

The Starkey Music Memory Q&A

Q: What is the Music memory?

A: Starkey Evolv AI 1600, 2000 and 2400 hearing aids include a dedicated Music memory environment. This memory offers several unique features, each developed with input from professional musicians and conductors, designed for optimised sound quality for music. Optimised sound quality is achieved through a twin compression architecture system and a unique, proprietary prescriptive fitting algorithm designed specifically for music. The Music memory is programmed by the clinician in Inspire and can be selected for use by the patient, either via the user controls on the hearing aids or through the Thrive mobile app. The Starkey Music memory was first launched in the Muse product range and clinical trials with Muse were conducted with 58 individuals, ranging in age from 47 to 82. All participants were fitted with bilateral hearing aids programmed to their individualised e-STAT prescription, which included clinically appropriate ear-coupling that ranged from open-canal domes to vented custom earmolds. Everyone had access to the Music memory and was instructed to listen to music as often as possible in a variety of environments. The clinical trial consisted of four visits over a six- to eight-week period during which participants wore the devices full time. Data from this study will be included throughout the discussion below.

Q: Who is a good candidate for the Music memory?

A: The Music memory is like other memory environments, such as Crowd or Restaurant, in that not all hearing aid wearers will find benefit from the Music memory, however, use should be considered for any patient that expresses interest in music listening. Our clinical trials with Muse revealed that some participants were more likely to listen to music and attend concerts on a regular basis when compared to others. This was not unexpected as the same trend holds true in the real world, regardless of hearing aid use. Despite the variety in time spent listening to music, as well as level of musical training, the large majority of clinical trial participants were extremely satisfied with the sound quality of music while listening in the Music memory. Forty-five of 53 research participants rated the overall sound quality of the Music memory as "good" or "very good" (Figure 1).

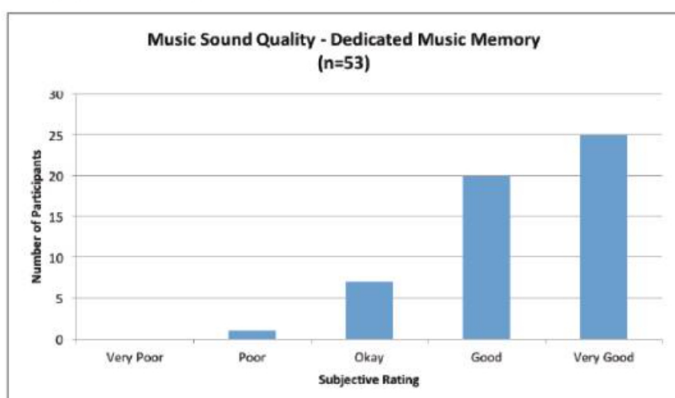


Figure 1

Below are quotes from the clinical trial participants (including professional musicians):

- Excellent sound quality ... I really enjoy listening to music again.
- The dynamics of sound are deeper.
- Depth and quality of sound is so much richer!
- I think acoustical engineers and others who play instruments or sing, and those who listen to as much live and recorded performances as I do will be happy with this hearing aid.
- My experience with memory 2 [Music memory] for music listening has been positive both in the concert hall (orchestra hall) and at home. The tonal clarity is not compromised by volume, delineation is more satisfying, ambient sound is less intrusive, and distortion of individual instruments/sections is reduced perhaps due to a softer overall sound quality.
- Whoever came up with the music algorithm ought to be on the star board because it's incredible.
- Lack of sublimation of awareness of musical construction, because the memory transmits sound without any bassy, distorted, slightly metallic transmission is especially satisfying.
- Richer, fuller and louder.
- I have not heard this sound quality in years.
- Much more natural.
- This is what I've been looking for for years - being able to naturally hear my own singing voice and the harp playing. Listening to the radio and others performing was great too. Even when I was singing, it didn't sound like I was listening to a CD of myself. It sounded like it ordinarily sounds when I don't have hearing aids in, which was really wonderful.

Q: I've identified a client that would benefit from the Music memory. Now what?

A: Enable the Music memory just as you would enable a Crowd or Restaurant memory in any of the available memory banks. Once enabled, baseline settings are determined by the prescriptive music fitting algorithm and new compression architecture. See Inspire screen capture below (Figure 2).

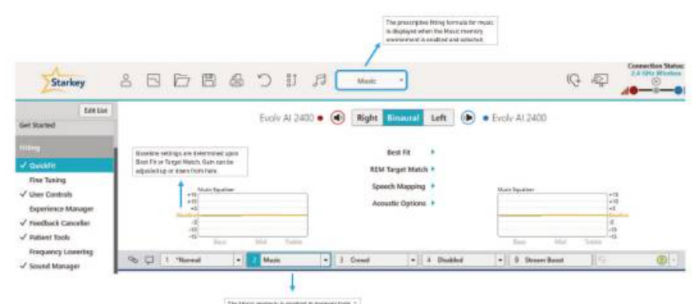


Figure 2

Q: Why does the Music memory screen in Inspire look so different than other memory environment screens?

A: Fitting hearing aids for music is unlike fitting hearing aids for speech, in a variety of ways. Fitting for speech communication is a well-defined process that includes objective measures of audibility and hearing aid performance. There are accepted fitting prescriptions that define appropriate gains across input and frequency, for a given hearing loss (e.g., e-STAT or NAL-NL2); before the introduction of Muse, there was no accepted standard for prescription of music amplification. Even with this validated prescription for music listening, preferences remain highly subjective and may be affected by the patient’s preferred music genre. Therefore, the Music memory controls and fitting graphs in Inspire have been designed to facilitate communication with the patient, with an end goal of finding music gain settings that sound pleasing to the patient.

Q: Is it useful to play music during the fitting or at follow-up appointments?

A: Although not required, it may be useful to play music during the fitting to get a sense of the patient’s initial thoughts regarding overall sound quality of the Music memory. Our recommendation would be to play something similar to what the patient listens to on a regular basis. As a helpful reminder, music samples are available for use in the Media Player in Inspire (Figure 3). Music was seldom played, however, in the office at follow-up appointments during the clinical trial to address requested adjustments.



Figure 3

Q: If baseline settings are not satisfactory, how can I adjust the gain settings of the Music memory?

A: First and foremost, clinical validation data revealed that mean adjustments for open and non-open (i.e., vented) fittings were within +/- 2dB, indicating baseline settings were satisfactory for the majority of participants (Figure 4).

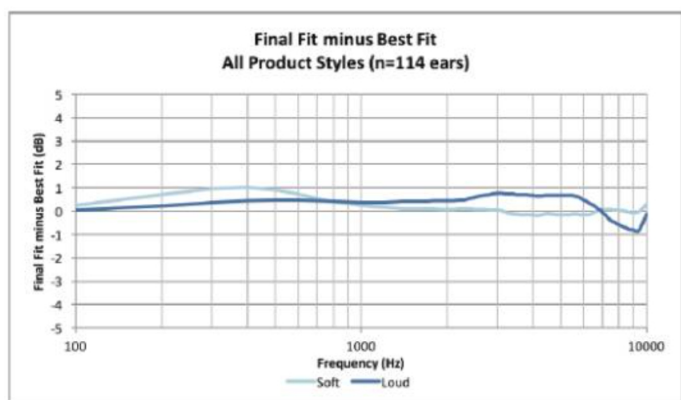


Figure 4

If adjustments are required, QuickFit Music EQ Controls are available upon selection of the Music memory in the memory bar (Figure 5). These controls are intuitively labeled and designed specifically for quick and easy adjustment of gain settings for music.

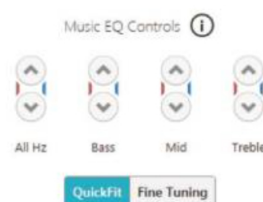


Figure 5

A Fine-Tuning screen is also available for cases in which additional adjustments are required. This screen allows the clinician to expand the frequency range for soft and loud level music for a more pointed adjustment via the + next to Bass, Mid and Treble (Figure 6).

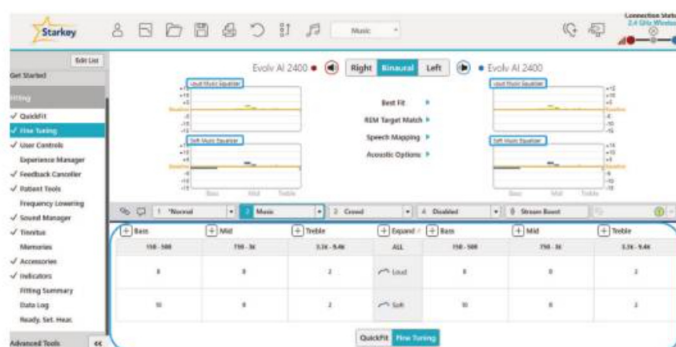


Figure 6

Q: What terms do patients use to describe their experiences when requesting adjustments to the Music memory?

A: The clinical trial revealed that research participants used common music descriptors such as treble, bass, and overall volume when requesting adjustments to the Music memory. This behavior contributed to the design of the QuickFit Music EQ Controls in the Inspire software. For the substantial majority of patients, the QuickFit controls provided enough flexibility to address any requested adjustments, meaning that the Music Fine Tuning screen was rarely accessed.

Q: What are some important discussions to have with my patients regarding the Music memory?

A: All adaptive features, with the exception of Quiet, are disabled by default in the Music memory and the hearing aid microphones are set to omnidirectional mode (Figure 7). The Music memory is not designed for listening in noise; rather, it is designed for music listening in quiet or live music listening at a range of levels from quiet music to loud music. As such, patients may report that it is not ideal for listening to music in the car or when other types of background noise are present. All automatic adaptive features, with the exception of Speech and Noise and

Music, can be manually activated to address patient complaints. Keep in mind that adjustment of these settings may impact the overall quality of music for the patient.



Figure 7

Q: Wait, you just mentioned an adaptive music feature. Is that different than the Music memory?

A: Good catch! The Music memory and automatic music classification and adaption are two different features available in Starkey Evolv AI products. Music adaptation is a more mild version of the dedicated Music memory and is enabled by default in the *Normal, Auditorium, Streaming, and Stream Boost memory environments. Settings for this feature can be found on the Sound Manager screen in Inspire. When music is detected in the environment, the hearing aids automatically adjust their settings to provide a better music listening experience. Automatic adjustments include:

- Adaptive Feedback Canceller is changed from High to Low Sensitivity
- Adaptive Directionality is changed to Dynamic; fixed omnidirectional and fixed directional modes are maintained
- Machine Noise adaptation is disabled
- Increased low-frequency gain, decreased mid-frequency gain, increased high-frequency gain

When music is no longer detected, the hearing aid settings change back to those optimised for speech listening.

The automatic adaptive music adjustments will offer mild benefits for music listening that are not as perceptually impactful as the Music memory. The Music memory introduces a broad range of changes to the hearing aid sound processing that result in a much different listening experience. This change is dramatic and should be motivated by the patient's intent.

Q: With two different music features, what did research participants prefer to listen to in the field?

A: (Figure 8) shows preference data for listening to music in the field. Participants' hearing aids were configured with *Normal plus the adaptive music feature in memory 1 and the Music memory in memory 2. The majority of participants (30 of 48) reported either a slight or strong preference for the Music memory over *Normal with the adaptive music feature. Fourteen of 48 participants reported that the two memories sounded essentially the

same when listening to music. Evaluation of individual participants' preference data revealed that music aficionados (i.e., trained musicians, or those who attend concerts on a weekly basis) preferred the Music memory, whereas those participants with less music listening experience were more likely to indicate that they could not tell a difference between the *Normal memory with the adaptive music feature and the Music memory. Of note, ratings of music sound quality with the Synergy platform hearing aids were very positive: 62 percent of participants rated sound quality in the *Normal memory with adaptive music feature as "good" or "very good" and 85 percent of participants rated sound quality in the Music memory as "good" or "very good."

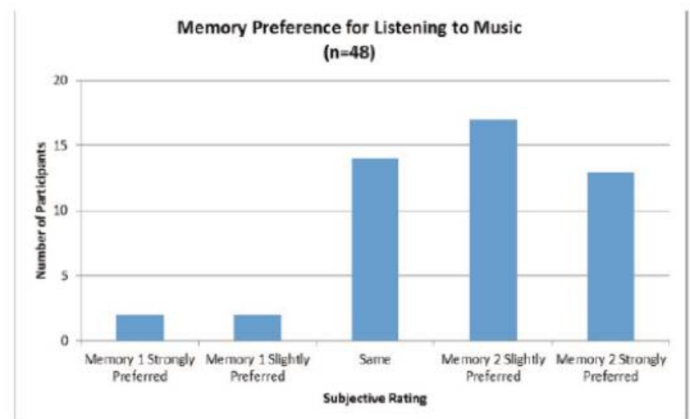


Figure 8

Q: Any final comments?

A: The Music memory, available on all styles of Evolv AI 1600, 2000 and 2400 technology tiers, driven by the music prescriptive algorithm and compression system, is a great solution for hearing aid patients that express interest in better sound quality for music. Furthermore, Inspire controls for this memory were designed with the clinician in mind through intuitive labels for easy programming and adjustment. The automatic adaptive music feature, also available in Evolv AI hearing aids, works behind the scenes to improve music sound quality for all patients in a less dramatic way. Go ahead, give these exciting music features a try!