



Music

Counselling and fitting

A guide for audiologists



Introduction

This guide is designed to assist healthcare professionals in supporting hearing aid users to engage with music. It details some findings from our **Hearing Aids for Music research** that you can use in clinic, and share with hearing aid users to support their understanding and progress with music listening. Our research showed that many music lovers did not understand their hearing loss nor how their hearing aids function. Moreover, they often did not understand why music listening became more difficult as a result of their hearing loss and/or the technological limitations of their aids. We therefore advocate a holistic approach ensuring that the understanding of hearing loss, hearing aids, assistive listening devices (ALDs) and the difficulties of music listening for hearing aids are addressed equally alongside the programming of aids to optimise outcomes for individuals.

This guide has been designed for audiologists who are interested in improving music listening. No prior knowledge of music is assumed. Our guidance derives from evidence-based research from our own and others' work. This leaflet should be used alongside our quickstart clinic guide *Starting out with a music program* which provides guidance on programming hearing aids for music.

These leaflets and detailed reports of our project findings are available on the resources section of our website at www.musicandhearingaids.org

Why is this important?

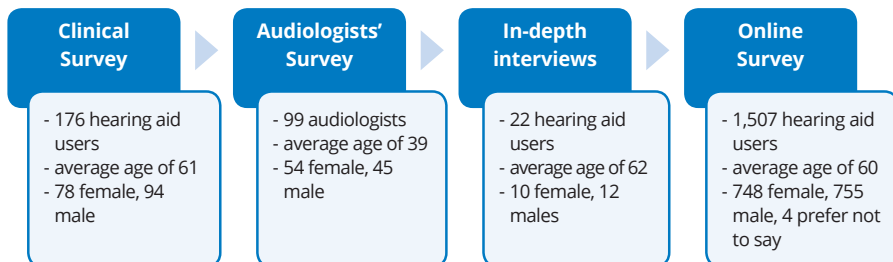
It has been known for many years that hearing aids can cause problems for music listening (Chasin & Russo, 2004; Fulford 2013; Madsen & Moore, 2014; Moore, 2016) but no wider scale studies have been undertaken until now. Our research was funded due to this lack of systematic evidence about listening to music with hearing aids alongside the knowledge that music is important for health and wellbeing. A key aim of the project has been to allow audiologists and hearing aid users to use these findings directly in the clinic. The 2015 government *Action Plan on Hearing Loss* is intended for all those involved in delivering improved hearing outcomes and support for individuals and the population at whatever level they operate. At **Hearing Aids for Music** we believe music should be a part of this delivery and have sought hearing aid users' views on listening and hearing technology through our 3-year funded project. We carried out four research studies, as detailed below.

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I saw hearing aids as primarily being designed for speech and my clinic was centred around that. I now realise that whilst speech recognition is a solid foundation that should be met, helping with music is incredibly beneficial and enriching.

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Our Research



a) Clinic survey

This asked patients whether they had experienced any problems with music listening and whether they felt this affected their quality of life, whether they had discussed music with their audiologist and if they had, whether this had improved their experience of music.

b) Audiologists' survey

This asked practitioners to reflect on their training level and background, their experiences of discussing music listening issues, their experiences of optimising hearing aids for music, and their perceived confidence in their ability to do so.

c) In-depth interviews

This asked hearing aid users to reflect on their hearing loss, past and current music listening practices, how their hearing loss has influenced listening over time, and experiences of hearing aid fitting.

d) Online survey

This aimed to identify trends in hearing aid users' musical experiences in both recorded and live settings according to different levels of hearing loss. This included an exploration of how helpful hearing aids are for hearing musical styles and features (e.g. genre, instrumentation, lyrics) and difficulties experienced (e.g. distortion, feedback, discomfort from loud sounds).

In this leaflet, we offer tips for counselling which are derived specifically from our studies. We encourage you to incorporate these into your counselling alongside programming changes to the hearing aids.

Getting to know your patients' musical needs

We found that people are highly engaged with music in their everyday life, irrespective of their level of hearing loss. The majority of hearing aid users across the private and National Health Service (NHS) sectors reported their aids were helpful for music listening. However, in our clinic survey 46% reported experiencing problems 'more often than not', and across our studies a range of problems were reported such as:

- Music sounding indistinct (e.g. lack of fidelity or sounding tinny)
- Music sounding distorted
- Problems hearing words in songs
- Difficulties in live music contexts

We found that many people did not understand why they may be experiencing these problems. This resulted from a poor understanding of their hearing loss and/or of their hearing aid technology. We found however that hearing aid users report more positive outcomes when increased time is spent discussing music in clinic, and when their hearing aids are tailored for music.

Taking these findings into account, we have divided our recommendations into three sections: initial counselling, hearing aid fitting and programming, and counselling after fitting.

History and initial counselling

- Ensure you have a history of what, when, where and how the hearing aid user listens and/or plays/sings.
- What problems are they experiencing, in what settings, and with what type of music?
- Does the hearing aid user understand their degree of loss and frequencies affected?
- Does the hearing aid users understand the capabilities of their hearing aid technology?
 - Do they understand and use all controls (e.g. volume) and programs on their aid?
 - Do they currently use any additional equipment?
- How does their hearing loss fit with the frequency range of their performance instrument, singing voice, or preferred instruments for listening?
 - A music chart (such as **Figure 1**) can be helpful if you are not familiar with the frequency ranges of different instruments.
 - The chart can help to show what sounds are missing without aids, and what sounds might be overlapping when listening to music with multiple instruments.
 - It is important to know whether there is loudness discomfort or hyperacusis for music listening.

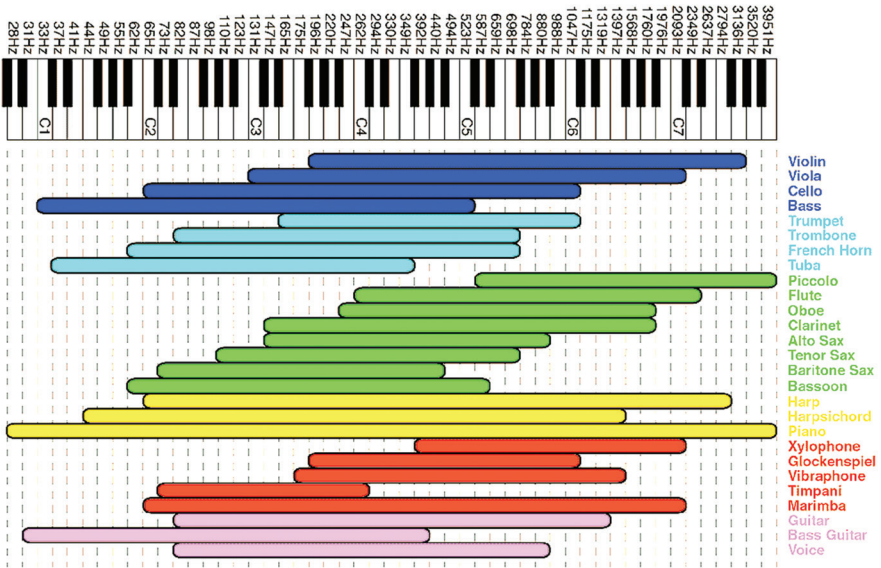


Figure 1: Chart for use in counselling, showing the frequency ranges of different musical instruments (Image by Alexyo.Netcom, CC BY-SA 3.0).

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I tailor the fitting strategy based on the patient's reports of the type of music listening they do, their concerns and desires, and the degree and type of hearing loss.

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Getting to know your patients' musical needs (continued)

- Discuss the complexity of listening to music with hearing aids with your patients
 - Convey that it will take some time to acclimatise to music listening with hearing aids.
 - There may need to be different solutions for different listening settings.
 - It is important that hearing aid users know occasional distortion may be expected simply due to the complex range of sounds and volume of music versus speech.
- Take into account that the severity of hearing loss affects music listening outcomes.
- Refer patients to *Music listening with hearing aids* advice leaflet and encourage them to engage in the listening practice(s) recommended.
- Use the *Glossary of terms for music listening with hearing aids* to share terminology in your discussions to promote better conversations.

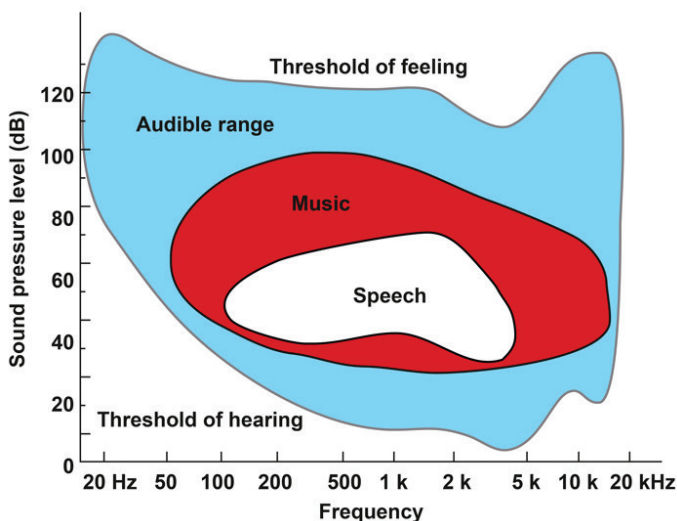


Figure 2: Music occupies extended frequency and dynamic ranges compared with spoken language (image from Ramirez, T. & Herbig, R. Optimising hearing aid processing for music appreciation. *ENT & Audiology News* 2016, 25(4), 101-2).

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I opt for settings that maximise the audibility and sound quality of the aspect of music that is of interest.

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Fitting hearing aids for music

This section expands on our *Quickstart clinic guide* which offers hearing aid fitting recommendations from both existing evidence based research and those most frequently used by audiologists within our studies.

Music occupies extended frequency and dynamic ranges compared with spoken language (see **Figure 2**), and therefore it is not surprising that manufacturers have started to offer programs specific for music listening in hearing aids.

Though the effectiveness of these music programs has been contested, with some people unsure as to their usefulness, our data showed that hearing aid users who do use a music program are significantly more likely to rate their hearing aids as helpful in both recorded and live music settings. However it is noteworthy that only 38% of those asked in our large-scale survey had a specific music program, and of these, only 45% used it 'often' or 'all the time', and therefore more hearing aid users could be benefiting in this way.

On balance, we therefore recommend that you fit hearing aids with a specific music program, and ensure that your patients are aware that existing users find them helpful in both live and recorded music settings.

General hearing aid settings



Mould selection – keep open if possible.

Open fittings provide a more natural acoustic for music listening just as they do for speech and environmental sound. We reduce build-up of self-generated low frequency sound – a clear benefit for singers and performers. For those with good high frequency thresholds, they can also utilise high frequency localisation cues of the pinna in vertical plane (cf. Byrne et al., 1998).



Give a volume control with as wide a range possible, and ensure that hearing aid user knows how to use it.



Keep volume control separate for left and right aids.

The wider dynamic range of music makes a volume control invaluable for hearing aid users. Discomfort from loud sounds was reported more frequently for live than for recorded music, so it is important that hearing aid users have access to a volume control and are counselled on how to use this. Allowing independent control of the volume for each ear allows optimal control of the environment for music. Musicians in particular reported problems with distortion at high levels and need a volume control to help alleviate this issue. In our studies 75% of users reported use of volume control in relation to music. Results suggest better outcomes for those using volume control (whether via a control on their hearing aids, or through a phone application).



Offer a mute button for control of loudness in live settings/performing.

Discomfort from loud sounds were reported more frequently in live performance settings. We also suggest providing a mute button to allow rapid control of louder inputs.



Prescription: use the same prescription as in patients' everyday program.



Verify fitting with Real Ear Measurement (REM) as accurately as possible to target.

Verification of hearing aids and the prescription to use was not explored directly in our study, and there is no clear evidence that any one prescription is better for music. However, a commonly reported problem was that of swapping between music and speech effectively. For this reason we recommend maintaining the same prescription across music and everyday listening programs to provide as much consistency as possible in the shared aspects of sound processing. With regards to verifying, we recommend fitting as closely as possible to the prescription target as a baseline. The prescription targets aim to maximise audibility for speech and give a good basis for setting target gain. It is possible to see whether this amplified sound sits within the music spectrum (see **Figure 2**) to aid in adapting dynamic range or balance of frequency response to try to achieve target gain for music. In the longer term for designing music programs, this also gives you a consistent baseline as a starting point for your fittings.



Try manufacturer's music program with the tips below.

Settings in a music program



Disable feedback manager and frequency transposition/compression.



Disable noise management and wind-noise management.

Disabling the feedback manager prevents pure tone musical stimuli (e.g. organ, flute) being mistakenly analysed as feedback and being suppressed. Sometimes manual feedback adjustments are still required but these can have a less detrimental effect on music than enabling an automated algorithm. Similarly with noise and wind noise management, the rationale is to avoid musical stimuli being interpreted as unwanted sounds.



Disable microphone adaptive directionality.



Consider selecting fixed microphone directionality.

Future research may clarify the benefits of directional versus fixed microphone settings. For live settings, fixed directionality can allow focus on music and limit distraction from audience and competing noise. In addition, for performers, fixed directionality can help with reduction of loud input from behind so long as ambient noise (e.g. other performers) is audible. Removing adaptive directionality provides more consistency to the input signal which may allow listeners to focus more easily on identifying musical features.



Base gain on everyday listening program.

Making changes to the frequency response based on listening trials can be done via in-clinic listening to music or by patient report. Looking at the match between instrument ranges and gain can assist with this. If specific frequencies are not audible you can try increasing gain here within reasonable limits. For example, where listeners report missing quiet high-frequency passages, increasing soft gain can improve audibility and can be trialled in clinic with familiar music or with other stimuli and free field aided testing.



Increase Maximal Power Output (MPO) if possible – check loudness comfort if you do this.

Increasing Maximum Power Output (MPO) needs to be done with care and within safe limits. Loudness comfort checks need to be used where MPO has been increased. The rationale for trying this is due to the wider dynamic range of music, though input limiting in the aid will play a part in this as well and is typically not adjustable by the audiologist. Increasing MPO minimally allows more flexibility for adapting gain across frequency where wide dynamic range compression (WDRC) is used, and this was consistent in audiologists' practice for music programming. Remember, however, that short-duration intense sounds in excess of 115 dB SPL carry a risk of permanent threshold shift (PTS) (Hunter et al., 1999). REM with music input at measured levels is an easy way to look at gain delivered for musical stimuli and most real ear measurement systems allow custom inputs to be used.



Keep compression ratios as low as possible within your fit to target.



Select slow-acting compression.

Slow acting compression and lower compression ratios are recommended as they have the advantage of preserving more natural temporal cues (Souza, 2002). Slow acting compression was found to be preferred for music listening by hearing aid users (Moore & Sek, 2016) as it does not flatten the spectrum, avoids modulation of foreground sounds by background sounds and is typically rated as more comfortable.

Audibility check

- Check all sounds are audible when wearing the aid, for a moderate to loud sweep (65-80 dB), or use a free-field stimuli.
- Note any problematic frequencies.
 - If inaudible – increase volume control first, increase gain if needed.
 - If distorted – reduce volume control first, reduce gain if needed.
 - If problem persists – apply frequency transposition/compression.
- Remember to ask about music listening experiences at review appointment.

Occlusion check for singers/players

It is easy to do a live check for occlusion in clinic, and is useful to demonstrate to patients.

- Occlusion is more likely to be problematic when hearing aids are worn binaurally.
- Remove REM tube before testing as this can create a slit leak which reduces actual occlusion.
- Test with hearing aids in ears. If two aids are worn, test with both aids in place.
- Ask client/patient to say [a] as in father, and [i] as in beet.
- If occlusion is significant, the [i] will appear louder to them.
- To resolve occlusion, try
 - Vent or increase vent size.
 - Reduce low frequency gain.
 - Try longer ear mould depth into the bony portion of the canal - these are sometimes forgotten but can be very effective.
 - If binaural, venting one side can help, while retaining low frequency gain.

Other considerations

Around a third of our participants reported experiencing distortion 'often' or 'all the time', with over 80% reporting that they experience distortion at least occasionally. Where distortion is a recurrent complaint for both speech and music, consider whether cochlear dead regions are present. Test for this using Threshold Equalising Noise (TEN) testing, or if you do not have access to this, then a simple recorded piano scale can sometimes help to identify problematic frequencies.

If you suspect dead regions, it is useful to identify where you can refer for testing. Our data shows it is beneficial for music lovers to understand which limitations are related to their underlying hearing loss rather than due to the hearing aid programming or functions. Many patients with cochlear dead regions do learn to work around the limitations of their hearing and still gain musical enjoyment.



Very occasionally I'll ask patients who are really struggling to either sing or bring their instrument to see if it's possible to ask the right questions and get them to listen to the sound and see if they can pinpoint what's resonating too much for them, or drowning out particular sounds.



Counselling after fitting

Music is very important to people in their everyday lives because it provides pleasure, facilitates relaxation and mood-regulation, and is an essential part of social situations. It can be emotionally distressing to hear music in an unfamiliar and/or distorted way, and unfortunately this occurs frequently because it can take a long time to acclimatise to hearing aids. This is particularly the case for musicians whose livelihood depends on a degree of ability to discern fine-grained details of sound.

Our study found that those with more severe losses rate hearing aids as less helpful for hearing musical features such as the melody, the singer, and picking out individual instruments. This is useful in assessing and counselling on expectations and evaluating success of fittings.

The good news is that repeated discussions about music lead to more positive reported experiences by both listeners and musicians.

- Our research found that persistence really pays off. Encourage listeners to keep practising music listening with hearing aids, and remind them it can take a long time to see benefits.
 - One of our participants for example commented that “it was two years before it was a pleasure to put them [hearing aids] in rather than a pleasure to take them out.”
- Encourage hearing aid users to try some of the specific exercises in our *Music listening with hearing aids* leaflet.
 - Start by listening to familiar music.
 - Try listening to solo instrumental music.
 - Listen to music with lyrics.
 - Try listening to different versions of the same song.
 - Explore musical styles.
 - Explore different places to practice listening.
- Ensure hearing aid user is aware of ALDs they could use at home or in larger venues
 - Amplified or noise-cancelling headphones,
 - Loops, streamers, remote microphone
- As music is often much louder than speech, particularly in live settings, people with mild to moderate losses sometimes prefer to listen to music without aids. The effectiveness of this depends on sound intensity levels which can vary significantly by venue, and from one performance to another.



In many cases I have built a management plan for a hearing aid user that involves different programs, removing the devices and using assistive listening devices to suit different listening environments.



Hearing protection

Be prepared to provide information on hearing protection and safe noise exposure limits.

- Be aware that listening in the car often involves higher sound levels to combat road noise, and that some types of music are routinely performed at a high intensity level so caution is always needed.
- Anyone with regular exposure (e.g. a performer or sound engineer) should have appropriate ear plugs e.g. ER-15 or ER-25 which require a custom mould. You can refer them to Help Musicians UK who run a Hearing Health Scheme for professional musicians within which they can get bespoke hearing protection: www.helpmusicians.org.uk
- Ensure listeners are aware that Temporary Threshold Shift (TTS) and tinnitus can occur after noise exposure.
- Noise exposure calculations can be complex but some rules of thumb can help.
 - Repeated or prolonged exposure to sound levels over 85 dB can cause permanent hearing loss.
 - For every increase of 3 dB the exposure time is halved (e.g. 40 hours/week at 85 dB, 5 hours/week at 94 dB).
 - Use the Health and Safety Executive website: www.soundadvice.info
- Decibel meters and dosimeter apps can be really useful to encourage safe listening levels. They can also give you feedback about whether your patient's expectations are realistic in relation to the sound levels experienced (e.g. Apple SoundMeter+, Decibel X).

What else can you do?

- If music listening is an occupational problem, referring hearing aid users to Access to Work (www.gov.uk/access-2-work) may provide them with useful practical support.
- Refer to our resources (see below).
 - People are more likely to engage with resources if they have been shown them personally, either individually or in a group setting.
 - Consider whether you could show the hearing aid user our website in clinic or ask if they have a relative/volunteer who can assist them at home.

Further resources

You can find a range of resources on our website including leaflets for hearing aid users and audiologists, research summaries, suggested websites, blogs and books, phone apps and applications and links to related organisations. www.musicandhearingaids.org/resources

Resources for hearing aid users

- *Music listening with hearing aids* (leaflet)
- *A glossary of terms for music listening with hearing aids* (online document)
- Blogposts with shared personal experiences

Resources for audiologists

- *Music counselling and fitting: A quick guide for audiologists* (leaflet)
- *Starting out with a music program: Quickstart clinic guide* (leaflet)
- *A glossary of terms for music listening with hearing aids*
- Image resources (e.g. instrument frequency ranges, pitch to frequency chart)

The following online courses provide a useful introduction and link hearing terminology to musical terms which can help when talking to musicians.

- Open University's Introduction to music theory (8 hours, free course).
- Open University's Sound for Music Technology (20 hours, free course).

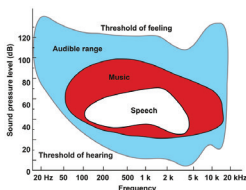
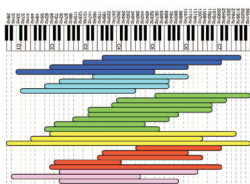
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Counselling and technical tips at glance

Top ten counselling tips

1. Establish the importance of music to the individual.
2. Take a history of what, when, where and how the hearing aid user listens and/or plays/sings.
3. Check hearing aid user understands their hearing loss and hearing aid technology.
4. Ask what difficulties they are experiencing with music, and how this differs according to musical setting.
5. Use charts to explain the perceptual consequences of hearing loss and how this may affect their listening and/or performance (see **Figure 1**).
6. Explain why music can be challenging for hearing aid technology (see **Figure 2**).
7. Convey that it takes time to acclimatise to music through hearing aids, but that most hearing aid users are satisfied with their aids for music.
8. Encourage them to use our *Music listening with hearing aids* leaflet.
9. Be aware that musicians are more likely to report worse outcomes and will need more guidance.
10. Refer them to our resources: www.musicandhearingaids.org/resources



Top ten technical tips

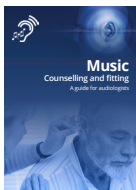
1. Fit volume control and mute.
2. Use open fitting.
3. Verify fitting with REM as accurately as possible.
4. Use a music program.

Within music program

5. Use everyday gain prescription.
6. Turn off adaptive functionality (e.g. feedback reduction, noise reduction).
7. Increase MPO.
8. Look at compression ratios, and select slow-acting compression.

Other

9. Check for audibility and occlusion.
10. Refer to our resources: www.musicandhearingaids.org/resources



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