groups, including diet and physical activity, diet alone, and then their control group. They were assessed using a number of different methods, including dietary records. They used the Thi. They looked at depression through the Beck depression inventory.

They also looked at a health scale, the visual analog scale. So they did look at a number of different factors here. And what they found ultimately, is that when individuals were compliant with the plan and they made these dietary changes and they increased their physical activity, either doing one or the other, this is going to be a shocker, but they're tinnitus improved. So, you know, we're looking at improved quality of life in these individuals with tinnitus. So I think that, you know, this is, you know, obviously a mind blowing research study that we had to bring to light for everyone to be able to hear about.

But no, I think that this, this article is really important because it, when we talk with our patients in the clinic and we're trying to talk to them about that, it's not just hearing aids, it's not just sound therapy. It's not these types of, necessarily just these types of management options for tinnitus. But we have to look at the holistic approach of the patient. Articles like this can help to support why patients need to be adhering to a healthy diet and why physical activity can help to not only benefit their overall well being, but also their quality of life in terms of their tinnitus symptoms. So hopefully these gave

you something to think about, to simmer on and maybe gave you some new research ideas.

And with that, I'm going to go ahead and pass the baton to my great colleague, doctor David Jedlicka.

Thank you, Doctor Scaglioni. I'm working on getting my video set up here, but here we go. All right, so let's talk about one of my favorite things, and that is combination devices. These are essentially mixing hearing aids with sound therapy for tinnitus patients. And I will fully admit, of the people presenting today, I do not consider myself a tinnitus expert.

And that's mainly because amplification is, and always has been my first true love. So, being a part of this group, I'm really happy to be able to talk about how hearing aids can be used in addition to the sound therapy devices to really provide some benefit for your patients. So, like the other co presenters have mentioned, this is a slide that might be very important come quiz time. But one of the things that I've always had an interest in was wondering if patients are receiving treatment for tinnitus through amplification as well as a sound therapy device, is there going to be any residual inhibition occurring when the patient no longer wears that device? So, essentially, if they're using this device for treatment, for hearing and for tinnitus, when they take the device out at night to charge the hearing aid, or for whatever reason, will they have any relief of that tinnitus when they take this device out?

So there are two main objectives from this study. The first was to evaluate the feasibility of residual inhibition technique therapy through just daily use of hearing aids. And the second objective was to determine the effects by measuring reactionary changes in tinnitus with one of my favorite tools for tinnitus patients, and that is the tinnitus functional index. So the authors were able to include 20 adults with chronic

tinnitus, and they did this over four visits. Now, the four visits, I think they broke down in a very traditional way that we usually see in tinnitus research, where we will have the baseline measures and initiation of the intervention period, aka fitting the hearing aids.

And then these authors decided to do three follow up visits, basically one month out, and then the very third or the very last visit. With the three month follow up, the authors took a look at washout effects or intervention effects. Now, the one thing that I feel like the authors did very well in this study was that the residual inhibition stimulus was individually created for all of the participants, and they were fit via hearing aids that were fit bilaterally. So all of these products being provided to the patients were individually fine tuned for what was felt that was going to help them the best, rather than just creating a one size fits all, blanket type intervention, which we know is not going to be very beneficial for most tinnitus patients. The individuals were instructed to wear their devices for two months during all waking hours, which I think if you're a clinician like I am, we hopefully will see our patients doing that, but doesn't necessarily mean that they will.

Luckily, these people seem to be a little bit more motivated since they did volunteer to be in this research study. Now, they were instructed to wear their devices for two months. But a washout period was completed after the residual inhibition treatment, where essentially the users would continue to use their hearing aids for amplification purposes only. But the residual, I'm sorry, the tinnitus treatment program was going to be removed from the devices again. The authors took a look at the TFI to see if there were any changes along the way, and the participants also completed some tinnitus self report measures.

They completed tinnitus loudness and pitch matching, which some people like, some people don't, but it is pretty common to see occur. They also included minimum masking and minimum residual inhibition level testing. So they got a lot of good data

out of this study. Well, what did they find? Well, they found that the TFI scores improved from the initial visit to visit one, which is great.

They also found that the TFI improvements remain stable through all visits, including the washout period. So even though the person, the individuals did not have that program available to them after the washout period, they still found improvement with amplification only, which is good because this is something that you can tell patients, you might not need this for the duration of your use of this device. Maybe we just need to provide some treatment early on, and then all of a sudden things will be better for you that you could eventually not need that second program. What was interesting to me, though, was tinnitus measured. Tinnitus loudness did not change significantly throughout the study, so that remained the same.

And in good news, the majority of participants did report having positive experience from the tinnitus treatments. So in general, I think it's not too unsurprising for us to find that a properly fit hearing aid with a tinnitus treatment program that was designed with these individuals specifically for what they need had good outcomes. But it's always nice to see that the data lines up with what we expect to happen now. Some of the discussion points and future directions that the authors pointed I think, are worthy of mentioning as well. And the authors did attribute that the self perceived positive experience could likely be due to the participants having a sense of control over their tinnitus, where now that they have a tool in their arsenal to use that sound generator if they feel like the tinnitus is really bothersome, whereas an individual who has a hearing aid only just for amplification purposes might not have that same sense of control, or even if we're comparing it to when they did not have their hearing aids, that they just had to deal with something that was going to be bothersome.

Without any type of treatment being provided whatsoever. And the authors did recommend that a larger scale replication study be completed with validation

purposes, which would make sense since there were only 20 participants in the study. And one thing that they didn't include, which would be great to see, would just be a control group of maybe just individuals who were fit with hearing aids and amplification as a treatment alone. This way we could compare looking at those who received the tinnitus sound generator plus amplification versus amplification only because, heck, maybe just proper amplification is all the individuals need. So if any of you are looking for a research project to do, the authors are hoping that somebody will pick this up and take this in a future direction study.

Maybe we'll see this pop up in tinnitus treatment trends in 2024. And then another article that I felt worthy of inclusion was one that was titled hearing aids with tinnitus sound support reduced tinnitus severity for new and experienced hearing aid users. I love when authors just get right to the point when it comes to their article, so they title their article. You know exactly what to have, what you'll expect to have happen here, but let's break it down so we can understand the methodology and what the authors were hoping to study a little bit further. Now, the authors felt that having a tinnitus support feature would reduce the impact of tinnitus for new and previous hearing aid users over a twelve week period.

So that's why they decided to study it. They have 40 total participants. 19 people were experiencing hearing aid users with tinnitus. 21 were brand new hearing aid users who also have tinnitus. Now, they use the same hearing aid for all of the participants.

They picked one from the big six, and they were fit using comprehensive real or measures with na, I and I, two targets. Kudos to them. I love best practice. So great job. Grant search field and your team, they now, this study varied a little bit from the first one, whereas this one now provided four programs for the patients to have.

So they had an amplification alone program, they had a noise reduction program. So those were the first two. But then they also had the amplification program plus a tinnitus sound generator as well as a noise reduction program plus tinnitus sound generator. So these individuals had four programs to choose from. And just from a clinical perspective, I think of a brand new hearing aid user having access to four programs, and I'm thinking, man, that's a lot of counseling you have to provide all at once.

But again, this is a research study. So this is why it's a good time to ask these questions, such as, would providing for programs be that different? So rather than just kind of jumping to the finding, let's talk a little bit about how these things were measured. So again, you're going to find it's pretty common that when we're looking at tinnitus research, that the follow up visits usually will occur over the period of a few weeks or a few months. And same thing applied here.

We had the initial visit, a three week follow up and a twelve week or a three month follow up. Again, the TFI was used. So you'll see a lot of the same measures that we have being incorporated in most of these studies. But the one measure they use, which I really like is the COSI, the client oriented scale of improvement. And they use the participants having this measurement that did tinnitus related questions for the COSI.

They also asked the participants to rate their tinnitus as far as how bothersome it was on a Likert scale using zero through five, where zero is no problem whatsoever and five is a pretty significant problem. They also measured a Likert scale using five different dimensions of tinnitus perception for strength, intrusiveness, discomfort, unpleasantness and the ease to ignore the tinnitus. But in this case, they use a zero to ten Likert scale, and that's going to be able to provide the participant a little bit more specificity in reporting how much of a problem they're experiencing. So this is just a breakdown of what the group and participants look like, where their tinnitus pitch

matching would occur, how loud the tinnitus was. But the graph on the right, I think, is the more telling story.

So the darker boxes that will show what the tinnitus functional index scores were prior to the fitting. So the one on the far left is for new users, the one that's kind of the darker box, more in the middle, that is for experienced users, and then the lighter orange boxes, those are the ones looking at the post fitting outcomes. And as you can see, we did see improvement in both groups, which is great. But if you take a look at the severity, those who are experienced users didn't have as wide of a range of a TFI score as those who were brand new users. So this might be explained by these individuals maybe getting benefit from their previous hearing aids with amplification alone, maybe the fact that they're well versed, better versed, I should say, in expectations with their tinnitus, that that is why their TFI score was a little bit lower and more compact as far as variability of scores go compared to that new group.

But the important thing is both groups did find improvement, which is what the authors wanted to see happen. And I know there's a lot happening on this picture here, so don't worry too much about the nitty gritty. The whole purpose to show this was across those five different domains as well as the total TFI score. What we found was that there were significant differences between the pre and the post outcomes, showing that whenever individuals were fit with hearing aids using comprehensive real ear measures fit nal two targets, and they had all of these programs to choose from, there were significant improvements found for all of these conditions. So that's really nice to see the validation of what hypothesis the authors had and we had, if you are a clinician like myself, come to fruition.

Now, one area that I don't dabble in too much, but I'm always interested to know more about is what is the role of cochlear implants on tinnitus as far as a treatment? Because if you think about it with hearing aids, if you have an individual and they have

tinnitus and they're wearing their hearing aids, maybe that helps them. And then at night, when they take them out, if they're not having that residual inhibition, we can still provide things like tinnitus sound generators and whatnot. But for our cochlear implant patients, what do you do if they take their implant out at night and they still have tinnitus? Because guess what?

That tinnitus sound generator is not going to work very well if they don't have any residual hearing left following their surgery. Luckily, we had a really, really good subset of articles looking at the impact of cochlear implants on tinnitus, one that I found to be very interesting, and the main reason why I wanted to include it was this study here is called the early effects of very early cochlear implant activation on tinnitus. And I wondered, okay, well, what the heck is very early cochlear implant activation? Well, rather than waiting the three to four weeks of activation following surgery, these researchers activated the implant one day, 24 hours after the individual was implanted with their hearing aids. And they wanted to compare how the preoperative tinnitus handicap and the post operative operative tinnitus handicap changed among those who were fit within those 24 hours.

Now, these individuals were all fit the same way. They received the same devices, the same electrode array, they were all fit. The next day after their surgery, they used the tinnitus handicap inventory to measure those pre and post implantation tinnitus changes. And then again, they looked at the tinnitus change at comparing baseline to the day after one week, two weeks, and one month post implantation.

So here's what they found. So, from the pre op tinnitus ranking, you can see 24 hours right after that surgery, when they had the activation, the thi score actually went up slightly. And even though I say slightly, but even though it looks like it only went up slightly, it was still a significant difference. So these individuals did see an increase, a significant increase in their tinnitus when they were activated one day after their

surgery. But when we start, then look at the one week, the two week, and then the one month follow up period, we can see those numbers continually decrease.

Now, one, what I feel flaw in this study is that the authors only compared the outcomes of the Thi scores to the baseline measure. So there was a significant decrease at one week, two weeks, and one month compared to that initial baseline measure. But they didn't compare the one week to two weeks or the two weeks to one month. So even though we're seeing a general trend down in the Thi, we can't say if it was significantly improved because that statistical measurement was not completed. So why are we seeing this change?

Why do the authors suspect that the individuals had an increase in their tinnitus a day after? Well, it. It was probably due to intracochlear changes and modulation the entire auditory pathway. My personal opinion is these individuals just had major ear surgery, and there could be some other things going on in the head following the surgery, swelling, irritation, a whole bunch of other stuff happening. So maybe that, you know, this is something we could have expected to see.

It would have been really interesting to see, too, if the Thi could have been recorded on the day after for people who weren't being immediately activated. What if these people follow that traditional three to four week period? But the good news is, after that first day, which if I'm sure a day after surgery is not fun for any of these individuals, they did see that improvement occur throughout the next few weeks. And my idea for a future direction was that I would love to see what type of role counseling could play when it comes to these early activation individuals to determine if maybe if we provide them just some awareness to say, because of this surgery, you might experience a slight increase in your tinnitus perception after the surgery and after the activation implantation with tinnitus treatment. So much of what we do and the success we have is based on counseling.

Maybe if we educate the patients a little bit better with these early activation strategies, to say at first it's going to get a little bit worse before it gets better, or on average, it gets a little bit worse and it gets better. So that's just an idea that I had. If the early activation of implants continues to be a thing. And then the other article that I have for this category was looking at the changes in tinnitus characteristics in a residual inhibition following cochlear implantation. So again, the whole purpose of the study was to explore the effect of cochlear implantation on tinnitus perception.

And this study had a really, really nice sample size. So the fact that they were able to get 72 hearing aid users is impressive. Getting, I'm sorry, cochlear implant users. Cochlear implants are not an easy group to study just because of the sheer numbers don't exist, like you would see for an individual going through TRT or an individual receiving hearing aids. So the group broke down to 42 participants who reported tinnitus and then 30 participants who did not have any tinnitus.

So it's nice to have that control group. Now, the hearing status of the non implanted ear was reported, but they did not report on whether or not the use of a hearing aid was occurring on that side. So that was one, I think, issue in this study that would have been nice to include. So these individuals, they decided to measure the changes in tinnitus following implantation by using a few different measures. Two of my favorites, the TFI and the THI, as well as the tinnitus sample case history questionnaire.

These authors also recorded the etiology of hearing loss as well.

So here's what we see. Looking at the groups as a whole, we can see the pre implant, the TFI score was pretty high. And then once we got into the three months post implant and six months post implant, we did see a reduction. It did go down slightly, but not a

significant difference from that three to six month post implant. The authors also did report that the THi scores did improve, just like the TFI scores.

However, they didn't provide a figure which I think would have been nice to include. But that's just me maybe wanting too much. But most importantly, how did the tinnitus change when the. With the residual response? So, essentially, when the person took their cochlear implant off, how long did it take before the tinnitus started to become noticeable again?

So what you're looking at here is on the dark bars. Those are three months post implant, and then the lighter bars are six month post implant. So a little bit, a few changes, nothing too, too significant, though. And what you're seeing in the breakdown is that the vast majority of participants had lasting residual inhibition. So that's really, really good to see.

And then we still had a good portion of people as well that had 30 minutes of residual inhibition occurring before the tinnitus came back. There were, unfortunately, the next highest group was going to be those who reported immediate return of tinnitus once the implant was taken off, and then the smallest two groups being the less than a minute or that one to 15 minutes group. But I think the encouraging thing here is that we see a good number of individuals have lasting residual inhibition from tinnitus with the cochlear implantation, which is nice to see. All right, and we're going to bring things home. Talking about sound therapy here, sound therapy is one of my favorite treatments to provide, provide to the veterans that we see in our clinic, especially whether or not they have hearing loss or normal hearing.

So if you're like me, you probably watch more football than you should. And I remember during the Super bowl, there was an advertisement for an app that played green noise, and I know a whole bunch about different noises. I wasn't too familiar with

pink noise, so when I was going through the articles to select for inclusion, I came across this one that evaluated pink noise as a potential sound therapy for tinnitus. And I thought, okay, this is fun. Let's learn about this and see why pink noise might be a potential option for us to include.

So the authors wanted to take a look at pink noise as a tinnitus sound therapy, because pink noise, they say, has a more balanced frequency distribution compared to white noise, which I think a lot of us have recommended in the past, and the type of noise that can be included in a lot of tinnitus sound generators. So they were able to include 43 adults who both had hearing loss and tinnitus, but they capped it where the individuals could not have hearing loss worse than 70 decibels hl at any frequency. These individuals were identified from two different chinese hospitals that did provide tinnitus treatment. So these clinicians that were working with were well versed in providing tinnitus treatments. Now, the other thing was, patients or the participants couldn't just have tinnitus.

They needed to have a thi score of 18 or greater for inclusion. And then rather than just playing the steady state pink noise, they used the fractal tone. So a fractal is just little snippets of noise, and they were being provided through ear level devices, or is what we would just call hearing aids. And the thi scores, they were measured at one, three and six months post treatment to see what type of changes have occurred. And here's what we found.

This is a breakdown of all the individual subjects, and you will see that the vast majority did see an improvement from the before treatment and after treatment. We did see some people that were kind of flatlined. But one of the things I always say is very important is we didn't see anybody get worse. So that's really nice to have. So for these individuals, we have an improvement whenever we're providing this pink noise for therapy.

So that was just one way to look at it. But what about other types of therapies as well? What if we wanted to take a look at something like music therapy? What the authors of this article did, they took a look at three different types of music therapy, and they compared the Heidelberg model of music therapy, standard music therapy, which is the one that is probably most familiar for audiologists using, and then lastly, a tailor made notch music therapy, one that is going to be patient specific rather than just a generally provided music therapy. So what they did was they did a literature review.

And I will say I always try to include a systematic review or a scoping review of my presentations because I am just a sucker for a good systematic review. So the authors here, they did, they looked at five research databases and they included all the literature they could find that applied to the topic from its inception through May of 2023. They did not screen for any languages. Basically, if it was published, they were including it. The two authors that you see here, they screened all of the studies and extracted the data.

They included randomized and non randomized studies. From all of their database searching, they were found 19 studies that could be included. Now, I always think it's important to mention, too, for any type of review, whether it's a scoping review, rapid review, or systematic review, there is a system out there. It's called prisma. It stands for, for preferred reporting items, for systematic reviews, reporting guidelines.

So essentially what this is is it gives potential researchers a framework of what to follow if they want to go ahead and do a systematic review. But they do ask that the authors end up registering their data, registering their study. And in this case, the authors followed the Prisma data or study, but they didn't end up going to register that the information.

So this is just a breakdown of what a Prisma flow chart will look like. It talks about how they found 255 potential records and by the time that they used all their filters to see what can be included, they ended up including 19 studies in this article. And when they broke down what they found, they compared each of the three groups, one versus one. So they took a look at the Heidelberg method versus standard music therapy. Then they did the Taylor made music therapy versus standard, and then the Taylormade versus the Heidelberg.

And what they found was Heidelberg was actually the least effective of the three, and the Taylor made noise or therapy was not. Therapy was the best. Which shouldn't be surprising that if it's a therapy that's going to be individualized, it's going to be better than standard music therapy. But the authors actually recommended that. Standard music therapy should be recommended first because of efficacy, cost and convenience.

So it's going to be a lot faster, it's going to be less cost prohibitive for your patient, and it's something that should be easier. The other thing too is that the. What I was surprised. I thought that the standard music therapy might actually have the most articles included, but it was actually the tailor made notch therapy was the most researched, while the Heidelberg model was the least researched. So what are the future recommendations that we have here?

Well, it's going to be good if we have clear and uniform reporting guidelines so that equal comparisons can occur across studies for future systematic reviews. Future meta analyses and reviews should focus on high level randomized controlled studies so the authors could go back and then only include the studies that were randomized control studies, rather than including non randomized controlled studies. And then lastly, long term outcomes should be studied as well. And that's one thing I really wanted to highlight in this part of my presentation, was that we are typically seeing these

individuals back in the studies with within a few months, but we're not doing anything really longitudinal. So I think that would be a great future directions for all tinnitus studies is to include a more longitudinal component.

So now we're getting to the fun part here. These are our references from the studies that we provided today. But. But as promised, this is your QR code. So if you want to take your phone and scan this or however you want to get access to it, and it will be available for you at all times.

This will take you to the spreadsheet containing all of our 2023 tinnitus articles, not just for treatment, but all 618 that were published and reviewed by us. And I have to give special kudos to doctor Laurie Zatelli. She did pretty much all the heavy lifting, putting the articles together, doing the search. So big round of applause for her and the work that she completed to get us to this point.

Thank you. Thank you very, very much.

Thank you all so, so much for being here with us today. And we hope you enjoyed and felt like you learned something. Remember to take your exam after everything is over and it should be available again in about ten to 15 minutes. Minutes. So thank you for joining us today.

We'll all see you next time. Bye.