WHITEPAPER
2021

Simple ways to optimize your fittings

Oticon Optimal Fitting Series No. 1 - 2021 updates

INTRODUCTION

This is the very first part of the new Oticon Optimal Fitting Series. In this series, we aim to take a deeper clinical dive into the fitting flow and fitting offerings that are continuously updated by introducing new features and functionality that improve the experience of fitting an Oticon product. A hearing aid fitting can be very simple, but on the other hand, some clients have very specific needs that require additional steps, time, and knowledge in order to be successful. This series explores how we can optimize fittings in simple ways that heighten the quality of the fitting and allows us to fit a wide range of people with hearing loss who are all individuals with differing needs and preferences. You may want to use the paper as a reference work and only read the sections relevant for you.

In 2021, we are introducing some very useful tools for you, the hearing care professional. This paper covers more detailed information on and helpful fitting and counselling tips for: the integrated Probe*GUIDE*™ feature in Oticon Genie 2, the In-situ Audiometry tool now introduced as part of RemoteCare sessions, the customized MicroShell earmould, and some fitting considerations when using the new dedicated MyMusic program and fitting certain hearing losses or fitting musicians.

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Integrated Probe*GUIDE* in Oticon Genie 2

Hearing care professionals have many tools at their disposal when it comes to fitting a hearing aid. If following best practice guidelines, one of their options is to verify the fitting through real-ear measurement (REM) (ASHA, 2006). The use of REM has many advantages, including a closer match to prescriptive targets, whether generic or proprietary. When comparing gain to prescribed NAL-NL2 targets, Amlani, Pumford & Gessling (2017) found a significant difference between a quick-fit and a REM procedure. The quick-fit underfitted by roughly 7-10 dB compared to 1.5-2.5 dB for the REM procedure across input levels, thus yielding a greater target match obtained with this latter procedure (Amlani et al., 2017).

Though 57% of dispensing offices owned REM equipment in 2006, only 23% performed the procedure routinely in adult hearing aid fittings (Strom, 2006). This suggests possible obstacles to performing REM, like uncertainty in probe tube placement. As a solution, the North American company, Audioscan, offers a software-driven probe tube placement tool called Probe*GUIDE* in their Verifit2 REM system, designed to be easily incorporated into the clinical REM workflow (Folkeard, Pumford, Pietrobon, & Scollie, 2019). Probe*GUIDE* is now integrated in the REM AutoFit tool in Genie 2, creating a more automatic REM procedure and giving the hearing care professional probe tube placement support in Genie 2, with the click of a button.

Probe*GUIDE* is a clinically feasible, acoustic-based tool that was developed using a machine learning algorithm. It operates through broadband noise being presented from the loudspeaker of Verifit2, while the spectrum of the sound within the ear canal is repeatedly sampled and analysed. This analysis is then put into a model of probe tube depth, which was developed from a measured set of in-ear recordings, resulting in accurate real-time probe placement (see more in Folkeard et al., 2019).

Probe*GUIDE* allows for a confident probe tube placement when utilizing REM AutoFit, creating an easy REM flow in daily clinical work. Using this tool, the hearing care professional avoids causing the client discomfort from a probe placement that is too deep. The tool ensures that the probe tube is placed at the suggested 5 mm from the eardrum, thus obtaining accurate measurements and providing a sufficient output at the eardrum (Audioscan, 2021). When evaluating Probe*GUIDE*, Folkeard et al. (2019) found that insertion depths based on Probe*GUIDE* and resulting Real Ear Unaided Responses (REUR) were not significantly different from those obtained from a traditional, visually assisted probe tube placement method by an experienced clinician.

Practicalities

For the integration to work, it is important to have the most recent versions of the following software:

→ Oticon Genie 2 | 2021.2

→ Verifit2 | version 4.24.3 (2021.1)

The Verifit2 software can be downloaded from Audioscan's webpage.

Quick step-by-step guide

The following instructions provide guidance on how to use Probe*GUIDE* with REM AutoFit. Keep in mind that Probe*GUIDE* was developed and validated for adults with normal outer and middle ear function. Use of the tool on other patient groups is not advised by Audioscan (for the full guide, see Audioscan, 2021).

1. Before you start, make sure that the hearing aid acoustics and speaker fitting levels in Genie 2 match those of the hearing aids you have connected. Furthermore, ensure that a feedback analysis has been performed.
2. Place the client within 60 cm (24 in) of the Verifit2, facing the speaker.
3. In Genie 2, open the REM AutoFit tool. Click on Verifit® *LINK*. Follow steps 1-4 and click on the link in step five. The Probe*GUIDE* tool will automatically open in Verifit2 and the Audioscan window, if that has been opened via the NOAH software.
4. In Genie 2, click ▶ to start measuring the insertion depth on the left or right ear. A filtered noise stimulus will sound from the Verifit2 loudspeaker. On the ear canal simulation (Figure 2), an indicator ball will track the location of the probe tube in real-time.
5. Set the black marker ring on the probe approximately 28 mm from the end for adult females and approximately 30 mm for adult males.
6. Pass the probe tube in front of the red/blue lanyard and into the ear canal, slightly pulling back the lanyard, as shown in Figure 1.
7. Insert the probe tube using the indicator ball to identify the distance to the eardrum.
8. A chime will sound and a green check mark will appear on the ear canal simulation when the probe tube is placed within 5 mm of the eardrum (see Figure 2). The probe tube is now inserted at an appropriate distance.
9. Click ■ to end the measurement.
10. Hold the probe tube in place and carefully insert the hearing aid. Note the black marker ring on the probe tube. If the ear canal is an average length, the marker ring should be near the intertragal notch. This is a good reference to indicate if the probe tube position changes when inserting the hearing aid.
11. In REM AutoFit, click on Measure and run the REM as instructed on the screen.

Figure 1. Probe tube passed around the lanyard. Note the black marker ring.

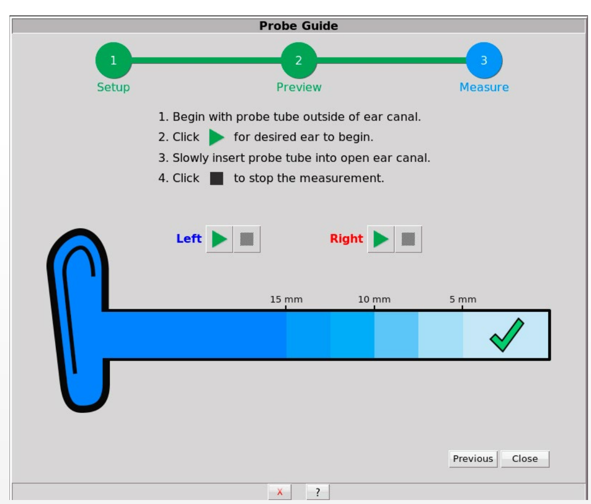

Figure 2. The ProbeGUIDE tool. The probe is at an appropriate distance to the eardrum and the Verifit2 will chime.

In-situ Audiometry through Oticon RemoteCare

Hearing aids are primarily fitted to the client in consideration of the person's individual audiogram. However, today's hearing aids provide an opportunity to determine thresholds "in-situ" with tones generated by the hearing aids without any special equipment (Junius, Lauer, & Miller-Wehlau, 2013).

In-situ Audiometry is now also possible through the RemoteCare app. This provides hearing care professionals with a flexible solution that enables a personalized hearing experience for the client, without involving an in-clinic visit.

Obtaining in-situ thresholds allows the hearing care professional to specify gain precisely for the client's hearing loss *and* chosen acoustics, as the measurement takes into consideration the anatomy and physiology of the ear canal, plus the depth of the earmould or dome (Durisala, 2015; Kuk, 2012). This may lead to a more accurate fitting and greater patient satisfaction with fewer returns of hearing aids (Durisala, 2015). The ability to obtain thresholds remotely is also a game changer for hearing care professionals and clients alike, especially in a time where clients increasingly demand more flexible healthcare that is not hindered by distance, mobility, or other hindrances. Furthermore, the in-situ measurement can be of great value to people with fluctuating hearing loss (Kuk, 2012). In-situ Audiometry does not require extra training of hearing care professionals, as the thresholds are obtained in a similar way to conventional audiometry. The tool is easily applied to the fitting flow through Genie 2 after the hearing care professional enters a RemoteCare session, simply by choosing In-situ Audiometry under More Tools.

Both the literature and our latest research show that in-situ thresholds can be obtained with a high level of accuracy. Durisala (2015) found no significant mean differences between the thresholds of conventional and In-situ Audiometry at 250-1000 Hz and 4000 Hz, showing that In-Situ Audiometry is a valid method in comparison to conventional audiometry. In a 2021 internal study, with 10 participants (mean age 62.1 years) ranging from mild to severe hearing loss, results showed that when comparing in-situ thresholds obtained through RemoteCare ("Remote Quiet" in Figure 3) to in-situ thresholds obtained in the clinic ("Clinic" in Figure 3), the remote thresholds did not differ significantly from the clinic thresholds. In fact, the mean thresholds of the two conditions only deviated with *-0.3 dB across frequencies* (see Figure 3). This means that if remote In-situ Audiometry is measured in generally quiet environments, the hearing care professional can achieve thresholds that are as accurate as if the client was fitted using In-situ Audiometry in the clinic.

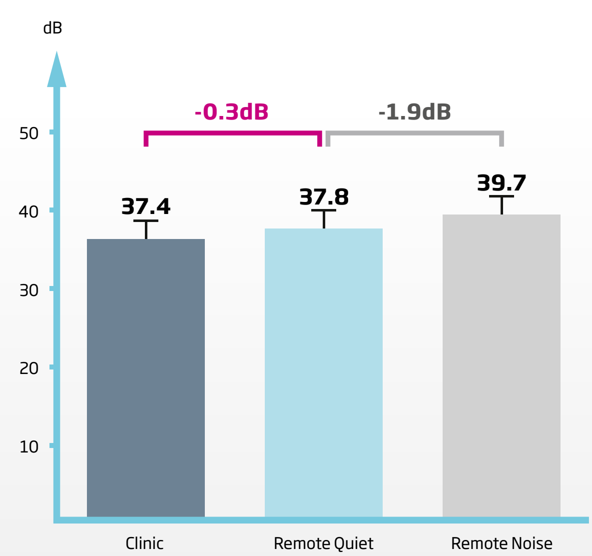

Figure 3. The mean thresholds of the three conditions: "Clinic", "Remote Quiet", and "Remote Noise".

It is important to point out that even though In-situ Audiometry has many advantages, it is not intended to replace the conventional audiogram, especially since it is not capable of determining bone-conducted thresholds and does not provide an opportunity for masking. The purpose instead is to ensure a personalized and high-quality follow-up fitting in this case while the clients are in the comfort of their home, without compromising professionalism or sacrificing quality.

Integrated monitoring of background noise level during In-situ Audiometry

During In-situ Audiometry, ambient noise in the client's home may compromise the accuracy of the measurement, so the client should be counselled to go to a quiet space. To provide the hearing care professional with confidence in this regard, the integrated "Background noise level" feature in Genie 2 functions as a real-time noise level reading, picking up environmental noise through the microphones in the hearing aids.

The Background noise level feature is found at the bottom of the In-situ Audiometry screen as a simple indicator bar. To obtain accurate thresholds, the indicator bar must be well within the green range, illustrating a low enough environmental noise level. If the indicator bar turns orange, it is alerting that the ambient noise level is too loud, hence indicating a possible risk of a negative impact on the threshold measurement accuracy. The hearing care professional must advise the client to find a quieter room.

Our latest research investigated the accuracy of In-situ Audiometry thresholds obtained through RemoteCare in a noisy environment, with a Background noise level reading bordering on turning orange (condition "Remote Noise" in Figure 3). We compared the mean threshold of this condition to the remote mean threshold obtained in a quiet environment mentioned above (condition "Remote Quiet"). We found that at this level, mimicking the worst-case scenario, the mean threshold in "Remote Noise" only deviated *-1.9 dB across frequencies* from the mean threshold in "Remote Quiet" (see Figure 3). The study also showed that the prescribed gain resulting from the "Remote Noise" condition only deviated *0.23 dB across frequencies* from the "Remote Quiet" condition. However, although remote thresholds can be obtained well within a 5 dB range in a somewhat noisy environment, it is still recommended that In-situ Audiometry is *only* conducted in a quiet location.

Gain prescription

Since the obtained threshold after In-situ Audiometry is independent of the potential leakage of the vent, the gain will be prescribed just as after conventional audiometry. This implies that the hearing care professional does not have to adjust the gain relative to a potential leakage, since Genie 2 compensates for the selected vent or dome. Therefore, it is crucial that information about fitting level, earpiece, and vent are correct in Genie 2 before starting In-situ Audiometry.

Practical tips

As stated above, it is important that the client is in a quiet environment, especially if using an open dome/earmould, since background noise can artificially raise low frequency thresholds. Before initiating the measurement, allow the Background noise level to measure the noise level for 5 seconds. The reading should become stable, and the indication bar should be green, as shown in Figure 4. If the indication bar is orange, do not start the measurement, but instead, advise the client to move to a quieter location.

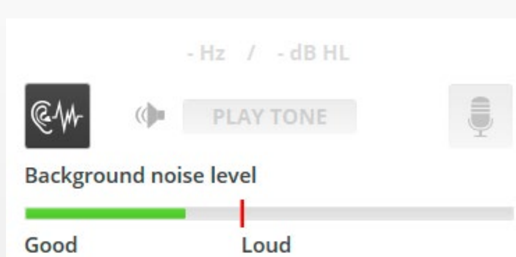

Figure 4. The Background noise level feature with the noise well within the green range.

When entering the In-situ Audiometry tool, the microphones of the hearing aids are automatically turned off. The hearing care professional can activate the microphones by clicking on the voice-over button next to 'Play tone'.

It is advised to mute the audio in the RemoteCare window to avoid interfering noise from the clinic, e.g. the hearing care professional's keyboard. The audio is muted when the button looks like . If unmuting during an in-situ measurement through RemoteCare, the voice of the hearing care professional will be presented from the loudspeaker of the client's smartphone or tablet.

Consider the speed of the internet connection when performing In-situ Audiometry remotely. We recommend a minimum internet speed of 1/1 Mbit/s for a stable RemoteCare connection. Depending on internet speed, tones may not be presented immediately after being triggered. Therefore, it can be valuable to present the tone for at least 2 seconds and give the client more time than usual to react. Have the client adapt to a new frequency by presenting the tone at a higher starting level than usual.

The hearing care professional is advised to instruct the client on how to react on the presented tone, like saying "yes" or raising a hand, before initiating the In-situ Audiometry.

Introducing the new MicroShell

Oticon now introduces the MicroShell, a new customized mould for optimal fit and comfort. Unlike the current Micro mould and LiteTip, where the normal speaker unit must be manually inserted into the mould, the MicroShell is manufactured with a built-in 60* or 85 speaker unit fixed to it. The MicroShell is acrylic and comes in a variety of colours. It is acoustically equivalent to any miniRITE hearing aid with a custom mould and manually inserted receivers, creating a great sound experience for the client.

With the MicroShell, the client will find a high level of usability. It is easily inserted into the ear and retains its position during the day; it does not spin, lose orientation, or fall out of the ear. These achieved benefits are due to the speaker unit being fixed directly in the mould with a membrane surrounding it, creating a very robust extension to the Oticon lineup. Hearing care professionals will find a high level of fitting consistency in this mould, and clients will find it aesthetically appealing.

The MicroShell comes in two lengths: short (max 14 mm) and long (minimum 14 mm). The venting options chosen in Genie 2 are 0.8, 1.4, 1.8, 2.4 and 3.3 mm aside from the closed and open options.

Figure 5. The new MicroShell.

*MicroShell 60 will not be available in Australia and New Zealand at time of launch in August 2021.

A use case of MicroShell

In recent development of the MicroShell, we invited a test participant to try it for two weeks with a pair of Oticon More™ hearing aids. Use cases like this are incredibly valuable for exploring the whole fitting experience and getting insights into the daily usage of products that must hold up in real-world use. To best help hearing care professionals getting started with the MicroShell, the following paragraph contains the main learnings of this investigation.

The test participant is a 48-year-old male who, due to early diagnosed otosclerosis in both ears, has had multiple ear surgeries. After the last surgery, the thresholds, especially for left ear, had improved dramatically. He was initially fitted with Oticon Opn S 1 hearing aids, which he was highly satisfied with (Løve, 2020). In Spring 2021, he was fitted with the new MicroShell, vent size 2.4 mm, and Oticon More 1 miniRITE R. NAL-NL2 targets were verified using REM Autofit, and he was set to Adaptation level 3. Personalization questions placed him in the Complex category of the Environment Configuration in MoreSound Intelligence. For Easy Environments, Virtual Outer Ear was set to Aware while the Neural Noise Suppression – Easy was set to 4 dB. For Difficult Environments, Sound Enhancer was kept at Balanced and Neural Noise Suppression – Difficult at 6 dB.

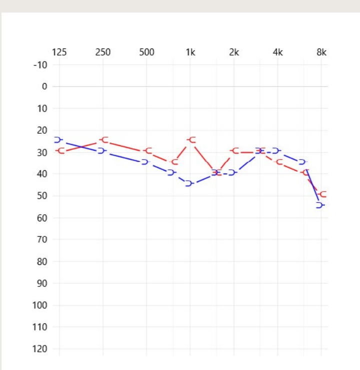

Figure 6. Audiometric thresholds used for the fitting.

During the two-week trial period, the test participant completed the same questionnaire four times, answering questions about ease of insertion, fit, and retention during the day, comfort, look, and subjective ratings of sound output, also while streaming. Responses were recorded using a five-point scale, ranging from strongly agree to strongly disagree. Asking the same questions over a longer period of time provides valuable insights into the experience of the MicroShell, from first fit to post-fitting daily use. On four out of four questionnaires, the test participant “strongly agreed” that the MicroShell kept its position in the ear during the day, while on three out of four questionnaires he “agreed” that it was comfortable to wear for the whole day. The test participant was asked if he liked the sound of his hearing aids in general and when streaming, both of which he “agreed” to on three out of four questionnaires. During a subsequent interview, he stated: “With this mould, the streaming and music experience was spot-on. Sometimes, I did not even change to my Bluetooth headphones.” On a scale from 1-10, the test participant rated the look of the MicroShell at 10 for all four questionnaires. The test participant experienced some occlusion effects, especially when eating and talking. The experience of occlusion is quite normal when switching a user from a more open type of acoustic to a more closed option and there is a high probability that a longer trial period would have altered his perception of the sound. On three out of four questionnaires he “disagreed” that the MicroShell was easy to insert – most likely due to dryness in the ear canal, rather than the fit of the mould. Potentially, due to the better retention and a tighter fit of the MicroShell, it may taker longer to learn how to place it optimally.

The main learnings from this use case are that even though this specific test participant struggled with the insertion, the MicroShell had an excellent retention and a high level of comfort during the day. He liked its appearance and expressed that the streaming experience was superb. “When I put my hearing aids on in the morning, a whole new sound universe opens up!”.

Music and hearing aid fittings

As hearing care professionals, it is in our DNA to counsel our clients in depth about listening to speech and counselling on many aspects of communication, including communication strategies such as body positioning toward a speech source, adequate lighting, and lipreading. But for many, the discussion of music listening and enjoyment is not routine. Including a conversation about what music means to a new hearing aid user can be very helpful in setting them up for hearing aid success for an aspect of life that stirs emotions for many and is something that truly contributes to higher quality of life. Figure 7 can be an excellent way to show a client how much music differs from speech, in terms of frequency range, level, and dynamics.

Crook, Greasley & Beeston (2018) have, based on extensive research in the area of music, hearing, and hearing aid fitting, created an excellent resource for hearing care professionals on how to counsel for music fittings and considerations for an optimal fitting of hearing aids for music. Based on surveys with users and hearing care professionals, they propose some key considerations. They are shown here, with the Oticon MyMusic program in mind:

Volume control and mute: Ensure that the user has the flexibility to use the volume control independently on the two ears and has the ability to mute in situations with, for instance, live music, where there is more exposure to loud sound levels.

Open fittings: Use as open a fitting as possible to maintain access to as natural a sound as possible. If working with a user who is a performer or singer, it also minimizes risk of occlusion/own voice complaints.

REM verification: Verify targets using REM to ensure audibility. Given the increased dynamics of music in terms of frequency and level, verifying REM at several input levels is recommended.

Use MyMusic: Use the MyMusic program for any user that values music listening. The music program can be added as program 2, 3, or 4 under Program Manager in Genie 2. In the Oticon tech paper by Brændgaard (2021), an in-depth explanation of the development and characteristics of MyMusic is described. It is a fundamentally different approach to music sound processing than what is provided in the VAC+ proprietary rationale as well as the available generic fitting rationales, where the primary objective is the audibility of speech. Because music has such different properties, MyMusic has been developed more as a new dedicated fitting rationale for music, rather than "just" a program with slightly different processing from rationales that focus on speech. Therefore, it is highly recommended to use MyMusic for live music listening as well as streaming purposes.

Check for occlusion: Especially for singers. In a Quick guide for audiologists by Crook, Beeton & Greasley (2018), some simple steps are recommended to test for occlusion. Ask the hearing aid wearer to say /a/ as in "father" and /i/ as in "cheese". If they have occlusion, the /i/ will appear louder. To minimize occlusion, increase the vent size, turn down low frequency gain slightly, or try fitting with a deeper ear mould. Venting more on only one side (for binaural fittings) may also help.

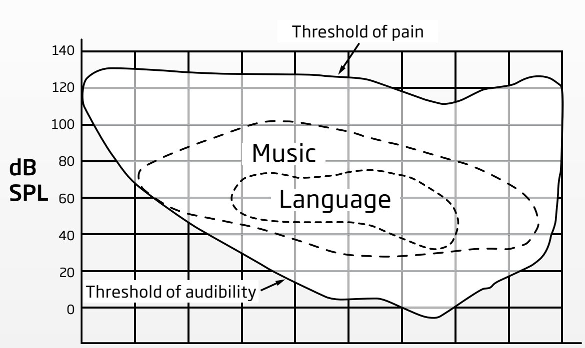

Figure 7. Image adapted from Ramirez & Herbig (2016). Optimising hearing aid processing for music appreciation. ENT & Audiology News 2016, 25(4), 101-2.

Counsel on insertion: Prioritize counselling related to correct insertion of dome or ear mould. As mentioned earlier, the choice of acoustics matters when fitting for music. But it also means that a dome or ear mould that is incorrectly placed, can have negative consequences for the experience of music, such as loss of low frequency gain due to shallow insertion. In our experience in internal investigations, professional musicians tend to prefer slightly less bass and, instead, prefer a very balanced musical sound scene where there is access to all sounds, even the more subtle ones. Regular music listeners tend to prefer slightly more bass.

Fitting clients for music listening can be a source of frustration for some hearing care professionals. The development of MyMusic aims to enhance the music experience and require a lot less manual adjustment by the hearing care professional. This is because the rationale was developed on the basis of the research done in the area of music and hearing aids and the optimal amplification and sound processing strategies for music. For some audiometric configurations and some user needs (playing a specific instrument for example), one should always expect to perform a more thorough case history on music and perhaps manual fine-tuning. MyMusic provides a comprehensive and evidence-based starting point for successful music fittings.

Summary

Oticon introduces new features to optimize the fitting flow, providing great clinical audiological benefits for both clients and hearing care professionals. Where the integrated Probe*GUIDE* provides confidence in the REM measurement and comfort of the client, In-situ Audiometry through RemoteCare and the new MicroShell are extending our current offerings during the rehabilitative journey.

The new dedicated MyMusic rationale allows us to fit a wide range of people with hearing loss who are all individuals with differing needs and preferences. Prioritizing music as an area that requires specific counselling and fitting needs, can elevate the quality of a fitting, and the enjoyment of life for the client, exponentially.

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